California Environmental Protection Agency

Air Resources Board

PUBLIC MEETING AGENDA

August 23, 2012

LOCATION:
Air Resources Board
Byron Sher Auditorium, Second Floor
1001 I Street
Sacramento, California 95814
http://www.calepa.ca.gov/EPAbldg/location.htm

This facility is accessible by public transit. For transit information, call (916) 321-BUSS, website: http://www.sacrt.com
(This facility is accessible to persons with disabilities.)

TO SUBMIT WRITTEN COMMENTS ON AN AGENDA ITEM IN ADVANCE OF THE MEETING GO TO: http://www.arb.ca.gov/lispub/comm/bclist.php

August 23, 2012
9:00 a.m.

DISCUSSION ITEMS:

Note: The following agenda items may be heard in a different order at the Board meeting.

Agenda Item #

12-5-1: Public Meeting to Present the Air Resources Board's Role in Responding to Air Emergencies in California

Staff will present to the Board the purpose, history and capabilities of the Air Resources Board's (ARB) emergency air monitoring program. Staff will also explain the importance of this function in the context of the State Emergency Plan and the State Emergency Management System.

12-5-2: Public Hearing to Consider Technical Status of and Proposed Amendments to On-Board Diagnostic System Requirements for Heavy-Duty Engines, Passenger Cars, Light-Duty Trucks, Medium-Duty Vehicles and Engines

Staff will present to the Board proposed amendments to the Heavy Duty On-Board Diagnostic (HD OBD) and Medium-Duty On-Board Diagnostic (OBD II) requirements. Most of the proposed amendments relate to the requirements for diesel engines, including providing revised requirements during the 2013 through 2015 model years based on the current limits of diesel technology. Staff is also proposing other changes specific to the HD OBD regulation, including accelerating the start date for on-board diagnostic system implementation on heavy-duty alternate-fueled engines from the 2020 model year to the 2018 model year. Staff is proposing to update the associated HD OBD and OBD II enforcement regulations to align with the diesel-related changes being proposed for the HD OBD and OBD II regulations.

12-5-3: Public Hearing to Consider Amendments to the Verification Procedure, Warranty and In-Use Compliance Requirements for In-Use Strategies to Control Emissions from Diesel Engines

Staff will present to the Board proposed amendments to the Verification Procedure, which is used by staff to evaluate diesel retrofits through emissions, durability, and field testing. The Verification Procedure is ARB's key tool for ensuring that diesel retrofits used by fleet owners are an effective means to reducing emissions from existing diesel engines used in vehicles and equipment. Staff's proposed changes are intended to reduce the amount of in-use compliance emissions testing required of retrofit manufacturers while maintaining the protections and remedies for the retrofit system purchasers with the addition of recall provisions. Staff will propose additional changes to improve the process of matching retrofits with their intended vehicles, strengthen ARB's ability to quickly and effectively address systems with high warranty claim rates, provide additional information to fleets on the maintenance and appropriate use of their diesel retrofits, and provide better information to assist applicants in navigating the verification process.

CLOSED SESSION

The Board will hold a closed session, as authorized by Government Code section 11126(e), to confer with, and receive advice from, its legal counsel regarding the following pending or potential litigation, and as authorized by Government Code section 11126(a).

Pacific Merchant Shipping Association v. Goldstene, U.S. District Court (E.D. Cal. Sacramento), Case No. 2:09-CV-01151-MCE-EFB.

POET, LLC, et al. v. Goldstene, et al., Superior Court of California (Fresno County), Case No. 09CECG04850; plaintiffs appeal, Court of Appeal No. F064045.

Rocky Mountain Farmers Union, et al. v. Goldstene, U.S. District Court (E.D. Cal. Fresno), Case No. 1:09-CV-02234-LJO-DLB; interlocutory appeal, U.S. Court of Appeal, Ninth Circuit Nos. 09-CV-02234 and 10-CV-00163.

American Fuels and Petrochemical Manufacturing Associations, et al. v. Goldstene, et al., U.S. District Court (E.D. Cal. Fresno) Case No. 1:10-CV-00163-AWI-GSA; interlocutory appeal, U.S. Court of Appeal, Ninth Circuit Nos. 09-CV-02234 and 10-CV-00163.

Association of Irritated Residents, et al. v. California Air Resources Board, Superior Court of California (San Francisco County), Case No. CPF-09-509562.

Association of Irritated Residents, et al. v. U.S. E.P.A., 2011 WL 310357 (C.A.9), (Feb. 2, 2011).

California Dump Truck Owners Association v. California Air Resources Board, U.S. District Court (E.D. Cal. Sacramento) Case No. 2:11-CV-00384-MCE-GGH.

Engine Manufacturers Association v. California Air Resources Board, Sacramento Superior Court, Case No. 34-2010-00082774.

Citizens Climate Lobby and Our Children's Earth Foundation v. California Air Resources Board, San Francisco Superior Court, Case No. CGC-12-519554.

Consideration of a personnel matter.

OPPORTUNITY FOR MEMBERS OF THE BOARD TO COMMENT ON MATTERS OF INTEREST

Board members may identify matters they would like to have noticed for consideration at future meetings and comment on topics of interest; no formal action on these topics will be taken without further notice.

OPEN SESSION TO PROVIDE AN OPPORTUNITY FOR MEMBERS OF THE PUBLIC TO ADDRESS THE BOARD ON SUBJECT MATTERS WITHIN THE JURISDICTION OF THE BOARD

Although no formal Board action may be taken, the Board is allowing an opportunity to interested members of the public to address the Board on items of interest that are within the Board's jurisdiction, but that do not specifically appear on the agenda. Each person will be allowed a maximum of three minutes to ensure that everyone has a chance to speak.

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ONLINE SIGN-UP:
You can sign up online in advance to speak at the Board meeting when you submit an electronic Board item comment. For more information go to:

http://www.arb.ca.gov/board/online-signup.htm

IF YOU HAVE ANY QUESTIONS, PLEASE CONTACT THE CLERK OF THE BOARD:
1001 I Street, 23rd Floor, Sacramento, California 95814
(916) 322-5594
ARB Homepage: www.arb.ca.gov

SPECIAL ACCOMMODATION REQUEST

Special accommodation or language needs can be provided for any of the following:
- An interpreter to be available at the hearing;
- Documents made available in an alternate format or another language;
- A disability-related reasonable accommodation.

To request these special accommodations or language needs, please contact the Clerk of the Board at (916) 322-5594 or by facsimile at (916) 322-3928 as soon as possible, but no later than 7 business days before the scheduled Board hearing. TTY/TDD/Speech to Speech users may dial 711 for the California Relay Service.

Comodidad especial o necesidad de otro idioma puede ser proveído para alguna de las siguientes:
- Un intérprete que esté disponible en la audiencia.
- Documentos disponibles en un formato alterno u otro idioma;
- Una acomodación razonable relacionados con una incapacidad.

Para solicitar estas comodidades especiales o necesidades de otro idioma, por favor llame a la oficina del Consejo al (916) 322-5594 o envíe un fax a (916) 322-3928 lo más pronto posible, pero no menos de 7 días de trabajo antes del día programado para la audiencia del Consejo. TTY/TDD/Personas que necesiten este servicio pueden marcar el 711 para el Servicio de Retransmisión de Mensajes de California.

SMOKING IS NOT PERMITTED AT MEETINGS OF THE CALIFORNIA AIR RESOURCES BOARD

California Environmental Protection Agency

Air Resources Board

PUBLIC MEETING AGENDA

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INDEX

August 23, 2012

TITLE 13. CALIFORNIA AIR RESOURCES BOARD

NOTICE OF PUBLIC HEARING TO CONSIDER TECHNICAL STATUS AND PROPOSED REVISIONS TO ON-BOARD DIAGNOSTIC SYSTEM REQUIREMENTS FOR HEAVY-DUTY ENGINES, PASSENGER CARS, LIGHT-DUTY TRUCKS, MEDIUM-DUTY VEHICLES AND ENGINES

The Air Resources Board (ARB or Board) will conduct a public hearing at the time and place noted below to consider adopting amendments to California's Heavy Duty Engine On-Board Diagnostic System Requirements (HD OBD) and On-Board Diagnostic System Requirements for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines (OBD II). The Board will consider amendments to the HD OBD and OBD II regulations to update the diesel monitoring requirements, to make some requirements consistent between the HD OBD and OBD II regulations, and to clarify and improve the regulation where necessary, among other revisions.

DATE: August 23, 2012

TIME: 9:00 a.m.

PLACE: California Environmental Protection Agency
Air Resources Board
Byron Sher Auditorium
1001 I Street
Sacramento, California 95814

This item may be considered at a two day meeting of the Board, which will commence at 9:00 a.m., August 23, 2012, and may continue at 8:30 a.m., on August 24, 2012. This item may not be considered until August 24, 2012. Please consult the agenda for the meeting, which will be available at least 10 days before August 23, 2012, to determine the day on which this item will be considered.

INFORMATIVE DIGEST OF PROPOSED ACTION AND POLICY STATEMENT OVERVIEW

Sections Affected: Proposed amendments to California Code of Regulations, title 13, sections 1968.2, 1968.5, 1971.1, and 1971.5 and the following documents incorporated by reference therein:

ARB Mail-Out #MSC 09-22, "Guidelines for Heavy-Duty On-Board Diagnostic (HD OBD) Certification Data," July 7, 2009.

International Standards Organization (ISO) 15765-4:"Road Vehicles – Diagnostics Communications over Controller Area Network (CAN) – Part 4: Requirements for emission-related systems," February 2011.

Society of Automotive Engineers (SAE) J1699-3 – "Vehicle OBD II Compliance Test Cases", December 2009.

SAE J1930-DA "Electrical/Electronic Systems Diagnostic Terms, Definitions, Abbreviations, and Acronyms Web Tool Spreadsheet", March 2012.

SAE J1979 "E/E Diagnostic Test Modes," February 2012.

SAE J1979-DA "Digital Annex of E/E Diagnostic Test Modes", October 2011.

SAE J2012-DA "Digital Annex of Diagnostic Trouble Code Definitions and Failure Type Byte Definitions", July 2010.

SAE J2403 "Medium/Heavy-Duty E/E Systems Diagnosis Nomenclature," February 2011.

SAE J1939 consisting of:

J1939 Recommended Practice for a Serial Control and Communications Vehicle Network, April 2011;
J1939/01 On-Highway Equipment Control and Communications Network, May 2011;
J1939/13 Off-Board Diagnostic Connector, October 2011;
J1939/21 Data Link Layer, December 2010;
J1939/31 Network Layer, May 2010;
J1939/71 Vehicle Application Layer (Through May 2010), March 2011;
J1939/73 Application Layer—Diagnostics, February 2010;
J1939/81 Network Management, June 2011; and
J1939/84 OBD Communications Compliance Test Cases For Heavy Duty Components and Vehicles, December 2010.

Background:

OBD systems serve an important role in helping to ensure that engines and vehicles maintain low emissions throughout their full life. OBD systems monitor virtually all emission controls on gasoline and diesel engines, including catalysts, particulate matter (PM) filters, exhaust gas recirculation systems, oxygen sensors, evaporative systems, fuel systems, and electronic powertrain components as well as other components and systems that can affect emissions when malfunctioning. The systems also provide specific diagnostic information in a standardized format through a standardized serial data link on-board the vehicles. The use and operation of OBD systems ensure reductions of in-use motor vehicle and motor vehicle engine emissions through improvements in emission system durability and performance.

The Board originally adopted comprehensive OBD regulations in 1989, requiring all 1996 and newer model year passenger cars, light-duty trucks, and medium-duty vehicles and engines to be equipped with OBD systems (referred to as OBD II). The

Board subsequently updated the OBD II requirements in 2002 with the adoption of California Code of Regulations, title 13, section 1968.2, which established OBD II requirements and enforcement requirements for 2004 and subsequent model year vehicles. The Board has modified the OBD II regulation in regular updates since initial adoption to address manufacturers' implementation concerns and, where needed, to strengthen specific monitoring requirements. The Board last adopted comprehensive updates to the OBD II requirements in 2006 to address several concerns and issues regarding the regulation (California Code of Regulations, title 13, §1968.2) and enforcement requirements (§1968.5), while minor updates were made to the OBD II regulations in 2011. In 2005, ARB adopted California Code of Regulations, title 13, section 1971.1, which established comprehensive OBD requirements for 2010 and subsequent model year heavy-duty engines and vehicles (i.e., vehicles with a gross vehicle weight rating greater than 14,000 pounds), referred to as HD OBD. The Board subsequently updated the HD OBD regulation in 2009 as well as adopted HD OBD-specific enforcement requirements (California Code of Regulations, title 13, §1971.5). Finally, as part of the 2009 update, the Board aligned the HD OBD with OBD II requirements for medium-duty vehicles.

Objectives and Benefits:

The purpose of the HD OBD and OBD II regulations is to reduce motor vehicle and motor vehicle engine emissions by establishing emission standards and other requirements for onboard diagnostic systems (OBD systems) that are installed on 2010 and subsequent model-year engines certified for sale in heavy-duty applications in California. The OBD systems, through the use of an onboard computer(s), monitor emission systems in-use for the actual life of the engine, detect malfunctions of the monitored emission systems, illuminate a malfunction indicator light (MIL) to notify the vehicle operator of detected malfunctions, and store fault codes identifying the detected malfunctions. The use and operation of OBD systems ensure reductions of in-use motor vehicle and motor vehicle engine emissions through improvements in emission system durability and performance.

In adopting the HD OBD and OBD II regulations, the Board directed the staff to continue to follow manufacturers' progress towards meeting the regulations' requirements and to report back should modifications to the requirements be deemed appropriate. Since then, staff has met with stakeholders in teleconferences and face-to-face meetings, including a public workshop in March 2012, where staff and manufacturers identified areas in which modifications to the HD OBD and OBD II regulations, as it applies to medium-duty diesel vehicles, would be beneficial.

Additionally, since the adoption of amendments in 2010, stakeholders have argued that OBD system requirements are not emission standards or test procedures and that ARB does not have authority to order manufacturers to recall motor vehicles or engines if ARB were to determine that an installed OBD system was found to be in noncompliance with the HD OBD regulation. To clarify any misunderstanding, ARB staff is proposing that the OBD regulations be amended to be consistent with the federal definition of emission standard as set forth in *Engine Manufacturers Association v. South Coast Air Quality Management District* (2004) 541 U.S. 246, 253, 124 S.Ct. 1756, 1762 (*EMA*). For purposes of clarification and consistency, ARB staff is also adding the terms "exhaust emission standard" and "evaporative emission standard" in the definitions section to provide more specificity, where needed, to preexisting textual references to emission standards.

The proposed changes to the HD OBD regulation include revisions that accelerate the start date for OBD system implementation on alternate-fueled engines from the 2020 model year to the 2018 model year, relax some requirements for OBD systems on heavy-duty hybrid vehicles for the 2013 through 2015 model years, relax the malfunction thresholds until the 2016 model year for three major emission control systems (PM filters, oxides of nitrogen (NOx) catalysts, and NOx sensors) on diesel engines based on the current limits of technical feasibility, delay the monitoring requirements for some diesel-related components until 2015 to provide further lead time for emission control strategies to stabilize, and clarify requirements for several monitors and standardization. Proposed amendments to the HD OBD regulation include:

- Clarifying the purposes and objectives of the OBD regulations
- Adding a definition of emission standard as it applies to OBD systems
- Adding definitions for exhaust and evaporative emission standards
- Revisions related to alternate-fueled engines
- Adding definitions and revising the permanent fault code storage and erasure protocol and in-use monitoring performance requirements applicable to hybrid vehicles
- Revising the freeze frame storage and erasure protocol
- Revising the in-use monitoring performance requirements for the PM filter and PM sensor monitors
- Revising the diesel misfire monitoring requirements to no longer require emission threshold-based malfunction criteria and to require expanded monitoring conditions.
- Revising the 2013 through 2015 model year malfunction thresholds for the diesel PM filter monitor, the NOx catalyst monitor, and the NOx sensor monitor
- Delaying some monitoring requirements for catalyzed PM filters and diesel non-methane hydrocarbon converting catalysts from the 2013 model year to the 2015 model year
- Revising the cooling system monitoring requirements to clarify when monitor enablement can occur
- Updating the SAE and ISO document references
- Revising the standardized communication protocol and diagnostic connector requirements to account for the new 500 kbps baud rate version of SAE J1939.
- Revising the readiness status requirements to clarify which monitors are to be included in determining readiness
- Clarifying the calibration verification number requirements
- Revising the certification demonstration testing requirements to clarify how to perform the testing for gasoline air-fuel ratio cylinder imbalance monitoring and

exhaust gas sensor monitoring, to exempt manufacturers from testing the diesel misfire monitor, and to clarify the test requirements for catalyst faults and other faults where default actions are taken
- Adding items required to be submitted as part of the certification application
- Revising the deficiencies section to allow up to two free deficiencies for 2013 through 2015 model year heavy-duty hybrid vehicles and for PM filter and PM sensor monitors

Concurrently, the staff is proposing to update the medium-duty vehicle diesel-related requirements in the medium-duty OBD II regulation (§1968.2) to be consistent with the proposed diesel-related amendments to the HD OBD regulation. These proposed changes for medium-duty vehicles include diesel monitoring requirements and diesel-related in-use monitor performance requirements mentioned above. This would allow manufacturers of both heavy-duty and medium-duty diesel engines to design to and meet essentially the same requirements.

Further, the staff is also proposing amendments to the HD OBD and OBD II enforcement regulations (California Code of Regulations, title 13, §1971.5 and §1968.5, respectively) to align with the proposed diesel-related changes to the HD OBD and OBD II regulations, specifically the selection criteria of engines/vehicles for the test sample group and the mandatory recall provisions for diesel engines.

The proposed HD OBD and OBD II amendments provide engine manufacturers with greater compliance flexibility and clarify the performance requirements that they are expected to meet in designing and developing robust OBD systems. This in turn will encourage manufacturers to design and build more durable engines and emission-related components, all of which will help ensure that forecasted emission reduction benefits from adopted medium- and heavy-duty engine emission control programs are achieved in-use.

CONSISTENCY AND COMPATIBILITY WITH EXISTING STATE REGULATIONS

As stated above, OBD II regulations were first adopted in 2002 while the HD OBD regulations were first adopted in 2005. The intent of OBD systems is to ensure that motor vehicle tailpipe and evaporative emission standards are met in-use throughout the useful lives of the motor vehicle and that emission-related components are durable and effective. The proposed amendments will provide for robust systems that are consistent and compatible with existing State regulations.

MANDATED BY FEDERAL LAW OR REGULATIONS

The federal Clean Air Act establishes ambient air quality standards that states must achieve by specific dates. The Clean Air Act does not mandate specific requirements that states must adopt but instead provides states with discretion on how to achieve these emission reductions. The OBD amendments set forth here have been determined by the California legislature and ARB as a necessary and important part of California's emission reduction program to achieve the federal objectives.

COMPARABLE FEDERAL REGULATIONS

In February 1993, the U.S. EPA promulgated final OBD requirements for federally certified light-duty vehicles and trucks. (40 CFR Part 86, §§ 86.094-2, 86.094-17, 86.094-18(a), 86.094-21(h), 86.094-25(d), 86.094-30(f), 86.094-35(l), 86.095-30(f), 86.095-35(l); see 58 Fed.Reg. 9468-9488 (February 19, 1993).) The requirements were later amended to require OBD systems on medium-duty vehicles by the 2008 model year. The final rule with the latest modifications of the requirements was published on February 24, 2009. A central part of the federal regulation is that, for purposes of federal certification of vehicles, U.S. EPA will deem California-certified OBD II systems to comply with the federal regulations.

In Health and Safety Code sections 43013, 43018, and 43101, the Legislature expressly directed ARB to adopt emission standards for new motor vehicles that are necessary and technologically feasible and to endeavor to achieve the maximum degree of emission reduction possible from vehicular and other mobile sources in order to accomplish the attainment of the State standards at the earliest practicable date. ARB initially adopted the OBD II regulations to meet those legislative directives. The OBD II regulation was first adopted in 1990. On October 3, 1996, the U.S. EPA formally granted California's request for a waiver regarding the OBD II regulation, as last amended in December 1994,[1] recognizing that the OBD II regulation is at least as stringent in protecting public health and welfare as the federal regulation, and that unique circumstances exist in California necessitating the need for the State's own motor vehicle regulations program.

The federal OBD requirements are comparable in concept and purpose with California's OBD II regulation; however, differences exist with respect to the scope and stringency of the requirements of the two regulations. More specifically, California's current OBD II regulations are generally more comprehensive and stringent than the comparable federal requirements. Under OBD II requirements, manufacturers must implement monitoring strategies for essentially all emission control systems and emission-related components. Generally, the OBD II regulation requires that components be monitored to indicate malfunctions when component deterioration or failure causes emissions to exceed 1.5 times the applicable tailpipe emission standards of the certified vehicle. The regulation also requires that components be monitored for functional performance even if the failure of such components does not cause emissions to exceed 1.5 times the standard. The federal requirements, in contrast, require monitoring only of the catalyst, engine misfire, evaporative emission control system, and oxygen sensors. Other emission control systems or components, such as exhaust gas recirculation and secondary air systems, need only be monitored if by malfunctioning, vehicle emissions exceed 1.5 times the applicable tailpipe standards. No functional monitoring is required.

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[1] *California State Motor Vehicle Pollution Control Standards; Waiver of Federal Preemption; Decision,* dated October 3, 1996, 61 Fed.Reg. 53371 (October 11, 1996).

Historically, virtually every vehicle sold in the U.S. is designed and certified to California's OBD II requirements in lieu of the federal OBD requirements.

ARB initially adopted the HD OBD regulation in 2005. A waiver for the regulation was granted by U.S EPA in 2008.[2] The U.S. EPA has also adopted OBD requirements for vehicles and engines above 14,000 pounds, which is the weight range for California's "heavy-duty" class. The federal regulation, which was published on February 24, 2009, is consistent with ARB's California regulation in almost all important aspects, and while minor differences may exist between these requirements, heavy-duty OBD systems can be designed to comply with both the federal and California programs. In fact, U.S. EPA's regulation directly allows acceptance of systems that have been certified to California's HD OBD regulation and to date, all heavy-duty engine manufacturers have chosen this path for certification.

Finally, in 2004, the United States Supreme Court clarified the definition of emission standard as it applies to motor vehicles and motor vehicle engines, finding that emission standards relate to the emission characteristics of a vehicle or engine and that for compliance purposes require a motor vehicle or motor vehicle engine to emit no more than a certain amount of a given pollutant, be equipped with a certain type of pollution-control device, or have some other design feature related to the control of emissions. (*EMA.* 541 U.S. at 253.) An OBD system, in general, is a design feature related to the control of emissions and specifically establishes malfunction criteria that set numerical emission limits for pollutants for the purpose of detecting emission control system malfunctions. The proposed amendments are intended to make clear that the definition of emission standard as used in the OBD regulations conform to the federal definition as interpreted.

AVAILABILITY OF DOCUMENTS

ARB staff has prepared a Staff Report: Initial Statement of Reasons (ISOR) for the proposed regulatory action, which includes a summary of the economic and environmental impacts of the proposal. The report is entitled: Technical Status and Revisions to Malfunction and Diagnostic System Requirements for Heavy-Duty Engines (HD OBD) and Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines (OBD II).

Copies of the ISOR and the full text of the proposed regulatory language, in underline and strikeout format to allow for comparison with the existing regulations, may be accessed on ARB's website listed below, or may be obtained from the Public Information Office, Air Resources Board, 1001 I Street, Visitors and Environmental Services Center, First Floor, Sacramento, California, 95814, (916) 322-2990, on July 5, 2012.

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[2] *California State Motor Vehicle Pollution Control Standards; Waiver of Federal Preemption; Decision,* dated August 13, 2008 73 Fed.Reg. 52042 (September 8, 2008),

Final Statement of Reasons Availability
Upon its completion, the Final Statement of Reasons (FSOR) will be available and copies may be requested from the agency contact persons in this notice, or may be accessed on ARB's website listed below.

Internet Access
This notice, the ISOR and all subsequent regulatory documents, including the FSOR, when completed, are available on ARB's website for this rulemaking at http://www.arb.ca.gov/regact/2012/hdobd12/hdobd12.htm

AGENCY CONTACT PERSONS
Inquiries concerning the substance of the proposed regulation may be directed to the designated agency contact persons, Mike McCarthy, Manager, Advanced Engineering Section, at (626) 771-3614 or Adriane Chiu, Air Resources Engineer, Advanced Engineering Section, at (626) 350-6453.

Further, nonsubstantive inquiries concerning the proposed administrative action may be directed to Ms. Lori Andreoni, Manager, Board Administration and Regulatory Coordination Unit at (916) 322-4011, or Ms. Amy Whiting, Regulations Coordinator at (916) 322-6533. The Board staff has compiled a record for this rulemaking action, which includes all the information upon which the proposal is based. This material is available for inspection upon request to the contact persons.

FISCAL IMPACT

The determinations of the Board's Executive Officer concerning the costs or savings necessarily incurred by public agencies and private persons and businesses in reasonable compliance with the proposed regulations are presented below.

DISCLOSURES REGARDING THE PROPOSED REGULATION

Pursuant to Government Code sections 11346.5(a)(5) and 11346.5(a)(6), the Executive Officer has determined that the proposed regulatory action would not create costs or savings to any State agency or in federal funding to the State, costs or mandate to any local agency or school district, whether or not reimbursable by the State pursuant to Government Code, title 2, division 4, part 7 (commencing with section 17500), or other nondiscretionary cost or savings to State or local agencies.

COST IMPACTS ON REPRESENTATIVE PRIVATE PERSONS OR BUSINESSES

In developing this regulatory proposal, ARB staff evaluated the potential economic impacts on representative private persons or businesses. The proposed revisions to the regulations consist primarily of providing interim relaxations of requirements and clarifying existing requirements. The only changes that are expected to affect costs involve the increased reporting requirements for the diesel misfire monitor and the two year earlier implementation of full OBD for heavy-duty alternate-fueled engines. Regarding the diesel misfire monitor reporting requirements, the additional reporting costs to comply with the more comprehensive misfire monitoring requirements will result in total costs of about $30,000 annually when the requirement is fully phased-in, which amounts to an incremental cost of less than $0.56 per vehicle passed on to consumers. Thus, the cost related to heavy-duty engine manufacturers and medium-duty vehicle manufacturers are expected to be negligible. For heavy-duty alternate-fueled engines, the additional incremental cost for buyers of these vehicles has been estimated to range from $21 per vehicle for vehicles from large volume manufacturers to $207 per vehicle for small businesses. These costs, however, are expected to be offset by various financial incentives offered by the State and federal agencies that have ranged from $7500 to $32,000 per vehicle in past years. More details of this analysis are set forth in the ISOR.

SIGNIFICANT STATEWIDE ADVERSE ECONOMIC IMPACT DIRECTLY AFFECTING BUSINESS, INCLUDING ABILITY TO COMPETE

The Executive Officer has made an initial determination that the proposed regulatory action would not have a significant statewide adverse economic impact directly affecting businesses, including the ability of California businesses to compete with businesses in other states, or on representative private persons. Support for this determination is set forth in the ISOR.

STATEMENT OF THE RESULTS OF THE ECONOMIC IMPACT ASSESSMENT PREPARED PURSUANT TO GOVERNMENT CODE SEC. 11346.3(b)

The Executive Officer has determined that the proposed regulatory action would have minor or no impact on the creation or elimination of jobs within the State of California, the creation of new businesses or elimination of existing businesses within the State of California, or the expansion of businesses currently doing business within the State of California. A detailed assessment of the economic impacts of the proposed regulatory action can be found in the ISOR.

Benefits of the Proposed Regulation:

As set forth above, the proposed HD OBD and OBD II amendments will provide engine manufacturers with greater compliance flexibility and clarify the performance requirements that they are expected to meet in designing and developing robust OBD systems. This in turn will encourage manufacturers to design and build more durable engines and emission-related components, all of which will help ensure that forecasted emission reduction benefits from adopted medium- and heavy-duty engine emission control programs are achieved in-use. A detailed assessment of the economic impacts of the proposed regulatory action and ascribed benefits can be found in the Economic Impact Analysis in the ISOR.

EFFECT ON SMALL BUSINESS

The Executive Officer has also determined, pursuant to California Code of Regulations, title 1, section 4, that the proposed regulatory action may affect small businesses. There are an estimated nine alternate-fueled conversion manufacturers, some of which may be considered "small businesses", though the exact number cannot be determined. One of these manufacturers is located in California. A typical small business is an alternate-fueled engine conversion manufacturer that converts up to 500 diesel or gasoline engines per year to run on alternate fuels. An analysis was conducted that estimates the cost of the proposed amendments on such a small business at $212,000 over two years. Such small businesses would be expected to pass these costs on to the purchaser of the engine in the form of increased retail price for the converted engine as noted above in the cost impacts on private persons or businesses.

REPORTING REQUIREMENTS

In accordance with Government Code sections 11346.3(c) and 11346.5(a)(11), the Executive Officer has found that the reporting requirements of the regulation which apply to businesses are necessary for the health, safety, and welfare of the people of the State of California.

ALTERNATIVES

Before taking final action on the proposed regulatory action, the Board must determine that no reasonable alternative considered by the Board, or that has otherwise been identified and brought to the attention of the Board (which includes during preliminary workshop activities), would be more effective in carrying out the purpose for which the action is proposed, or would be as effective and less burdensome to affected private persons than the proposed action, or would be more cost-effective to affected private persons and equally effective in implementing the statutory policy or other provisions of law.

ENVIRONMENTAL ANALYSIS

In accordance with ARB's certified regulatory program, California Code of Regulations, title 17, sections 60006 through 60007, and the California Environmental Quality Act, Public Resources Code section 21080.5, ARB has conducted an analysis of the potential for significant adverse and beneficial environmental impacts associated with the proposed regulatory action. The environmental analysis of the proposed regulatory action can be found in Chapter III of the ISOR.

SUBMITTAL OF COMMENTS AND WRITTEN COMMENT PERIOD

Interested members of the public may also present comments orally or in writing at the meeting, and comments may be submitted by postal mail or by electronic submittal before the meeting. The public comment period for this regulatory action will begin on

Monday, July 9, 2012. To be considered by the Board, written comments, not physically submitted at the meeting, must be submitted on or after Monday, July 9, 2012 and received **no later than 12:00 noon on Wednesday, August 22, 2012**, and must be addressed to the following:

Postal mail: Clerk of the Board, Air Resources Board
1001 I Street, Sacramento, California 95814

Electronic submittal: http://www.arb.ca.gov/lispub/comm/bclist.php

You can sign up online in advance to speak at the Board meeting when you submit an electronic board item comment. For more information go to: http://www.arb.ca.gov/board/online-signup.htm

Please note that under the California Public Records Act (Gov. Code, § 6250 et seq.), your written and oral comments, attachments, and associated contact information (e.g., your address, phone, email, etc.) become part of the public record and can be released to the public upon request.

ARB requests that written and email statements on this item be filed at least 10 days prior to the hearing so that ARB staff and Board members have additional time to consider each comment. The Board encourages members of the public to bring to the attention of staff in advance of the hearing any suggestions for modification of the proposed regulatory action.

Additionally, the Board requests but does not require that persons who submit written comments to the Board reference the title of the proposal in their comments to facilitate review.

STATUTORY AUTHORITY AND REFERENCES

This regulatory action is proposed under that authority granted in Health and Safety Code, sections 39010, 39600, 39601, 43000.5, 43013, 43016, 43018, 43100, 43101, 43104, 43105, 43105.5, 43106, 43154, 43211, and 43212. This action is proposed to implement, interpret and make specific sections 39002, 39003, 39010, 39018, 39021.5, 39024, 39024.5, 39027, 39027.3, 39028, 39029, 39031, 39032, 39032.5, 39033, 39035, 39037.05, 39037.5, 39038, 39039, 39040, 39042, 39042.5, 39046, 39047, 39053, 39054, 39058, 39059, 39060, 39515, 39600, 39601, 43000, 43000.5, 43004, 43006, 43013, 43016, 43018, 43100, 43101, 43102, 43104, 43105, 43105.5, 43106, 43150, 43151, 43152, 43153, 43154, 43155, 43156, 43204, 43205, 43211, and 43212 of the Health and Safety Code.

HEARING PROCEDURES

The public hearing will be conducted in accordance with the California Administrative Procedure Act, Government Code, title 2, division 3, part 1, chapter 3.5 (commencing with section 11340).

Following the public hearing, the Board may adopt the regulatory language as originally proposed, or with non-substantial or grammatical modifications. The Board may also adopt the proposed regulatory language with other modifications if the text as modified is sufficiently related to the originally proposed text that the public was adequately placed on notice and that the regulatory language as modified could result from the proposed regulatory action; in such event, the full regulatory text, with the modifications clearly indicated, will be made available to the public, for written comment, at least 15-days before it is adopted.

The public may request a copy of the modified regulatory text from ARB's Public Information Office, Air Resources Board, 1001 I Street, Visitors and Environmental Services Center, First Floor, Sacramento, California, 95814, (916) 322-2990.

SPECIAL ACCOMMODATION REQUEST

Special accommodation or language needs can be provided for any of the following:

- An interpreter to be available at the hearing;
- Documents made available in an alternate format or another language; or
- A disability-related reasonable accommodation.

To request these special accommodations or language needs, please contact the Clerk of the Board at (916) 322-5594 or by facsimile at 916) 322-3928 as soon as possible, but no later than 10 business days before the scheduled Board hearing. TTY/TDD/Speech to Speech users may dial 711 for the California Relay Service.

Comodidad especial o necesidad de otro idioma puede ser proveído para alguna de las siguientes:

- Un intérprete que esté disponible en la audiencia.
- Documentos disponibles en un formato alterno u otro idioma.
- Una acomodación razonable relacionados con una incapacidad.

Para solicitar estas comodidades especiales o necesidades de otro idioma, por favor llame a la oficina del Consejo al (916) 322-5594 o envíe un fax a (916) 322-3928 lo más pronto posible, pero no menos de 10 días de trabajo antes del día programado para la audiencia del Consejo. TTY/TDD/Personas que necesiten este servicio pueden marcar el 711 para el Servicio de Retransmisión de Mensajes de California.

CALIFORNIA AIR RESOURCES BOARD

James N. Goldstene
Executive Officer

Date: June 26, 2012

The energy challenge facing California is real. Every Californian needs to take immediate action to reduce energy consumption. For a list of simple ways you can reduce demand and cut your energy costs, see our website at www.arb.ca.gov.

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Appendix C: Proposed Regulation Order: Title 13, California Code of Regulations, Section 1971.5, Enforcement of Malfunction and Diagnostic System Requirements for 2010 and Subsequent Model-Year Heavy-Duty Engines

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I. SUMMARY OF STAFF PROPOSAL AND RELATED POLICY ISSUES

Background

On-board diagnostic (OBD) systems are comprised mainly of software designed into the vehicle's on-board computer to detect emission control system malfunctions as they occur by monitoring virtually every component and system that can cause increases in emissions. When an emission-related malfunction is detected, the OBD system alerts the vehicle owner by illuminating the malfunction indicator light (MIL) on the instrument panel. By alerting the owner of malfunctions as they occur, repairs can be sought promptly, which results in fewer emissions from the vehicle. Additionally, the OBD system stores important information, including identifying the faulty component or system and the nature of the fault, which allow for quick diagnosis and proper repair of the problem by technicians. This helps owners achieve less expensive repairs and promotes repairs done correctly the first time. The use and operation of OBD systems ensure reductions of in-use motor vehicle and motor vehicle engine emissions through improvements in emission system durability and performance.

The California Air Resources Board (ARB or Board) originally adopted comprehensive OBD regulations in 1989, requiring all 1996 and newer model year passenger cars, light-duty trucks, and medium-duty vehicles and engines to be equipped with OBD systems (referred to as OBD II). ARB subsequently updated the OBD II regulations with the adoption of California Code of Regulations (Cal. Code Regs.), title 13, sections 1968.2 and 1968.5, which established OBD II requirements and OBD II-specific enforcement requirements for 2004 and subsequent model year passenger cars, light-duty trucks, and medium-duty vehicles and engines. In 2004, ARB adopted the Engine Manufacturer Diagnostic system (EMD) regulation (Cal. Code Regs., title 13, section 1971), which requires manufacturers of heavy-duty engines and vehicles (i.e., vehicles with a gross vehicle weight rating greater than 14,000 pounds) to implement diagnostic systems on all 2007 and subsequent model year on-road heavy-duty Otto-cycle (gasoline) and diesel engines. However, the EMD regulation is much less comprehensive than the OBD II regulation, requiring the monitoring of only a few major emission control technologies and containing no standardized requirements. Essentially, the EMD regulation was developed to require heavy-duty engine manufacturers to achieve a minimum level of diagnostic capability while focusing most of their resources on meeting the new 2007 exhaust emission standards. In 2005, ARB adopted Cal. Code Regs., title 13, section 1971.1, which established comprehensive OBD requirements (HD OBD) for 2010 and subsequent model year heavy-duty engines and vehicles, and an HD OBD-specific enforcement regulation, section 1971.5, was subsequently adopted in 2009.

Since amendments were last adopted for the heavy-duty OBD regulations in 2009, ARB staff has met with manufacturers to review progress in meeting the regulatory requirements and identify the need for revisions. Staff believes that modifications to the regulations are warranted and is proposing amendments to the HD OBD regulation section 1971.1, which can be found in Appendix A. Staff is also proposing similar amendments to the OBD II regulation section 1968.2 (included in Appendix B) for medium-duty diesel engines and vehicles to harmonize the requirements of the two regulations. The proposed regulation order for section 1968.2 also contains minor amendments that were recently approved by the Board at the January 23, 2012 Board hearing but have not been formally adopted to date. These amendments are designated by single underline to indicate additions and ~~single strikeout~~ to indicate deletions from the existing regulatory text, while the amendments proposed during this rulemaking are shown in double underline to indicate additions and ~~double strikeout~~ to indicate deletions. Lastly, staff is proposing to amend the associated enforcement regulations, sections 1971.5 and 1968.5 (included as Appendices C and D, respectively), to align these regulations with the new or modified OBD requirements. Within section 1971.1, which initially applied to 2010 model year engines, some requirements include specific implementation model year dates that dictate exactly when manufacturers are expected to meet a requirement; requirements that do not reference an implementation date were required to be initially be implemented for 2010 and subsequent model year engines.

Summary of Proposed Amendments

A summary of the main issues and technical amendments are provided below while detailed explanations of each of these issues are provided in section II. Summaries and rationales of the proposed changes are provided in section VII of this report. Of the proposed amendments to the HD OBD regulation, many have been discussed with manufacturers and have raised little issue or have mostly been settled. They include:

- Clarifying the purpose and objectives of the OBD regulations.
- Adding a definition for "alternate-fueled engines."
- Adding a definition of "emission standard" as it applies to OBD systems.
- Adding definitions of "exhaust emission standards" and "evaporative emission standards."
- Adding definitions and revising the permanent fault code storage and erasure protocol and in-use monitoring performance requirements applicable to hybrid vehicles.
- Revising the freeze frame storage and erasure protocol.
- Revising the in-use monitoring performance requirements for the PM filter and PM sensor monitors.
- Revising the diesel misfire monitoring requirements to no longer require emission threshold-based malfunction criteria and to require expanded monitoring conditions.
- Delaying some monitoring requirements for catalyzed PM filters and diesel NMHC converting catalysts to the 2015 model year and adding test-out criteria.
- Revising the cooling system monitoring requirements to clarify when monitor enablement can occur.
- Updating the Society of Automotive Engineers (SAE) and International Standards Organization (ISO) document references.

- Revising the readiness status requirements to clarify which monitors are specifically to be included in determining readiness.
- Clarifying the calibration verification number (CVN) requirements.
- Revising the certification demonstration testing requirements to clarify how to perform the testing for gasoline air-fuel ratio cylinder imbalance monitoring and exhaust gas sensor monitoring, to exempt manufacturers from testing the diesel misfire monitor, and to clarify the test requirements for catalyst faults and other faults where default actions are taken.
- Adding items required to be submitted as part of the certification application.

The purpose of the HD OBD and OBD II regulations is to reduce motor vehicle and motor vehicle engine emissions by establishing emission standards and other requirements for OBD systems that are installed on motor vehicles and motor vehicle engines certified for sale in California. The use and operation of OBD systems ensure reductions of in-use motor vehicle and motor vehicle engine emissions through improvements in emission system durability and performance. The regulations ensure that emission reductions forecasted under California's various motor vehicle and engine exhaust and evaporative emission regulations are effectively achieved by monitoring the emission-control systems of individual vehicles during every day in-use operation. Without functional diagnostic systems, there would be no way to ensure that every individual component installed on a motor vehicle is working properly and that every malfunction is detected and corrected expeditiously. Such emission reduction objectives and benefits are distinct from those derived from ARB's in-use vehicle enforcement test procedures (title 13, Cal. Code Regs., section 2136 et seq.), which are directed at ensuring that certified vehicles and engines, on average, do not exceed certification exhaust and evaporative emission standards. The proposed amendments to sections 1968.2(a) and 1971.1(a) are to reaffirm and make more explicit these longstanding and intended purposes of the OBD regulations.

Regarding the proposed amendments to the diesel monitoring requirements, the HD OBD regulation establishes monitoring requirements for approximately 10 major emission control components/systems and another 20 or more minor comprehensive components on a typical diesel engine. For each major component/system, the regulation contains several different monitoring requirements that target specific aspects of each component/system that can have an emission impact when not functioning properly, which collectively represents about 40 to 50 different monitoring requirements. For each minor comprehensive component, the regulation also requires separate monitors for individual failures to enable pinpointing of the likely malfunction for repair technicians, which collectively represents another 80 or more monitoring requirements. In total, staff is proposing significant changes to seven requirements, with two of these changes (for diesel misfire monitoring and PM filter feedgas monitoring) making the current requirements more stringent and the other five relaxing the requirements for the 2013 through 2015 model years.

Concurrently, the staff is proposing to update the medium-duty vehicle diesel-related requirements in the medium-duty OBD II regulation (section 1968.2) to be consistent with some of the proposed diesel-related amendments to the HD OBD regulation. These proposed changes for medium-duty vehicles include diesel monitoring requirements and diesel-related in-use monitor performance requirements. This would allow manufacturers of both heavy-duty and medium-duty diesel engines to design to and meet essentially the same requirements. Staff is also proposing changes that would establish specific monitoring requirements and thresholds for future medium-duty vehicles certified to a chassis dynamometer tailpipe emission standard in lieu of manufacturers requesting ARB approval of their proposed thresholds.

Further, the staff is proposing amendments to the HD OBD and OBD II enforcement regulations (sections 1971.5 and 1968.5, respectively) to align with the proposed diesel-related changes to the HD OBD and OBD II regulations, specifically the selection criteria of engines/vehicles for the test sample group and the mandatory recall provisions for diesel engines.

Stakeholders have recently argued that OBD system requirements are not emission standards or test procedures and that ARB does not have authority to order manufacturers to recall motor vehicles or engines if ARB were to determine that an installed OBD system was found to be in noncompliance with the HD OBD regulation. Staff is proposing a new definition of "emission standard" to clarify any confusion and misunderstanding as to whether the OBD requirements include emission standards. The proposed definition conforms with the federal definition applied to Title II of the Clean Air Act by the U.S. Supreme Court in *Engine Manufacturers Association v. South Coast Air Quality Management District* (2004) 541 U.S. 246, 253, 124 S.Ct. 1756, 1762 (*EMA*). There the Court clarified that an emission standard, with respect to motor vehicles and motor vehicle engines, is a standard that relates to the emission characteristics of a vehicle or engine and that, for compliance purposes, requires a motor vehicle or motor vehicle engine to emit no more than a certain amount of a given pollutant, be equipped with a certain type of pollution-control device, or have some other design feature related to the control of emissions. (*Id.* at 253.) The proposed amendments are intended to make clear that the definition of emission standard as used in the OBD regulations conforms to the federal definition as interpreted by the Supreme Court.

In addition to the proposed amendments mentioned above, there are a few issues where ARB staff and industry differed significantly as to the necessity or the stringency of a requirement. In addition to proposed amendments that require more stringent requirements that manufacturers objected to, ARB staff also proposed many changes that would relax some requirements based on manufacturers' concerns, though the proposal does not go as far as manufacturers have requested. The requirements of concern to the affected manufacturers include:

Heavy-Duty and Medium-Duty Diesel Monitors

Manufacturers have expressed concerns about meeting some of the required diesel monitoring emission malfunction thresholds during the 2013 through 2015 model years, particularly for NOx catalyst/NOx sensor monitoring and PM filter monitoring. The HD OBD and OBD II regulations currently require manufacturers to detect conversion efficiency faults before NOx emissions exceed the applicable NOx standard plus 0.2 grams per brake-horsepower hour (g/bhp-hr) for the 2013 and subsequent model years. For PM filter monitoring, manufacturers are required to detect faults before PM emissions exceed a threshold ranging from 0.03 to 0.05 g/bhp-hr for the 2013 through 2015 model years with a final threshold of 0.03 g/bhp-hr for all 2016 and subsequent model year engines and vehicles. Manufacturers have argued that meeting these thresholds is difficult or not feasible in the required timeframe. Concerning the NOx catalyst and NOx sensor monitor thresholds, manufacturers have indicated that the dynamics of the selective catalytic reduction (SCR) system and its control, including the NOx sensors and the reductant delivery system, have made it difficult to meet the thresholds. Concerning the PM filter monitor thresholds, manufacturers have indicated that PM sensors, which many believe will be the only viable way to meet the thresholds, will not be available in time for the 2013 model year. Accordingly, they proposed that engines continue to use the higher malfunction thresholds required before the 2013 model year. While staff believes these thresholds are technically feasible to meet, staff agrees some relaxation is necessary for the near-term model years, though it disagrees with manufacturers about the extent of the relaxation needed. For both the NOx catalyst/sensor monitors and the PM filter monitors, staff is proposing higher interim thresholds during the 2013 through 2015 model years, with the final stringent thresholds delayed until the 2016 model year. Additionally, for the PM filter and PM sensor monitors, staff is also proposing free deficiencies related to these monitors for the 2013 through 2015 model years to acknowledge the risk manufacturers are taking when implementing new PM sensors and ensure that they are not penalized for doing so.

Heavy-Duty SAE J1939 Protocol

Part of the HD OBD requirements includes standardization of data to be output from the engine and vehicle to off-board tools used by technicians and inspectors. The regulation currently allows engines to use SAE J1939 as the standard for the communication protocol and the diagnostic connector specifications. When the requirement was first adopted, SAE J1939 only had a single (250 kilobits per second (kbps)) baud rate and a single connector, so there was no need to identify a specific baud rate or connector version in the regulation. However, since then, SAE J1939 has added an additional baud rate (500 kbps) and a second connector variant to handle the new baud rate. Thus, to ensure that all manufacturers were using the same baud rate and connector, staff originally proposed to clarify that only the original baud rate and connector versions (i.e., the 250 kbps baud rate version) were allowed for standardized OBD communication. However, manufacturers have indicated that most of industry was already moving towards using the 500 kbps baud rate version to handle an increased number of messages and data and requested that they be allowed to use either the 250 kbps or the 500 kbps version indefinitely. While staff agrees that some changes are needed to account for the industry trend towards the 500 kbps version, staff does not believe both baud rate versions should be allowed as options indefinitely given the potential problems of allowing multiple communication variants in the field. Thus, staff is proposing to amend the HD OBD regulation to use either variant and their associated connector up through the 2015 model year and would allow only the 500 kbps variant for all 2016 and subsequent model year heavy-duty engines.

Heavy-Duty Hybrid Vehicles

The HD OBD regulation has required monitoring of hybrid components since the regulation was first adopted in 2005. While updating the regulation in 2009, staff added language that provided general guidelines for monitoring of the hybrid system and required manufacturers to submit a monitoring plan for ARB's review and approval. Affected manufacturers, however, have complained about the burden of having to comply with the HD OBD requirements and have argued that because the heavy-duty industry is horizontally-integrated and heavy-duty engine manufacturers only manufacture the engine while hybrid system manufacturers are only responsible for the hybrid components, it is very difficult to design compliant diagnostics that would account for the wide range of engine-hybrid applications. Citing that hybrid vehicles only constituted a very small part of the heavy-duty market and are only economically viable because of sizable government funding subsidies and incentives to purchasers, hybrid system manufacturers have requested exemption from having to implement OBD systems on heavy-duty hybrid vehicles until a later model year (e.g., 2018 model year). Concurrently, engine manufacturers have requested that they be relieved from any liability for engine diagnostics that are adversely affected by the hybrid system. While ARB staff believes revisions are needed given these circumstances, it disagrees with the amount of lead time requested, given that these monitoring requirements have been in the regulation for many years. Staff believes that further delays in hybrids becoming compliant should be avoided and will better ensure that near term hybrid vehicles (that are largely subsidized by ARB through ARB's hybrid and zero-emission truck and bus voucher incentive project) achieve and maintain emission benefits over the life of the vehicle. Thus, staff is proposing one extra year (the 2013 model year) in which manufacturers are allowed the option of complying with alternative, much less stringent requirements. In addition, staff is proposing changes to the deficiency provisions which allow for certification of HD OBD systems with minor implementation problems that don't fully meet the HD OBD requirements. Specifically, staff is proposing two additional free deficiencies in the 2013 through 2015 model years (for a maximum of four free deficiencies) for hybrid-related issues to help manufacturers certify their HD OBD systems.

Heavy-Duty Alternate-Fueled Engines

The regulation currently requires manufacturers to implement "full" HD OBD systems on alternate-fueled engines starting in the 2020 model year. When first adopting this requirement, ARB staff had anticipated alternate-fueled engines to constitute a very low percentage of the heavy-duty market. This assumption, however, is no longer expected to hold true, with several manufacturers indicating plans to offer more alternate-fueled engines in the near future. Considering the importance of ensuring the durability and emission benefits of these engines, staff initially proposed to move up the start date from the 2020 to the 2016 model year. Alternate-fueled engine manufacturers, however, have argued about the difficulty in meeting this proposal, and some proposed a phase-in plan to come into compliance starting in the 2016 model year, with 100 percent of 2018 model year engines meeting the HD OBD requirements. Based on further discussions with manufacturers, staff ultimately revised its proposal to require HD OBD system implementation on alternate-fueled engines starting in the 2018 model year. This would result in alternate-fueled engines complying two years earlier than currently required and minimize the chance for inequities in the phase-in years between manufacturers that offer many different alternate-fueled engines and those that have only one or two offerings. Staff, however, is anticipating some alternate-fueled engine manufacturers to oppose this revised proposal.

Emission and Cost Impacts

The proposed amendments are not expected to have an adverse impact on the environment. Overall, the proposed amendments to the HD OBD and OBD II regulations would result in cleaner vehicles than those currently produced, since the requirements for later model years will still be more stringent than those for current model year, and are not expected to significantly alter previously calculated emission benefits or findings. During the 2009 HD OBD regulatory process, the lifetime cumulative emission reductions for HD OBD, on a per engine basis calculated with the most recent version of the base emission inventory model (EMFAC), were calculated to be 165 pounds of reactive organic gases (ROG), 2000 pounds of NOx, and 14 pounds of PM. For OBD II, during the 2002 OBD II regulatory update, staff calculated a combined benefit for OBD II and LEV II of 57 tons per day of ROG + NOx in the South Coast Air Basin alone. These benefits calculations have not changed since.

The additional costs to manufacturers to meet the proposed amendments are expected to be negligible. Staff calculated the cost effectiveness of this proposed rulemaking to be $13.13 per pound of PM and $0.08 per pound of ROG + NOx. Further details of the emission benefit, costs, and cost-effectiveness are included in sections III. and V.

Recommendation

ARB staff recommends that the Board adopt the amendments to the HD OBD and OBD II regulations and associated enforcement regulations as proposed in the Initial Statement of Reasons.

II. TECHNICAL STATUS UPDATE AND PROPOSED AMENDMENTS

A. HEAVY-DUTY HYBRID VEHICLES

One issue of concern to heavy-duty engine, vehicle, and hybrid system manufacturers is OBD monitoring of heavy-duty hybrid components. The HD OBD regulation currently requires hybrid systems and components to be monitored for emission-related malfunctions and to ensure the addition of such systems to a certified engine does not adversely affect the ability of the engine to comply with OBD requirements. Because hybrid systems vary greatly in terms of system architecture and capability, manufacturers are required to submit a monitoring plan for ARB's review and approval for hybrid vehicles. Affected manufacturers have argued that, unlike the light-duty and medium-duty industry, the heavy-duty industry is a horizontally-integrated industry in which the heavy-duty engine manufacturers only manufacture the engine and the hybrid system manufacturers are responsible for the hybrid components and neither have total integrated system responsibility or capability. Further, they argue the use of hybrid technology on heavy-duty vehicles is still emerging, that they constitute a very small market share, and that they are only economically viable because of sizable government funding subsidies and incentives to purchasers and would be even less viable given additional expenses to incorporate OBD systems.

The hybrid system manufacturers have indicated that, despite the requirements being adopted in the HD OBD regulation well in advance of the 2013 model year, they have not yet developed compliant diagnostics for their own components let alone attempted to understand their impact on the engine diagnostics. This leads to the engine manufacturers representing that they cannot be responsible for designing their engine diagnostics to account for all of the various hybrid applications that might get mated to one of their engines in the future. Additionally, hybrid system manufacturers argue that because they have no knowledge of how the engine diagnostics work on the various engines they work with, they cannot be responsible for ensuring compliant systems. Accordingly, the hybrid system manufacturers have asked to be exempted from OBD requirements at least until the 2017 model year, which parallels the exemption recently granted by the U.S. EPA under the federal OBD regulation. Additionally, the engine manufacturers have requested relief for any of their engines that get mated to a hybrid, specifically proposing that they not be held liable for ensuring the engine diagnostics comply with the hybrid system components, and, where necessary, be allowed to desensitize or disable diagnostics that no longer work correctly when used in hybrid applications.

Fundamentally, an integrated approach needs to be used for engine and hybrid system manufacturers to have a reasonable chance at meeting all of ARB's requirements, including the OBD requirements and tailpipe standards. Modern engine and emission control systems are extremely complex and must balance many competing factors such as durability, performance, emissions, and fuel economy. Engine manufacturers expend significant resources to find a solution that simultaneously meets all of these requirements, so it should come as no surprise that major alterations to the system such as attaching a hybrid system that can turn the engine on and off and change the speeds and loads the engine is routinely operated at can substantially compromise the ability of the engine to continue to meet all of the requirements. Further, an integrated approach has the advantage of likely being able to maximize hybrid operation and efficiency, thereby making the system more economically viable for the long term. As such, staff is proposing an extra year of relaxation (the 2013 model year) before hybrid systems are required to be properly integrated and compliant with the OBD regulation.

In general terms, there are three areas where hybrid systems need to comply with the OBD requirements. First, there are diagnostics of the added hybrid components/systems themselves. Such diagnostics are required to identify malfunctions that lead to emission increases or affect other diagnostics. These hybrid component/system diagnostics primarily fall under a section of the regulation that details monitoring requirements for comprehensive components, which ensures all electronic input and output components/systems that can affect emissions are fully monitored. Hybrid components that would typically be monitored under such requirements include electric motors, inverters, sensors used for the battery pack, and the battery pack itself. While hybrid manufacturers readily acknowledge that they already have a fair amount of diagnostics for their components to facilitate service, these diagnostics do not fully cover all of the components and failure modes required by the HD OBD regulation. Therefore, most hybrid systems will need added diagnostics (i.e., software routines and calibrations in the on-board computers) to cover the additional failure modes and components. It is expected that the hybrid system manufacturer and suppliers that already provide some diagnostics for service will also need to implement additional diagnostics to require such additional failure notification since they know how these components work. Achieving this is primarily a matter of dedicating sufficient engineering resources to develop, implement, and calibrate the additional diagnostics.

Second, there are the engine diagnostics themselves. While these diagnostics have largely been developed and calibrated to meet the stand-alone engine requirements, the addition of a hybrid system can adversely impact some of these diagnostics. As a very simple example, an engine manufacturer may have designed a required diagnostic of an emission control component to run only at idle. However, when mated to a hybrid system that turns the engine off at every idle, that monitor would no longer be able to run and, consequently, would no longer be able to detect failures of that emission control component. A more complicated example involves engine diagnostics that are calibrated to a tailpipe emission threshold such as EGR diagnostics that must detect malfunctions before tailpipe emissions exceed two times the tailpipe standards. Engine manufacturers do iterative testing on an engine dynamometer to determine the level of malfunction that equates to that tailpipe emission level and design a diagnostic that uses EGR parameters to detect such a level. However, when mated with a hybrid, the engine could be utilized in different speeds and loads where it is more dependent on proper EGR operation and thus, have higher corresponding tailpipe emissions when a fault is detected. Engine manufacturers clearly cannot predict every possible hybrid system control strategy or feature and thus cannot by themselves design an OBD system that will remain compliant regardless of how it is modified. Similarly, hybrid system manufacturers cannot by themselves be expected to know how every engine diagnostic works and make sure they design their system accordingly.

This leads to the only viable solution: having an integrated system whereby one entity takes responsibility to ensure the system as a whole works properly. Such an approach is not unlike what engine manufacturers already do when coordinating with their suppliers that source the emission control components on their engines to ensure that the end result actually works. Hybrid system manufacturers currently do the same with their systems that are comprised of components from various suppliers. Coordination between the hybrid system manufacturer and the engine manufacturer (and even other entities like the transmission or vehicle manufacturers) already happens to varying degrees to ensure some reasonable level of drivability and performance and to work out details such as warranty responsibility. Staff's proposal would require further coordination between the hybrid system manufacturer and engine manufacturer and would ensure that some party takes ultimate responsibility to ensure that the OBD system, in total, works. In some cases, there are engine manufacturers that are more vertically integrated (e.g., that manufacture both the engine and the vehicle and perhaps even the hybrid system), with a few of those manufacturers already well on their way to an integrated design. In other cases, staff expects hybrid system, engine, and even vehicle manufacturers to partner together to achieve an integrated solution. For some, staff expects the existing relationships to change very little other than more involvement between the entities and one of them taking overall responsibility for OBD system compliance. In any case, ultimately one party will be the 'manufacturer' applying for and receiving OBD certification for the integrated hybrid system and engine and that party – be it the manufacturer of the hybrid system, the engine manufacturer, or, in some cases, the vehicle integrator – will be the party the ARB recognizes as the manufacturer of the system and liable for noncompliance.

Third, a more minor but still important element of OBD is structure and standardization of the diagnostics. The OBD requirements lay out detailed rules for everything from types of statistical protocols that can be used for diagnostics to when and how fault information must be stored and communicated to the driver and repair technicians. While the engine diagnostics should already meet these requirements, the hybrid system diagnostics likely do not, so changes will need to be made to the software in the on-board computers to be able to conform to the OBD requirements. For some of the requirements, industry standards such as SAE recommended practices are referenced and used, but some hybrid system manufacturers have expressed concern that sufficient standardization has not yet been defined for all of the various hybrid components and systems. Staff, however, believes the hybrid manufacturers have overemphasized the need for some elements to be standardized. The SAE committees are accustomed to engine manufacturers and others adding new components and needing additional standardized designations and are usually able to accommodate such requests in a timely manner, and should be able to do that here as well. Where standardization is not likely to occur fast enough is in the area of messages for control of such systems (e.g., between the engine and hybrid system computers); however, such standardization is not required to comply with HD OBD or any other ARB requirements. Any integrated approach would, by definition, resolve such issues regardless of whether the solution used standardized or proprietary control messages.

To address concerns raised by hybrid system and engine manufacturers, staff is proposing to modify the 2013 model year requirements to allow use of hybrid systems. Under the proposed modifications, a hybrid vehicle would be required to use a California-certified 2013 model year engine as the base engine and that any modifications made to the base engine's certified OBD system be solely for the purpose of preventing false malfunction determinations that could otherwise occur as a result of the integration of the hybrid system hardware and software. If a hybrid vehicle is certified, the engine manufacturer would be exempt from enforcement or liability for any noncompliance caused by the addition of the hybrid system. Finally, hybrid system and engine manufacturers would be exempted from having to monitor any of the hybrid system components. Staff believes it is necessary to modify the 2013 model year requirements given the current capabilities of both hybrid and engine manufacturers. Further, without providing clear and direct relief to engine manufacturers for engines that are used in hybrid vehicles, engine manufacturers may be hesitant to allow their engines to be used in such applications at the risk of their engines becoming noncompliant. It should be noted, however, that this relaxation applies only to the HD OBD regulation and not any other applicable emission standard or regulation such as tailpipe standards.

Staff's proposal to amend the requirements for the 2013 model year does not necessarily mean that all the systems will go from zero to full compliance by 2014. The HD OBD regulation already provides for deficiencies – areas of the requirements where manufacturers make a good faith attempt to comply in full but fall short – and manufacturers can use the provisions to still get certified even though they do not meet every requirement. Approval of deficiencies is based on several factors identified in the regulation including the overall compliance of the system, good faith effort on the part of the manufacturer to comply, and the manufacturer's plan to come into compliance as soon as possible. Staff expects that it is likely that some, if not many, hybrid systems in 2014 may fall short of some of the requirements, despite the best efforts of manufacturers to comply, yet the systems will still be eligible to be certified by using the deficiency provisions. Staff also expects that some hybrid system manufacturers may make a business decision to not expend the resources for compliance in 2014, in which case they will not be able to offer hybrids for sale in California beyond 2013. For those that do remain in the California market and are thus eligible for incentive funds, the integrated design approach required by the HD OBD regulation will likely lead to more capable hybrid systems having increased efficiencies that meet all ARB requirements.

Hybrid manufacturers have indicated that the proposed changes provided above are not enough, indicating that their lack of experience with designing OBD systems makes it difficult to meet the required HD OBD implementation dates. They further indicated that hybrid vehicles comprise less than 1 percent of the heavy-duty market, and that the requirements would impose a huge burden on the hybrid manufacturers. Thus, they proposed delaying HD OBD compliance for heavy-duty hybrid vehicles beyond the 2013 model year. Staff, however, disagrees that more lead time is the appropriate solution. The requirements for hybrids to comply have been clearly identified in the regulation since 2009 and little progress has been made since then, so providing even more lead time is not likely to change the situation. In contrast, requiring manufacturers to begin compliance in the short-term to remain eligible for funding through ARB's hybrid and zero-emission truck and bus voucher incentive project (HVIP) will likely provide sufficient motivation to manufacturers to make real progress. Avoiding further delays in compliance will also better ensure that near-term hybrid vehicles (that are largely subsidized by ARB through the HVIP) actually achieve and maintain benefits over the life of the vehicles.

Hybrid manufacturers also suggested that there would be a learning curve for them and that while the deficiencies available in the HD OBD regulation provide an avenue for them to get certified with less-than-fully compliant systems, there are fines for engines certified with more than two deficiencies. Knowing that most hybrid engines certified in 2014 may fall short of some HD OBD requirements, just like many engines certified in 2010 fell short of the initial HD OBD requirements, hybrid manufacturers have requested that additional or unlimited free deficiencies be allowed for the first several years of implementation. While engine manufacturers were allowed unlimited free deficiencies in the 2010 through 2012 timeframe, engine manufacturers then were faced with a much more difficult task than hybrid system manufacturers will be facing. Accordingly, staff does not agree that similar deficiency allowances be given. However, staff does acknowledge that most hybrid systems will likely have some deficiencies in the early years and thus is proposing an additional two free deficiencies for hybrid systems in the 2013 through 2015 model years to help reduce the fines for manufacturers that fall short. As is done with engines and is described above for hybrids, the party applying for and receiving OBD certification will be the 'manufacturer' and deficiencies (including the additional two free deficiencies or any associated fines for deficiencies beyond that) will be assessed on this manufacturer.

B. ALTERNATE-FUELED ENGINES

The heavy-duty OBD regulation currently allows alternate-fueled engines to delay implementation of "full" OBD systems until the 2020 model year, with 2013 through 2019 model year alternate-fueled engines required to comply with the less comprehensive EMD requirements and basic monitoring of all NOx aftertreatment components. This late start date of 2020 was adopted in 2006 as part of the initial HD OBD regulation with the expectation that alternate-fueled heavy-duty engines would make up a small portion of the market share and, based on light-duty experience with alternate fuel conversions of gasoline vehicles, that the engines would primarily be OBD-compliant gasoline or diesel engines that are converted to an alternate-fueled engine and continue to have functional full OBD systems. Recent information, however, has indicated that some of these assumptions by staff were incorrect. Several manufacturers have indicated that alternate-fueled engine sales are not insignificant, with at least one engine manufacturer announcing plans to offer significantly more alternate-fueled engines in the near future. Recent discussions with other regulating agencies indicate they are considering near or mid-term measures to greatly increase the market share of alternate-fueled engines. Additionally, in discussions with manufacturers currently offering alternate-fueled engines, staff has found more diverse solutions than previously expected. These include alternate fuel conversions that remain compression-ignited and retain the diesel emission control solution, conversions that change from compression-ignition to spark-ignition and change over to more gasoline-like emission control solutions, conversions to non-stoichiometric spark-ignition that retain diesel-like emission control solutions, etc. Such conversions can have a much larger impact on the OBD system than simpler conversions staff were familiar with, resulting in several unmonitored major emission control components in addition to the normal impacts of altering correlation to emission thresholds and monitoring frequency. Therefore, staff is proposing to move up the required start date for full OBD monitoring from the 2020 model year to the 2018 model year.

Staff had originally proposed that the compliance date be moved up to the 2016 model year, but feedback from several manufacturers at the workshop indicated bringing their many alternate-fueled engine families into compliance in the 2016 model year would be difficult. As such, they requested a phase-in plan for the 2016 through 2018 model years in lieu of compliance for all engine families in 2016. In subsequent discussions with manufacturers that had multiple engine families, staff determined that, within the small market share of alternate-fueled engines, there could be a significant inequity during the phase-in years between manufacturers that offer many different product offerings and those that have only one or two offerings. To address the initial request for additional lead time and to avoid inequity during the phase-in years, staff revised the HD OBD regulation proposal to require that the HD OBD requirements apply to all alternate-fueled engines starting with the 2018 model year.

While the HD OBD regulation currently does not have a specific definition for alternate-fueled engines, the definition of "gasoline engines" includes alternate-fueled engines based on staff's presumption from light-duty experience that all alternate-fueled engines would be spark-ignited and have emission controls most like gasoline engines. This presumption, however, was wrong. To date, there has also been some confusion about what exactly constitutes an alternate-fueled engine versus a gasoline or diesel engine. Specifically, issues have come up with engines that can use more than one type of fuel, such as engines that can operate on two different types of fuels at the same time and engines that can operate on two different types of fuel but only one at a time. In some instances, these engines are appropriately classified as alternate-fueled engines when both fuels are used for the engine to operate. In other cases, such engines can also operate exclusively on diesel or gasoline if the alternate fuel is not used or not available, and such engines should not be considered alternate-fueled during those conditions. Accordingly, staff is proposing a definition that would more explicitly identify what configurations are considered alternate-fueled (and thus exempt from OBD monitoring until the 2018 model year). This clarification would provide manufacturers with direction as to how possible future configurations would be classified and prevent gaming by manufacturers looking to inappropriately classify something as an alternate-fueled engine to avoid OBD requirements.

Additionally, regarding heavy-duty alternate-fueled engines, staff is proposing another clarification with respect to evaporative system monitoring. As currently written, engines are exempt from evaporative system monitoring if they are not required to be equipped with evaporative emission systems. Technically, ARB regulations do not mandate vehicles be equipped with components specifically to control evaporative emissions, so the existing language is unclear about which vehicles and engines are subject to the evaporative system monitoring requirements. ARB regulations do however clearly delineate which vehicles and engines are subject to evaporative emission standards. Accordingly, the proposed change would exempt engines from evaporative monitoring if they are not subject to the evaporative emission standards. As examples, compressed natural gas (CNG) engines are not subject to evaporative emission standards but liquid propane gas (LPG) engines are subject to the standards. The change would make it clear that evaporative system monitoring is required for LPG engines, irrespective of whether the manufacturer claims it has or has not equipped the engine with an evaporative emission system. Alternate-fueled engines that are subject to evaporative emission standards and thus required to do evaporative system monitoring would be required to submit a plan for Executive Officer approval on what monitoring they would do and its equivalence to the type of evaporative system monitoring required for gasoline applications.

C. DEFINITIONS

Staff is proposing that a definition of "emission standard" be added to the OBD regulations to help clarify any confusion among stakeholders that the OBD requirements are not emission standards. The proposed definition specifically defines emission standard in the context of OBD regulations and conforms that definition with the *EMA decision,* which defined a "standard relating to the control of emissions" under Title 2 of the Clean Air Act as it applies to motor vehicles and motor vehicle engines. There, the Court found that an emission standard relates to the emission characteristics of a vehicle or engine and that for compliance purposes, requires a motor vehicle or motor vehicle engine to emit no more than a certain amount of a given pollutant, be equipped with a certain type of pollution-control device, or have some other design feature related to the control of emissions. (*Id.*) Staff is proposing that the OBD regulations add a definition of emission standard to be consistent with the definition set forth in *EMA* for purposes of clarity, consistency, and conformity. Under the federal definition, requirements establishing OBD design features related to the control of emissions, as well as exhaust and evaporative numerical emission limits, relate to the emission characteristics of the engine and are emission standards. The proposed amendments are intended to make clear that the definition of emission standard as used in the OBD regulations conforms to the federal definition. The proposed definition, which modifies the definition of "emission standard" as set forth in Health and Safety Code section 39028, is authorized by Health and Safety Code sections 39010 and 39601 in that the proposed definition conforms with existing federal definitions.

For purposes of consistency and clarity, ARB staff is also adding the terms "exhaust emission standard" and "evaporative emission standard" in the definitions section to clarify, where needed, previous references to emission standards. These proposed terms are two subcategories of emission standards and are used to specifically identify the specified subcategories as opposed to the broader term of emission standard that encompasses all standards, including among other requirements OBD design features relating to the control of emissions and tailpipe and evaporative numerical limits.

HD OBD systems are required to support standardized reporting of the calibration identification number (CAL ID), which identifies the current software version installed in the engine, and the calibration verification number (CVN), which verifies the integrity of the software. These two parameters are intended to be used during heavy-duty vehicle inspections to help verify that valid software is installed in the on-board computer and that the software has not been corrupted or tampered with, which may occur for performance or fuel economy reasons or to defeat the OBD system. These parameters can also be used to verify that the proper software has been installed as the result of an in-use action (e.g., service campaign, recall). The HD OBD regulation currently requires a CAL ID/CVN combination for each "diagnostic or emission critical" electronic control unit. The current definition of "diagnostic or emission critical" includes the engine control unit and is intended to cover other control units that play a significant role in the emission control system or diagnostic systems. However, there is an ongoing trend with engine and vehicle designs to distribute diagnostic and control functions across multiple control units thereby subjecting more control units on an engine or vehicle to reporting these parameters. Under the current definition, there is a potential proliferation of CAL ID and CVN data and maintenance of those data without a commensurate OBD program benefit. Staff is therefore proposing to modify the definition of "diagnostic or emission critical" to limit the number of control units that are subject to the requirement while preserving the requirement for control units that serve a significant role in emissions or diagnostics or would likely be targeted for tampering.

The HD OBD regulation currently includes a definition of "small volume manufacturer" in section 1971.1(d)(7.4), which states "a manufacturer with projected engine sales for California heavy-duty vehicles of less than 1200 engines per year for the 2010 model year." This definition was adequate for the original use that was limited to initial implementation of the HD OBD system itself. With the proposed additions of required phase-in schedules for the diesel misfire, NOx catalyst/NOx sensor, and PM filter monitoring requirements (described below in their respective sections), staff is proposing to relax requirements for small volume manufacturers with limited resources to meet the phase-ins (described in section II.S. below). Accordingly, staff is proposing to add a definition for "small volume manufacturer" that would reference the definition in Cal. Code Regs., title 13, section 1900(b), with the exception that California sales of less than 1200 heavy-duty engines will be used in lieu of 4500 engines.

The HD OBD regulation currently allows manufacturers to erase a confirmed fault code or a previously MIL-on fault code if the identified malfunction has not been again detected in at least 40 engine warm-up cycles and the MIL is presently not illuminated for that malfunction. The regulation currently defines "warm-up cycle" as "sufficient vehicle operation such that the coolant temperature has risen by at least 40 degrees Fahrenheit from engine starting and reaches a minimum temperature of at least 160 degrees Fahrenheit (140 degrees Fahrenheit for applications with diesel engines)." Some concerns have been raised that certain vehicles, such as vehicles with highly efficient engines, may not be able to meet these temperature criteria under normal driving and ambient conditions. Staff understands that some allowances should be made for these vehicles that are unable to warm-up the engine coolant temperature to the defined temperatures even if they have been sufficiently driven. Thus, staff is proposing to allow manufacturers the option to define a "warm-up cycle" as a driving cycle in which the criteria to erase a permanent fault code for continuous monitors are met. This would ensure that the vehicle has been operated for a sufficient period of time to reasonably detect a recurrence of the malfunction and would allow timely erasure of confirmed or previously-MIL on fault codes.

Staff is proposing changes to the permanent fault code erasure requirements and the in-use monitor performance requirements that would apply to heavy-duty hybrid vehicles, the details of which are described below. Given the context of the proposed changes, new definitions are needed to complement the proposed requirements. Thus, staff is also proposing three new definitions for "hybrid vehicle," "fueled engine operation," and "propulsion system active" and making changes to the "ignition cycle" definition to supplement the proposed changes. More details about the proposed definitions can be found below.

D. MIL ILLUMINATION AND FAULT CODE STORAGE PROTOCOL

The HD OBD regulation currently requires vehicles using the ISO 15765-4 protocol to store and erase freeze frame conditions in conjunction with the storage and erasure of either the pending fault code or the confirmed fault code. This has unintentionally resulted in manufacturers erasing freeze frame conditions for pending fault codes that mature to confirmed fault codes and has left repair technicians without helpful information to diagnose detected faults. To prevent such erasures, staff is proposing that starting with the 2016 model year, manufacturers be required to store freeze frame conditions in conjunction with storage of a pending fault code. If the pending fault code is erased in the next driving cycle because no fault is detected, the manufacturers would also be required to erase the freeze frame conditions. If, however, the pending fault code matures to a confirmed fault code, the manufacturer would be required to either retain the current freeze frame conditions or update the freeze frame conditions with those related to storage of the confirmed fault code. For monitors that do not store pending fault codes (e.g., one-trip monitors or monitors that use alternate statistical MIL illumination strategies), staff is proposing that manufacturers store and erase freeze frame conditions in conjunction with storage and erasure of a confirmed fault code. Such changes will better ensure under all conditions that freeze frame information is available to aid a technician in diagnosing a detected fault.

Staff is also proposing minor amendments to the erasure protocol for confirmed or previously MIL-on fault codes in the HD OBD regulation. The regulation currently states that the OBD system "may" erase the fault code if the fault isn't again detected "in at least" 40 warm-up cycles" and the MIL is not presently illuminated for that fault. To ensure consistency among manufacturers, staff is proposing to modify the language to state that the OBD system "shall" erase the fault code if the fault isn't again detected "in" 40 warm-up cycles and the MIL is not presently illuminated for that fault – this amendment would apply starting with the 2016 model year. This change will better ensure that repair technicians focus on recently detected faults and are not led astray chasing down faults that have long since disappeared.

Additionally, staff is proposing changes to address issues concerning permanent fault code erasure on heavy-duty hybrid vehicles for monitors that are designed to run continuously, including monitors that must wait until similar conditions are satisfied (e.g., gasoline misfire and fuel system monitors). Currently, the regulation requires that the permanent fault code for these monitors be erased only after the vehicle has been operated such that, among other conditions, criteria similar to those for a general denominator (section 1971.1(d)(4.3.2)(B)) have been satisfied on a single driving cycle (with the exception that the general denominator conditions require ambient temperature above 20 degrees Fahrenheit or below 8000 feet in elevation). This ensures that the vehicle has been operated for a sufficient period of time to reasonably detect a recurrence of the malfunction but does not unnecessarily delay erasure of the permanent fault code. Among these conditions is the criterion that the "cumulative time since engine start" be greater than or equal to 600 seconds. This language may not be clear for vehicles such as hybrid vehicles, where the engine may not start running at the beginning of a drive cycle like it would on a conventional vehicle. Thus, for hybrid vehicles, staff is proposing to clarify that manufacturers use 600 cumulative seconds of "propulsion system active" time in lieu of the 600 cumulative seconds after engine start, with "propulsion system active" defined as when the vehicle is operated, regardless of whether it is powered by the battery or the engine or both. Staff believes this new definition would ensure equivalent vehicle operation time between conventional vehicles and hybrid vehicles.

E. STANDARDIZED METHOD TO MEASURE REAL WORLD MONITORING PERFORMANCE

The OBD regulations require manufacturers to track monitor performance by counting the number of monitoring events and the number of driving events. The number of monitoring events is defined as the numerator and the number of driving events is defined as the denominator. The ratio of these two numbers is referred to as the monitoring frequency and provides an indication of how often the monitor is operating relative to vehicle operation. The regulation also requires all vehicles to keep track of a "general denominator", which is a measure of how often the vehicle is operated and is intended to represent a "typical" driving cycle the vehicle usually encounters. The regulations require the manufacturer to increment this denominator only if certain criteria are satisfied on a single driving cycle. This method allows very short trips or trips during extreme conditions such as very cold temperatures or very high altitude to be filtered out and excluded from the count. This is appropriate because these are also conditions where most OBD monitors are neither expected nor required to operate. In addition to the general denominator, manufacturers are required to track specific denominators for several major monitors. These denominators are tailored to the specific components being monitored and provide a more accurate and appropriate indication of the monitoring opportunities for each of those components relative to how often those components are used.

The HD OBD regulation currently requires all vehicles to increment the general denominator if, among other conditions, the cumulative time since engine start is greater than or equal to 600 seconds. For the same reasons noted above, hybrid vehicles need an alternate definition to recognize trips where the engine does not start right away. Thus, similar to the changes proposed above for the permanent fault code erasure protocol, for hybrid vehicles, staff is proposing to clarify that manufacturers must use 600 cumulative seconds of "propulsion system active" time in lieu of the 600 cumulative seconds after engine start when incrementing the general denominator. Additionally, staff is also proposing to require 10 seconds of "fueled engine operation" to be met in order to increment the general denominator to discern between trips with and without engine operation. This condition would ensure that only trips where the engine has at least turned on once during the driving cycle are counted when looking at how often engine-related emission control component monitors are running. These proposed changes would apply to all 2016 and subsequent model year heavy-duty hybrid vehicles.

Staff is also proposing amendments to the in-use monitor performance requirements for PM filter monitors. The HD OBD regulation and OBD II regulation currently require the PM filter active/intrusive injection monitor (sections 1971.1(e)(8.2.6) and 1968.2(f)(9.2.6)) to increment the denominator for that monitor when, in addition to the general denominator criteria, a regeneration event is commanded for a time greater than or equal to 10 seconds. Intrusive injection, while used during a regeneration event, is not necessarily tied to when regeneration begins. Staff believes the denominator incrementing criteria for such a monitor should instead be similar to monitors of other components/systems that are commanded to activate in-use where monitoring frequency is tracked relative to how often that particular component or system is used. Thus, staff is proposing to require manufacturers to increment the denominator for this monitor when, in addition to the general denominator criteria, the intrusive injection is commanded to function for a cumulative time greater than or equal to 10 seconds in both the HD OBD and OBD II regulations.

Additionally, staff is proposing amendments to the denominator incrementing criteria for the PM filter filtering performance and missing substrate monitors in both the HD OBD and OBD II regulations. The HD OBD regulation currently requires these PM filter monitors to increment the denominator when, in addition to the general denominator criteria, the cumulative engine run time exceeds 800 minutes, while the OBD II regulation currently requires the denominator to increment when, in addition to the general denominator criteria, the cumulative miles of vehicle operation exceeds 500 miles. Further, the HD OBD regulation requires these monitors to meet a minimum acceptable in-use performance ratio of 0.100, while the OBD II regulation requires these monitors to meet a ratio of 0.336 starting in the 2013 model year. ARB adopted the current denominator incrementing criteria based on the capability of PM filter monitoring technology. Most current monitoring strategies are limited to running during a narrow window relative to a PM filter regeneration event. Accordingly, the denominator criteria were tied roughly to a period of vehicle operation that would allow a regeneration event. However, there has been concern with this approach because PM filters are needed to control emissions throughout each and every driving cycle, not just for a narrow window of once per regeneration event. Additionally, regeneration event intervals have been significantly increasing leading to longer and longer intervals between monitoring events and significant consequent delays from the time of occurrence of a fault to detection of the fault. Fortunately, monitoring technology has continued to evolve and newly developed PM sensors are now estimated to be the primary method for detection of faults starting in the 2014 and 2015 model years. Such sensors are capable of evaluating the performance of the PM filter on virtually every driving cycle and have little or no connection to PM filter regeneration events. Given the importance of properly-operating PM filters on every trip and the direction monitoring technology is headed, staff is proposing to require manufacturers to increment the denominators for these monitors when the general denominator criteria are met in lieu of only once per 800 minutes of engine operation or 500 miles of vehicle operation starting in the 2016 model year for both heavy-duty engines and medium-duty vehicles. Further, for medium-duty vehicles, given the current higher ratio of 0.336 that these monitors are required to meet, staff is proposing to modify the OBD II regulation to lower the required ratio to 0.100 for the first few years these monitors use this new denominator, 2016 through 2018 model years, to give manufacturers more time to assess the monitoring frequency of the new monitoring technologies.

Staff is also proposing amendments to the in-use monitor performance requirements for PM sensor and PM sensor heater monitors. The HD OBD regulation currently requires the PM sensor monitoring capability monitor (section 1971.1(e)(9.2.2)(D)) and the PM sensor heater monitor (section 1971.1(e)(9.2.4)(A)) to use the general denominator as the monitor denominators. PM sensors, like PM filters, may be regenerated infrequently in-use, which may make frequent monitoring difficult. Further, as opposed to oxygen sensor and NOx sensor heaters, PM sensor heaters may be used infrequently in-use. Manufacturers are concerned that using the general denominator may result in the denominator incrementing more often than is appropriate for the sensor technology and how it is used. Thus, staff is proposing to allow manufacturers to propose alternate criteria (for ARB review and approval) to increment the denominator for PM sensor monitoring capability monitors until further experience is gained and more appropriate criteria can be defined in the regulation. For PM sensor heater monitors, staff is proposing to amend the HD OBD regulation to require manufacturers to increment the denominator when, in addition to the general denominator criteria, the heater has been commanded to function for a cumulative time greater than or equal to ten seconds.

Staff is also proposing changes to the ignition cycle counter requirements for heavy-duty hybrid vehicles. Currently, manufacturers are required to track and report an ignition cycle counter, which is required to be incremented every time the vehicle is started (i.e., "engine start" is met). This is basically a counter of the number of driving cycles experienced by the vehicle. Staff is proposing to modify the incrementing criteria for hybrid vehicles under the HD OBD regulation to clarify that manufacturers increment the ignition cycle counter when the "propulsion system active" definition is met (e.g., each time the vehicle is operated, without respect to whether the engine is started or used).

Lastly, staff is proposing changes to the tracking and reporting requirements in the HD OBD regulation and OBD II regulation. First, in the HD OBD regulation, staff is proposing to modify the diesel components/systems required to report in-use monitoring performance data (section 1971.1(d)(5.1.1)) to align with the requirements in SAE J1979 and J1939. Second, in both the HD OBD and medium-duty OBD II regulations, staff is proposing changes to the in-use performance tracking and reporting requirements for diesel NOx and PM sensor monitors. The regulation currently does not require manufacturers to track and report the diesel NOx/PM sensor "monitoring capability" monitors (sections 1971.1(e)(9.2.2)(D) and 1968.2(f)(5.2.2)(D)); it only requires manufacturers to track and report diesel NOx/PM sensor performance monitors that are emission threshold-based (sections 1971.1(e)(9.2.2)(A) and 1968.2(f)(5.2.2)(A)). However, recent discussions between staff and manufacturers have indicated that many of these sensors do not have emission-threshold based monitors, and thus would only be subject to monitoring if the malfunction causes the sensor to no longer be sufficient for use as an OBD system monitoring device. Considering how important NOx and PM sensors are for monitoring of major aftertreatment emission control devices, they should be monitored to ensure that they are running frequently in-use. Thus, staff is proposing that the HD OBD and OBD II regulations be modified to require manufacturers to track and report the diesel NOx/PM sensor "monitoring capability" monitors for 2016 and subsequent model year heavy-duty engines and medium-duty vehicles.

F. DIESEL MISFIRE MONITORING

Diesel manufacturers are currently required to monitor for misfire only during engine idle conditions and only for faults that cause one or more cylinders to be continuously misfiring. This requirement was first proposed based on diesel manufacturers' assertion that misfire only occurred due to poor compression and would result in a cylinder misfiring under all operating conditions. The OBD requirements also specify that, for 2013 and subsequent model year heavy-duty diesel engines and 2010 and subsequent model year light- and medium-duty vehicles equipped with sensors that can detect combustion or combustion quality, diesel manufacturers are required to monitor for misfire continuously under all positive torque engine speeds and load conditions and to detect misfire before emissions exceed specific thresholds (e.g., 2.0 times the applicable standards). The premise for this was that engines so equipped would likely be more precisely controlling the combustion process based on information from these sensors such that misfires could likely exist only in limited operating regions.

However, the complexity of today's control strategies on all diesel engines and the addition of new technologies in recent years, like aggressive use of EGR or target air-fuel ratios or fresh air concentrations in certain operating conditions, has resulted in additional factors that can cause misfire in very specific operating conditions instead of continuously under all conditions. Thus, even for diesel engines that do not have direct combustion quality sensors, staff is concerned that real world malfunctions will cause intermittent or off-idle misfires that increase emissions but go undetected with today's monitors. As stated in the 2005 Staff Report when the HD OBD regulation was first adopted, staff intended to investigate the possibility of such misfires and had indicated that a more comprehensive requirement may be proposed at a future Board review based on their findings. Staff has found that in the field, misfire can occur during specific speed and load regions and would not likely be detected by an idle-only misfire monitor. Thus, staff worked on a proposal to require all 2016 and subsequent heavy-duty and medium-duty diesel engines to continuously monitor for misfire in addition to the idle-only misfire monitor.

Manufacturers have expressed several concerns about monitoring continuously for misfires and about establishing a level of misfire that would equate to a specific tailpipe emission level. They indicated that they would likely encounter difficulties in the highest engine speed and torque conditions and that there would be challenges in actually creating misfires in a repeatable manner without damaging the engine and representing a worst case emission scenario. As a result, they proposed that they be required to detect a fixed misfire rate of 5 percent in lieu of establishing the specific rate on an engine model basis that correlated to a specific tailpipe emission level. They also proposed that monitoring be limited to engine speeds and loads less than 75 percent of the maximum engine speed and load.

Staff agrees that there are significant difficulties in creating a repeatable misfire on diesel engines that is representative of the worst case emissions and thus is proposing the manufacturers' suggested solution of using a fixed percentage of 5 percent as the malfunction criterion for both heavy-duty engines and medium-duty vehicles. Concerning the continuous monitoring requirement, while staff agrees that some relaxation is necessary, there are still concerns and questions about the likelihood and possible effects of misfire during higher speed and load regions. Thus, for the interim model years of 2016 through 2018, staff modified the proposal to be consistent with the manufacturers' proposal to limit monitoring to positive torque conditions with engine speed up to 75 percent of the maximum-rated engine speed and engine load up to 75 percent maximum-rated load. Additionally, at the manufacturers' suggestion, a small region of high engine speed and very low load was defined and is proposed as an area where monitoring would not be required. However, because staff is concerned that higher speed and load regions may very well be susceptible to misfire, the proposal also requires manufacturers to phase in monitoring all the way up to the maximum engine speed and load for the 2019 through 2021 model years. Further, manufacturers would be required to collect and report data demonstrating the compliance of the misfire monitor as part of the certification application, similar to what is currently required for gasoline vehicles and engines. Specifically, the manufacturers would be required to provide data demonstrating the probability of detection of misfire events of the misfire monitoring system over the required engine speed and load operating range and data identifying all disablement of misfire monitoring that occurs during a specified test cycle. These data would provide assurance that the misfire monitor is robust and enabled under the required conditions. In addition to the new proposed misfire monitor requirements, manufacturers would still be subject to the idle-only misfire monitor requirements. Staff expects that manufacturers will be able to meet both requirements with the revised monitor developed to cover the expanded speed and load ranges. However, in case unforeseen difficulties arise that prevent detection of the 5 percent misfire at idle, the manufacturers would have to retain the current idle monitor. This would help protect the credibility of the monitoring system capability in the eyes of repair technicians by avoiding the situation where a technician can identify that an engine has an obvious and severe misfire at idle but the OBD system is incapable of detecting it. Staff is proposing all these changes to both the HD OBD and medium-duty OBD II requirements.

G. DIESEL EXHAUST GAS RECIRCULATION (EGR) SYSTEM MONITORING

The HD OBD regulation currently requires manufacturers to monitor any EGR catalysts used in the EGR system on all 2013 and subsequent model year engines. Such catalysts, though not very common, are used to further clean up the exhaust gas before it is recirculated into the intake of the engine to reduce contamination or fouling that might otherwise affect durability of the EGR system. While failures of the EGR catalyst may not result in an immediate impact on emissions, such failures lead to more aggressive deterioration of other EGR system components such as fouling or plugging of the EGR cooler.

Manufacturers have argued that OBD systems have always focused on the monitoring of components that directly influence emissions, not components that help to sustain the effectiveness or durability of the system. They have further argued that there are issues with detecting and pinpointing EGR catalyst failures as opposed to relying on other monitors such as the EGR cooler diagnostic to eventually detect the subsequent failure of the cooler itself. Thus, staff is proposing to modify the HD OBD regulation to exempt heavy-duty manufacturers from having to monitor the EGR catalyst if they can show that a fault of the catalyst will not cause a measurable emissions impact on the criteria pollutants (i.e., NMHC, CO, NOx, and PM) during any reasonable driving condition in which the catalyst is most likely to affect criteria pollutants.

H. DIESEL NON-METHANE HYDROCARBON (NMHC) CONVERTING CATALYST MONITORING

The HD OBD regulation currently requires manufacturers to design the OBD system on 2013 and subsequent model year engines to detect an NMHC catalyst malfunction when the catalyst conversion capability decreases to the point that NMHC emissions exceed 2.0 times the applicable standard. However, if a catalyst malfunction does not result in emissions exceeding this threshold, the regulation allows the manufacturer to detect a malfunction when the catalyst has no detectable amount of NMHC conversion capability.

Similar to what they argued during the 2009 HD OBD biennial review, manufacturers have again expressed concern that total failure of NMHC catalysts will push emissions over the threshold and force them to implement threshold monitors. Furthermore, they do not believe that there is any monitoring technology that can robustly detect anything other than a completely failed NMHC catalyst. Accordingly, manufacturers have again asked ARB to raise the threshold to 4.0 times the NMHC standard so that manufacturers would very likely only have to implement functional monitors to detect completely failed catalysts.

In the 2009 HD OBD staff report, staff detailed some possible monitoring approaches to meet the threshold monitoring requirements. To counter manufacturers argument that there is no level of catalyst degradation between perfectly adequate and completely failed and that an exotherm monitor can only discern those two states, staff indicated in the 2009 report that after talking with suppliers and individual manufacturers, it had determined that catalysts do have intermediate levels of deterioration that cause increases in light-off temperature and lower conversion efficiencies. Staff found that by looking more closely at the catalyst behavior during active regeneration (e.g., by investigating how much time and/or fuel is needed to generate an exotherm, tracking the actual temperature rise from the exotherm versus the expected, and using better temperature sensors), manufacturers may be able to better determine the characteristics exhibited as an NMHC catalyst degrades (even if it is still capable of eventually getting to a high enough exotherm to achieve regeneration of the PM filter). Manufacturers now argue that though there may be some validity to staff's position, there are significant limitations including the narrow temperature and time window around catalyst light-off that the exotherm monitor must run. Staff also mentioned in the 2009 staff report about a strategy to monitor the catalyst during a cold start, where during intrusive actions intended to bring the catalyst up to the desired temperature quickly after a cold start, the light-off and/or temperature rise characteristics are tracked to evaluate the catalyst. Manufacturers again argued there are limitations with this approach as well, with many factors including the condition of the catalyst that can affect catalyst warm-up, and note that most manufacturers have found that the cold start component monitor for the catalyst can only detect a completely failed catalyst. Lastly, staff mentioned in the 2009 staff report that manufacturers can also reduce the engine-out NMHC emissions associated with a malfunctioning catalyst. Manufacturers have countered that lower engine-out NMHC emissions would mean higher engine-out NOx emissions, which would make it more difficult to meet the NOx-based monitoring requirements.

In more recent discussions with manufacturers and suppliers, staff has found that some manufacturers have indeed been successful in incrementally aging the NMHC catalyst much like what has been done for over 15 years with gasoline catalysts. Additionally, virtually all manufacturers have indeed moved towards higher engine-out NOx emission levels (and generally, lower engine-out NMHC emission levels) to maximize efficiency and use of SCR systems as staff suggested was possible, thus requiring detection of a more degraded NMHC catalyst than before. Further, at least one manufacturer has already successfully demonstrated the ability to detect a degraded catalyst prior to emissions exceeding the current 2013 model year thresholds by monitoring the exotherm of the catalyst during regeneration events. Virtually all manufacturers have continued to make significant improvements to regeneration emissions both by increasing the time between regenerations and lowering the emissions during the actual regeneration events. This leads to reduced influences from the infrequent regeneration adjustment factors (IRAF), making it less of a factor in determining the threshold catalyst. Nonetheless, if a manufacturer were to choose a solution that still was very sensitive to NMHC catalyst degradation (due to high engine-out NMHC and/or high IRAFs), it is appropriate that such a solution be monitored at a reasonable emission level and not at something that is four times a standard that is already generous for diesel engines. Accordingly, staff is proposing no change in the current NMHC catalyst monitoring threshold.

Staff is proposing amendments to the HD OBD requirement for manufacturers to monitor the ability of the catalyst to generate a desired feedgas (e.g., nitrogen dioxide (NO_2)) to promote better performance in a downstream aftertreatment component (e.g., for higher NOx conversion efficiency in an SCR system). Currently, the regulation requires 2013 and subsequent heavy-duty model year engines to meet this requirement. During the most recent OBD II regulatory review for light- and medium-duty vehicles earlier this year, manufacturers asked ARB to delay the start date to meet this requirement to the 2016 model year in part because their original plans to comply were based on using monitors for the NMHC conversion efficiency of the NMHC catalyst and/or NOx conversion efficiency of the SCR system and such approaches were not uniformly successful. This resulted in manufacturers having to investigate alternative monitoring strategies, which indicated they needed more time to verify these strategies. While staff believes it is feasible to develop a monitor to meet this requirement and at least one manufacturer has already shown it will have this capability for the 2013 model year, staff acknowledges that more time is needed to develop a robust monitor to meet this requirement. Thus, to be consistent with what staff had recently proposed for the OBD II regulation, staff is proposing to modify the HD OBD regulation to delay monitoring of proper feedgas generation until the 2015 model year for heavy-duty engines.

Further, manufacturers have indicated that ability of the catalyst to generate a desired feedgas (e.g., high levels of NO_2) is a secondary function that often has very minor impacts. Manufacturers proposed that because the impacts are small, ARB should add test-out criteria that would allow an emissions increase of up to 15 percent of the standard due to a malfunction or loss of this feature before monitoring would be required. While the OBD programs at ARB have traditionally avoided this approach because of the concern that several 'minor' items could fail without fault detection and cumulatively lead to significantly higher emissions, or that two or more such failures could have an interaction that causes even higher emissions when both occur, staff has agreed to try such an approach here. Specifically, for this 'secondary' function of the NMHC catalyst (i.e., proper feedgas generation for downstream components), staff is proposing to modify the HD OBD and OBD II regulations to allow manufacturers to be exempt from monitoring if complete failure of the component or loss of the function results in less than a 15 percent of the standard increase for any pollutant over an applicable test cycle (e.g., Federal Test Procedure (FTP) or Supplemental Emission Test (SET)) during the engine's useful life. However, in addition to being less than a 15 percent of the standard increase, staff's proposal would also require that tailpipe emissions be below the standard with the failure to better ensure that any emission impact is truly 'minor.'

I. DIESEL OXIDES OF NITROGEN (NOx) CONVERTING CATALYST MONITORING

The HD OBD and medium-duty OBD II regulations require manufacturers to detect conversion efficiency faults of the NOx converting catalyst (typically an SCR catalyst) before NOx emissions exceed the following thresholds: for the 2010 through 2012 model years, the applicable NOx standard plus 0.4 g/bhp-hr, and for the 2013 and subsequent model years, the applicable NOx standard plus 0.2 g/bhp-hr.

Manufacturers have argued that the dynamics of the SCR system and its control, including the NOx sensors and the reductant delivery system, have made it difficult to meet the 2013 model year requirements. They contend that due to the high degree of conversion efficiency of the SCR catalyst, a system degraded to the level required to be detected by the OBD system is still a highly functioning SCR system and provides little separation from a properly performing one. They further contend that a good catalyst could resemble a bad catalyst since the instantaneous conversion efficiency can dramatically change given the operating conditions. Adding to the issue is the cross-sensitivity of the NOx sensors to ammonia (NH_3) and the less-than-desired accuracy of the sensors needed for robust monitoring.

Staff has met with virtually every manufacturer and several suppliers to assess current capability and what improvements are available in the near term. While several medium-duty manufacturers are on track to meet the existing 2013 standards, most heavy-duty manufacturers are not. Given the importance of achieving and preserving the NOx benefits of the 0.2 g/bhp-hr tailpipe standard, staff is committed to continuing to drive to the limits of technical feasibility to achieve the lowest threshold possible. Further, given industry trends towards increasing engine-out NOx emissions even higher for engine efficiency improvements or greenhouse gas reductions, staff is concerned that some may try to push too far in that direction such that tailpipe or OBD capability is sacrificed. Thus, staff is cautious about providing even interim relaxation that could be misinterpreted as showing that some ARB requirements are more important than others instead of keeping manufacturers on track to find a reasonable middle ground that meets all of our requirements, including OBD, tailpipe standards, and greenhouse gas standards (where applicable). In discussions with the manufacturers, it seems there are many elements of base SCR control and dynamics that are not well refined or understood. The problem appears to be exacerbated on larger catalysts that are more common on the biggest engine displacements, and many point to unknowns related to ammonia storage and release that produce both inconsistent in-use conversion efficiency and, consequently, quite varied catalyst monitoring results. Last-minute changes to the underlying base emission control strategy has also placed the OBD engineers within manufacturers at a disadvantage by forcing them to either develop and calibrate on less-than-finalized software or wait until very late in the process to begin the calibration process. Those manufacturers with more stable emission control solutions that were finalized early in the process tend to be further ahead in OBD capability as well.

When talking with manufacturers and suppliers, staff identified several items that continue to show promise for achieving the current 2013 model year threshold of the NOx tailpipe standard + 0.2 g/bhp-hr. NOx sensor accuracy is not expected to get appreciably better than the +/-10% and +/- 10 parts-per-million accuracy of current sensors, but that doesn't appear to be the limiting factor to achieving the final thresholds. Some manufacturers have shifted some focus to looking more at ammonia storage—both for purposes of better controlling emissions in the first place and also for another metric to correlate with the performance of the catalyst itself. One supplier has indicated that ammonia storage capability is affected earlier and more dramatically on deteriorated catalysts than NOx sensor-based measurements can detect, implying that monitoring strategies based on or incorporating some measure of ammonia storage would likely be more sensitive and able to detect malfunctioning catalysts sooner. Some manufacturers have even incorporated (or plan to incorporate) ammonia sensors to better quantify and understand the storage and release phenomena. Some of these strategies may even include intrusive monitors that saturate and/or deplete ammonia storage to better assess the current catalyst performance. Others have indicated they plan to look at partial volume monitoring approaches to monitor the conversion efficiency over a smaller portion of the total catalyst volume in an attempt to be able to work in an environment with higher NOx outlet concentrations. To the extent that the smaller engines (and thus catalysts) are closer to achieving (if not already achieving) the 2013 model year thresholds, such an approach continues to have promise. Additionally, some manufacturers believe that they just need to get a better handle on what they are currently observing as high variability in the monitor results through better base control strategies, including adaptive algorithms, further refinement of enable conditions to eliminate driving conditions that cause big fluctuations in catalyst efficiency, and even improved statistical filtering of the results.

Taking that all into consideration, staff is proposing a couple changes to the current HD OBD and OBD II requirement of a '+ 0.2' threshold across the board in the 2013 model year. Specifically, staff is proposing that for medium-duty vehicles, which are already further along than some of their heavy-duty counterparts (primarily because of the smaller catalyst size, more constrained vehicle packages and usage patterns, and perhaps earlier timing for finalized base calibrations), manufacturers would be required to meet a threshold of '+0.3' (i.e., the engine dynamometer standard + 0.3 g/bhp-hr) instead of the '+0.2' current threshold for 2013 through 2015 model year medium-duty vehicles. For chassis dynamometer-certified applications, based on the current capability of several such products, a threshold of 2.0x the applicable standard would be used as a level that is consistent with section 1968.2(f)(17.1.5)(C), which requires the threshold be set as tight as technically feasible.

For heavy-duty applications, staff is proposing to modify the 2013 model year threshold to remain at the '+0.4' threshold that applied in 2012. However, starting with the 2014 model year, manufacturers would be required to phase in a tighter threshold of '+0.3'. Specifically, manufacturers would have to meet the '+0.3' threshold on 20 percent of their 2014 model year diesel engine volume and 50 percent of their 2015 model year diesel engine volume, with the percentages based on the manufacturer's projected California sales volume of all heavy-duty diesel engines. For the 2016 model year, manufacturers would be required to meet the '+0.2' threshold with the exception that any engines that were phased-in during 2014 or 2015 to the '+0.3' threshold would be able to remain at that threshold in 2016 and would not have to meet the '+0.2' threshold until the 2017 model year. This phase-in would force manufacturers to continue to push forward but allow them to focus their efforts on the engine models for which compliance is more straight forward in the early years as well as give them time to continue to evolve base calibration beyond what was done for the 2013 model year. Further, the carry-over provision for the 2016 model year would provide them relief from having to recalibrate their entire product line to meet the tighter threshold in that one year. The phase-in would also provide much needed time to improve ammonia storage estimations and explore alternative monitoring methods or metrics.

Manufacturers raised questions about which heavy-duty engines could or could not be counted as part of the phase-in percentages for the heavy-duty OBD proposal. Specifically, whether only 'parent' ratings (those explicitly calibrated to emission thresholds and liable for them in-use) would count or if 'child' ratings (ratings with calibration that is extrapolated from the parent rating to be very similar but without explicit demonstration or in-use liability for the emission thresholds) could also be counted. Given the premise of parent and child ratings is that the parent is representative of the child and the extrapolated calibrations are intended to end up with compliant calibrations for the child ratings, the regulation would allow child ratings engines as well as parent ratings to count as part of the engine volume phase-in percentage. And while staff already scrutinizes the extrapolation method manufacturers use to establish an appropriate calibration on the child ratings, there is concern that manufacturers would take additional liberties when extrapolating the calibration for the tighter phase-in threshold. Specifically, staff is concerned that manufacturers would extrapolate towards a less stringent threshold in addition to making appropriate changes for the different rating. Accordingly, staff will likely be reviewing manufacturers' extrapolation techniques and calibrations carefully to ensure that manufacturers are calibrating to an equivalent stringency for any ratings they are including in the phase-in percentages.

J. DIESEL PARTICULATE MATTER (PM) FILTER MONITORING

The HD OBD regulation currently requires the OBD system to identify malfunctions of the PM filter when the filtering capability degrades to a level such that tailpipe PM emissions exceed a specific threshold. For the 2010 through 2012 model year engines, the PM threshold was essentially 0.07 g/bhp-hr (for an engine certified to the nominal standard of 0.01 g/bhp-hr). For the one engine family in 2013 through 2015 where full OBD is phased-in, the threshold is 0.03 g/bhp-hr (for an engine certified to the nominal standard of 0.01 g/bhp-hr). For all other 2013 through 2015 model year engines, the PM threshold drops to 0.05 g/bhp-hr (again for an engine certified to the nominal standard of 0.01 g/bhp-hr). For all 2016 and subsequent model years, the threshold is 0.03 g/bhp-hr (for an engine certified to the nominal standard of 0.01 g/bhp-hr). For medium-duty vehicles and engines covered under OBD II, the only difference from the above is that the 0.03 g/bhp-hr standard applies across the board in 2013 and subsequent model years in lieu of a phase-in on some products in 2013 and the rest in 2016.

The HD OBD regulation originally required manufacturers to meet the PM threshold of 0.050 g/bhp-hr starting in the 2010 model year, but due to heavy-duty engine manufacturers' concerns about meeting the threshold, staff amended the starting date to the 2013 model year based on projections that PM sensors, which many believe will be the only viable way to meet the thresholds, would be available in time for the 2013 model year. Now manufacturers are still expressing concern that the threshold is too stringent and is not technically feasible for the 2013 model year time frame. They contend that PM sensors are not yet commercially ready across all of industry and thus, the emission threshold needs to be revised to what current monitoring technologies (primarily backpressure or delta pressure-based metrics) are capable of achieving. Accordingly, they proposed that heavy-duty engines continue to use the 2010 model year 0.07 g/bhp-hr PM threshold up to and including the 2015 model year, with 2016 and subsequent model year engines using the PM threshold of 0.05 g/bhp-hr.

As noted earlier, staff met with virtually every manufacturer and several suppliers to assess their monitoring capabilities for 2013 and the improvements they plan to implement in the near term. While at least one light-duty manufacturer is implementing a PM sensor in 2013 model year and a few heavy-duty manufacturers were on track to do that until very recently, staff generally agrees that PM sensors are not ready for full scale implementation in the 2013 model year. In some cases, manufacturers have indicated the 2014 model year is still viable for implementation on some of their products while others have indicated the 2015 model year is more likely. In most cases, the data from the sensors continue to indicate that they are certainly capable of detecting faults at the final PM threshold level of 0.03 g/bhp-hr. In meeting with sensor suppliers, staff has confirmed that wide-scale implementation of PM sensors in heavy-duty engines is not feasible for the 2013 model year.

In the absence of PM sensors, several manufacturers have continued to move forward on alternate monitoring techniques, including further refinement of delta pressure-based approaches and concepts such as a downstream secondary filter optimized for monitoring capability. In some cases, especially on medium-duty products, such techniques have already achieved the emission level of the 2016 threshold. However, some of these monitoring strategies still rely on relaxed provisions provided in the regulation (and recently extended through the 2013 model year for medium-duty) to allow ARB to exclude certain failure modes such as a partially melted and partially cracked filter that results in the identical delta pressure characteristics of a good filter. Such relaxation is set to expire in 2014 for medium-duty because it provides an unknown risk for failures that cause high PM emissions to go undetected, but was seen as a necessary interim step to accommodate the best available monitoring techniques. Lastly, as most in industry continue to move towards higher engine-out NOx emission levels, this necessarily results in lower engine-out PM levels. As engine-out levels decrease, the amount of degradation of the PM filter the engine can handle before the emission threshold is reached is substantially increased. In some cases, engine-out levels are reaching 0.05 g/bhp-hr or lower, which in turn means a PM filter would need to drop from a 95 percent or higher trapping efficiency down to something less than 60 percent efficiency to reach the threshold of 0.03 g/bhp-hr.

Taking all this into account, staff is proposing a variety of changes to the thresholds including a couple of phase–in options to provide some interim relaxation. With minor exceptions depending on the phase-in options selected, medium-duty and heavy-duty applications would all have the same end point for all 2016 and subsequent model year engines: PM threshold levels of 0.03 g/bhp-hr and no provision for exclusion of certain failure modes. PM sensors are certainly on track to be available across industry before that timeframe so that is a viable solution to meet the requirements.

Staff is proposing the following changes to the OBD II regulation for medium-duty vehicles. For the 2013 model year, staff is proposing that the PM threshold for medium-duty vehicles remain at 0.03 g/bhp-hr; but with amendments previously approved in January 2012, manufacturers will be able to receive ARB approval to exclude specific failure modes. For 2014 and 2015 model year, medium-duty manufacturers would have two options. First, they could choose to implement monitoring to a PM threshold of 0.03 g/bhp-hr without the failure mode exemptions on at least 20 percent of their 2014 and 2015 annual model year medium-duty diesel vehicle volume, and certify the remaining vehicles to the 0.03 g/bhp-hr threshold with the failure mode exemption. Alternatively, a manufacturer could chose to continue to meet the 2013 threshold with failure mode exemption in the 2014 model year. However, for the 2015 model year, the manufacturer choosing this second path would need to certify at least 50 percent of its 2015 model year medium-duty diesel volume to the threshold of 0.03 without the failure mode exemption. These two options provide manufacturers the flexibility to either implement earlier (2014 model year) on a smaller portion of their fleet or implement later (2015 model year) but on a larger fraction of their fleet.

Staff is proposing the following changes to the HD OBD regulation. For 2013 model year heavy-duty engines, staff is proposing the PM threshold of 0.05 g/bhp-hr apply to all engines and to retain the provision for ARB to exempt certain failure modes. For 2014 and 2015 model year heavy-duty engines, staff is proposing two options. First, manufacturers can choose to certify 20 percent of their 2014 through 2015 model annual year heavy-duty diesel engine volume to a PM threshold of 0.05 without the failure mode exemption. The remaining engines can again be certified to the 0.05 g/bhp-hr threshold with the exemption of certain failure modes. Additionally, manufacturers using this alternative would be allowed to carry-over the 0.05 threshold without the failure mode exemption into the 2016 model year on engines first certified to this option in the 2014 model year. This would provide an extra year at the higher threshold on those engines brought in early and allow the manufacturer to avoid having to recalibrate all of its products in 2016 to the lower 0.03 threshold. As an alternative, manufacturers could choose to certify the 2014 model year engines to the same requirements as the 2013 model year -- a PM threshold of 0.05 g/bhp-hr with failure mode exemption. Those choosing this second option, however, would be required to certify 50 percent of their 2015 model year diesel engine volume to a PM threshold of 0.03 g/bhp-hr without the failure mode exemption. Manufacturers choosing this second option would also be required to meet the 0.03 threshold without failure mode exemption on all 2016 model year engines. As mentioned in the diesel NOx catalyst monitoring discussion above, manufacturers would be allowed to include child ratings in the phase-in percentages to the extent they are extrapolated from a parent rating that meets the tighter threshold.

The HD OBD regulation also currently requires manufacturers to monitor the NMHC conversion capability of catalyzed PM filters starting with the 2013 model year. The catalyzed coating of a PM filter has secondary functions that have an emission impact. These functions can include promotion of passive regeneration at lower exhaust temperatures, conversion of HC and carbon monoxide created during an active regeneration, and generation of NO_2 feedgas for downstream SCR systems. Manufacturers have argued that many of these functions are just side effects that directionally help, but are not necessary to comply with the emission standards. They further indicated that there are currently no suitable robust monitoring strategies available to discern the proper operation of these secondary functions. Thus, manufacturers have asked ARB to delay the start date to meet this requirement to the 2016 model year.

Staff believes that such secondary functions are not trivial and warrant monitoring to ensure overall effectiveness of the emission control system. Staff recognizes that the success of the monitoring approaches may be highly dependent on the actual catalyst configuration, significance of the catalyst loading on the PM filter, and regeneration strategy (especially reliance on high levels of passive regeneration) and thus require manufacturers to take OBD monitoring capability into consideration when designing and implementing the aftertreatment system and control strategy. It further recognizes that manufacturer OBD engineers have often been left out of the design process due to the rapid deployment of new technologies and increasingly stringent standards. Thus, consistent with the Board's approval of amendments to the OBD II regulation in January 2012, staff is proposing to delay the monitoring requirements of the catalyst function of catalyzed PM filters until the 2015 model year for heavy-duty engines to give manufacturers more time to refine their systems, optimize regeneration strategies, and better investigate the impacts of the catalyzed PM filter.

Staff is also proposing that for 2016 and subsequent model year engines that use catalyzed PM filters to generate feedgas constituency (e.g., NO_2) to assist SCR systems, manufacturers be required to monitor the capability of the system to generate desired feedgas. Currently, the HD OBD regulation specifically requires that manufacturers monitor the NMHC catalyst for proper feedgas generation for the SCR system, since this seems to be the primary component used to generate such feedgas. Through discussions with manufacturers, staff has learned that catalyzed PM filters are also used to generate such feedgas. Thus, staff's proposal would require the monitoring of all components that generate the desirable feedgas.

Lastly, similar to what is discussed above for proper feedgas monitoring of NMHC catalysts in section II.H., manufacturers have indicated that the abilities of the catalyzed PM filter to convert NMHC and to generate a desired feedgas (e.g., high levels of NO_2) are secondary functions that often have very minor impacts. While not arguing that such functions do not have any emission impact and should not monitored, the manufacturers propose that because the impacts are small, ARB should add test-out criteria, specifically allowing an emissions increase of up to 15 percent of the standard due to a malfunction or loss of this feature before monitoring would be required. While the OBD programs at ARB have traditionally avoided this approach because of the concern that several 'minor' items could fail without fault detection and cumulatively lead to significantly higher emissions, or that two or more such failures could have an interaction that causes even higher emissions when both occur, staff has agreed to try such an approach here. Specifically, for both of these 'secondary' functions of a PM filter (i.e., NMHC conversion due to a catalyzed coating and proper feedgas generation for downstream components), staff is proposing to allow manufacturers to be exempt from monitoring if complete failure of the component or loss of the function results in less than a 15 percent of the standard increase for any pollutant over an applicable test cycle (e.g., FTP or SET) during the useful life. However, in addition to being less than a 15 percent of the standard increase, staff's proposal would also require that tailpipe emissions be below the standard with the failure to better ensure that any emission impact is truly 'minor'. These proposed changes would apply to both the HD OBD and OBD II regulations.

K. DIESEL NOx SENSOR MONITORING

The HD OBD and medium-duty OBD II regulations currently require manufacturers to detect faults of the NOx sensor before emissions exceed the following thresholds: for the 2010 through 2012 model years, the applicable NOx standard plus 0.4 g/bhp-hr, and for the 2013 and subsequent model years, the applicable NOx standard plus 0.2 g/bhp-hr. Manufacturers have argued that they are unable to meet the 2013 model year thresholds given the current NOx sensor technology – specifically, considering the tolerances of the latest NOx sensors, they claimed there is too little separation between good sensors and bad sensors to ensure robust detection. Thus, they proposed that staff delay the 2013 model year thresholds until a later model year.

For sensors upstream of the NOx converting catalyst, there are fewer items affecting the output of the sensor condition. Accordingly, most manufacturers have monitoring strategies based on comparing an expected/modeled engine-out emission level to the sensor output. And while the better sensor accuracy at the higher NOx concentrations read by the upstream sensor generally improves the situation, there are still several factors affecting the sensor output and accuracy of the estimated engine out emission levels that impact what emission level a fault can be detected. Further, manufacturers are still refining these diagnostics including improving accuracy of engine-out models and sensor adaptation strategies to compensate for any sensor drift.

For NOx sensors located downstream of the NOx converting catalyst, the sensor output is affected by the condition of the catalyst itself. As such, it is difficult to discern sensor malfunctions from catalyst system malfunctions. For the most part, manufacturers have come up with separate diagnostics to discern the likely root cause and be able to direct a repair technician to a troubleshooting procedure that focuses on the likely cause. However, these sensor diagnostics are generally only able to detect malfunctions at the same emission level as the catalyst diagnostic itself.

Accordingly, staff is proposing that the HD OBD and OBD II regulations be modified to require identical thresholds for NOx sensors as those being proposed for NOx converting catalyst monitoring (described in section I above). Specifically, staff is proposing that for 2013 model year medium-duty vehicles, manufacturers would be required to meet a threshold of '+0.3' (i.e., the engine dynamometer standard + 0.3 g/bhp-hr) instead of the '+0.2' current threshold. For heavy-duty applications, staff is proposing to modify the 2013 model year threshold to remain at the '+0.4' threshold that applied in 2012. However, starting with the 2014 model year, manufacturers would be required to phase in a tighter threshold of '+0.3'. Specifically, manufacturers would have to meet the '+0.3' threshold on 20 percent of their 2014 model year heavy-duty engine volume and 50 percent of their 2015 model year heavy-duty engine volume. For the 2016 model year, manufacturers would be required to meet the '+0.2' threshold with the exception that any products that were phased-in during 2014 or 2015 to the '+0.3' threshold would be able to remain at that threshold in 2016 and would not have to meet the '+0.2' threshold until the 2017 model year. As already stated in section I for NOx catalyst monitoring, this phase-in would force manufacturers to continue to push forward but allow them to focus their efforts on engines in which compliance is more straight-forward in the early years as well as give them time to continue to evolve base calibration beyond what was done for the 2013 model year. Further, the carry-over provision for the 2016 model year would provide them relief from having to recalibrate their entire product line to meet the tighter threshold in that one year.

Further, staff is also proposing NMHC malfunction thresholds for the NOx/PM sensor performance monitoring requirements in the HD OBD regulation. Specifically, in addition to the NOx and PM malfunction thresholds currently required (e.g., detect a NOx sensor fault before NOx emissions or PM emissions, whichever happens first, exceed a specified level), manufacturers would be required to detect a sensor performance fault before NMHC emissions exceed 2.0 times the standards starting in the 2016 model year. The proposed NMHC thresholds would be consistent with the thresholds currently required for diesel NOx catalyst monitoring. In virtually all cases, staff does not expect this change to alter the current calibration or sensitivity of NOx or PM sensor diagnostics because NOx and PM emissions will likely be the two most sensitive pollutants and have the biggest emission impact. However, to be thorough and to protect against unforeseen interactions or control strategies, the change would ensure that a fault is detected before any one of the pollutants exceeds a defined threshold.

L. GASOLINE MISFIRE MONITORING

The HD OBD regulation currently requires manufacturers to continuously monitor for misfire faults from no later than the end of the second crankshaft revolution after engine start and, for engines that employ shutoff strategies (e.g., hybrid vehicles that shut off the engine at idle), no later than the end of the second crankshaft revolution after each engine restart. The term "engine start" is currently being used in the regulation for many requirements with the intent that "engine start" signifies the start of vehicle operation, which may or may not involve the engine actually being started in a hybrid vehicle. To avoid confusion about when exactly misfire monitoring is required to resume after the engine is shutoff, staff is proposing to revise the language to require manufacturers to monitor for misfire faults from no later than the end of the second crankshaft revolution after "engine fueling begins for the initial start and after each time fueling resumes."

M. GASOLINE SECONDARY AIR SYSTEM MONITORING

The HD OBD regulation currently requires manufacturers to monitor the secondary air system for malfunction prior to either a decrease or an increase from the manufacturer's specified air flow that would cause emissions to exceed 1.5 times the standards. Further, if no fault that causes a decrease or an increase in air flow could cause emissions to exceed 1.5 times the standards, the manufacturer is required to detect a fault when "no detectable amount of air flow is delivered during normal operation of the secondary air system." Manufacturers are presently not required to do a functional monitor for increases in air flow that do not cause emissions to exceed 1.5 times the standards. Consistent with what is required for other component/system monitors, staff believes that complete coverage of faults is needed for secondary air systems as well. Thus, staff is proposing to modify the language to require manufacturers to detect a fault when no detectable amount of air flow is delivered only if no fault that causes a decrease in air flow could cause emissions to exceed the threshold. Further, staff is proposing that if no fault that causes an increase in air flow could cause emissions to exceed the threshold, the manufacturer would be required to detect a fault when the system has reached its control limits such that it cannot reduce air flow during normal operation of the secondary air system.

N. ENGINE COOLING SYSTEM MONITORING

The HD OBD regulation requires manufacturers to monitor cooling systems for malfunctions that affect emissions or other diagnostics. Malfunctions resulting in improper engine temperature regulation may disable OBD diagnostics, reduce OBD monitoring frequency, cause changes in engine and emission control operation, and cause an increase in vehicle emissions. Therefore, ARB has required cooling systems to be monitored to detect thermostat malfunctions if either of the following occurs: (i) the engine coolant temperature (ECT) does not reach the highest temperature required by the OBD system to enable other diagnostics, or (ii) the ECT does not reach a warmed-up temperature within 20 degrees Fahrenheit of the engine manufacturer's nominal thermostat regulating temperature. Currently the regulation requires this thermostat monitor to be enabled "on every driving cycle in which the ECT sensor indicates, at engine start, a temperature lower than the" threshold temperature, but the regulation also indicates that ARB will not approve "disablement of the monitor on engine starts where the ECT at engine start is more than 35 degrees Fahrenheit lower than the" threshold temperature. The language has caused confusion about when the thermostat monitor is allowed to be enabled on a given driving cycle. Thus, staff is proposing clarifications to the HD OBD language to make clear when the thermostat monitor can be enabled. Essentially, the manufacturer would be required to disable the thermostat monitor on driving cycles where the ECT at start is within 35 degrees Fahrenheit of the thermostat monitor malfunction threshold temperature to avoid false passes when cooling system faults are present but still manage to warm the system up by a few degrees. However, manufacturers would be able to request Executive Officer approval to enable the monitor if the ECT at start is within a portion of this region (e.g., if the malfunction threshold temperature is 160 degrees Fahrenheit, the manufacturer may request approval to enable the monitor for a portion of the temperature region above 125 degrees but still below 160 degrees Fahrenheit) provided they submit data demonstrating that the monitor can indeed robustly detect thermostat malfunctions and is not at risk for false passing when starting at engine temperatures in those regions.

O. COMPREHENSIVE COMPONENT MONITORING

The HD OBD regulation currently requires diesel manufacturers to detect faults of the idle control system if, among other things, the fuel injection quantity is "not within +/-50 percent of the fuel quantity necessary to achieve the target idle speed for a properly functioning engine and the given operating conditions." Manufacturers have expressed concern that not all the "given operating conditions" are known to manufacturers, making it hard to determine what the appropriate fuel quantity to achieve the target idle speed should be and, consequently, whether or not there actually is a fault. Staff is proposing to modify the language to require detection of idle control system faults of the fuel quantity in relation to achieving the target idle speed for "known", not "given," operating conditions.

The HD OBD regulation currently requires manufacturers to monitor fuel control system components (e.g., injectors, fuel pumps) that have tolerance compensation features implemented in hardware or software during production or repair procedures on 2013 and subsequent model year engines. Examples of these include individually coded injector flow characteristics and fuel pumps that use in-line resistors to correct differences in fuel pump volume output. Monitoring of the components would ensure that misassembled systems, erroneous programming, or incomplete repair procedures that result in incorrect adjustment being applied (and consequently, increases in emission levels) will be detected. Manufacturers have questioned the need to monitor this feature and have expressed concern about meeting this requirement in the 2013 timeframe. They additionally stated that the fuel system monitoring requirements already require detection of emission-related malfunctions for pressure control, timing, and quantity. Light- and medium-duty manufacturers, who are also required to monitor this feature, have indicated they have been working hard on improvements to their fuel system adaptive strategies to fully compensate or learn out any errors that may occur due to mismatches in the injector and the programmed tolerance/adjustment. This would allow manufacturers to avoid adding new hardware, such as a communication chip in the injector that would automatically communicate its characteristics to the engine computer, and avoid other alternatives such as tighter tolerances on the injectors to meet this requirement. Staff believes that heavy-duty manufacturers could also take the same approach. Thus, consistent with what was approved by the Board in January 2012 for light- and medium-duty diesel vehicles under the OBD II regulation, staff is proposing to modify the HD OBD regulation to delay the monitoring requirement of this feature until the 2015 model year for heavy-duty engines. Such a delay should give sufficient time for manufacturers to fully refine adaptive strategies so that they can compensate for any mismatches that occur or to determine that such strategies are ineffective and implement an alternative method such as those previously mentioned.

Additionally, as discussed early in sections II.H. and II.J., manufacturers have requested that this monitor be subject to test-out criteria allowing manufacturers to be exempted from monitoring if the impact is less than 15 percent of the standard. While many manufacturers seem to be making great strides in adaptive strategies that nearly fully compensate for mismatches, achieving complete compensation may prove to be very difficult. Accordingly, staff is proposing to also apply test-out criteria to features that fall under this provision. Specifically, mismatches or faults that cause less than a 15 percent of the standard increase in emissions and are below the emission standard would be exempt from monitoring. However, because this function is often on multiple components (e.g., all injectors) and the severity of the fault can vary by how far off the mismatch is, staff is proposing that manufacturers be required to submit a test plan for Executive Officer approval of the test procedures and combination of failed parts and the degree to which they are a mismatch that will be used for the test-out. While staff would normally take the position of the worst-case scenario (e.g.., all injectors with a mismatch and with the largest mismatch possible), such a scenario is statistically virtually impossible and not very representative of the type of mismatches that happen in the real world. Accordingly, staff is proposing to give some additional latitude to manufacturers to propose a more realistic scenario based on the distribution of parts and likely in-use scenarios. Staff's intent is for the manufacturers to identify a reasonable bound within which most replacement parts would fall (e.g., perhaps within one sigma from the median part) and propose a test condition that would represent a reasonable worst case emissions scenario within those bounds. These proposed changes would apply to both the HD OBD and OBD II regulations.

P. STANDARDIZATION REQUIREMENTS

Reference Documents:
The staff is proposing amendments that would update the list of SAE and ISO documents that are incorporated by reference into the HD OBD regulation. As is common practice with technical standards, industry periodically updates the standards to add specification or clarity.

Diagnostic Connector and Communication Protocol:
Staff is also proposing amendments to the diagnostic connector and protocol requirements in the HD OBD regulation. Staff is proposing specific language clarifying the use of SAE J1939 for diesel manufacturers. When the HD OBD regulation was first adopted, SAE J1939 only had a 250 kbps baud rate version of the protocol and a single connector. However, since originally adopted, SAE J1939 had been updated to include an additional 500 kbps baud rate version of the protocol and a second version of the connector itself (i.e., the "Type 2" version) to handle the new baud rate. While staff initially objected to the addition of a second baud rate and second connector on the grounds that it was undermining the intent of standardization by creating more permutations, industry has indicated that the 250 kbps baud rate is likely to have insufficient bandwidth to handle all of the required message traffic in the near future. Further, the "Type 2" connector has been designed to be backwards compatible with both baud rates such that any technician or inspection entities would be able to purchase a single connector that would cover both variants. With this standardization first applying in the 2013 model year, it is also expected that a minimal amount of entities have already 'tooled up' for the "Type 1" connector and could jump straight to the "Type 2" connector for their equipment purchases. While two baud rates will generate more work for the tool and equipment manufacturers because they will have to validate their equipment on a sufficient number of vehicles on each of the two baud rates, the baud rate change is a fairly minor permutation. Several J1939 committee members have also committed to ensuring that the J1939 specification contains enough direction to tool manufacturers on how to accurately determine the appropriate baud rate when first connected to a vehicle. Thus, staff is proposing to amend the HD OBD regulation to clarify the combinations of baud rate and connectors that are allowed in the near term (prior to 2016 model year) and that the 500 kbps variant (and associated "Type 2" connector) would be the only allowed variant for 2016 and subsequent model years to align with industry's likely timeframe for switching to the higher baud rate.

Based on light-duty experience, staff is also proposing that the HD OBD regulation be amended to prohibit manufacturers from putting an additional identical standardized connector (i.e., an SAE J1939 connector or "Type A" SAE J1962 connector) used for non-OBD purposes in the same area where the standardized OBD diagnostic connector is required to be located. This would help avoid confusion among technicians or inspectors attempting to identify the 'correct' diagnostic connector to retrieve OBD information from the vehicle. Manufacturers would still be allowed to equip their engines and vehicles with additional diagnostic connectors as needed but, if they choose additional connectors that are identical to the standardized one, they would not be allowed to install those connectors in the driver footwell area where the HD OBD connector is required to be.

Readiness Status:
Staff is also proposing amendments to the readiness status requirements in the HD OBD regulation. Manufacturers are presently required to incorporate readiness status indications of several major emission control systems and components into their OBD systems, which helps determine if the OBD monitors have performed their system evaluations. When the OBD system is interrogated by an off-board tool, the system is to report a readiness status for each major emission-related component of either "complete" (if the monitor has run a sufficient number of times to detect a malfunction since the memory was last cleared), "incomplete" (if the monitor has not yet had the chance to run since the memory was last cleared), or "not applicable" (if the monitored component in question is not equipped or monitored on the vehicle). The main intent of the readiness status is to ensure an engine or vehicle is ready for an OBD-based inspection (i.e., that monitors have run prior to inspection). Technicians also can use the readiness status to verify OBD-related repairs. With the current language, however, there has been confusion about which monitors manufacturers are required to include when determining readiness status for each component/system. Further, manufacturers have expressed concern that certain diesel-related monitors may take too long to run and complete (e.g., monitors that require PM filter regenerations to occur), which would unnecessarily delay setting of the readiness status to "complete". While staff understands manufacturers' concerns regarding this last point, staff believes it is important to include most monitors of the primary emission controls on the engine, even though they make take time to complete. Staff, however, is proposing revisions that would clarify exactly which monitors are required to be included when determining readiness status to ensure consistency in implementation among all manufacturers.

Staff is also proposing additional amendments to correct confusion related to implementing the readiness requirements, including specific language on how to deal with monitors that detect faults of more than one major emission-related component (e.g., an oxygen sensor monitor that is used to detect both oxygen sensor faults that are tied to the oxygen sensor readiness bit and air-fuel ratio cylinder imbalance faults that are tied to the fuel system readiness bit). Lastly, staff is proposing to delete the current requirement that allows manufacturers to request Executive Officer approval to set the readiness status to "complete" without monitoring actually having been completed if monitoring is disabled on multiple driving cycles due to extreme operating conditions (e.g., cold ambient temperatures, high altitudes). This requirement was originally carried over from the OBD II requirements, where staff allowed a showing of complete status to avoid light- and medium-duty vehicles from failing inspection and maintenance tests due to unset readiness bits solely because the vehicle was being operated in extreme conditions (e.g., high altitude, very cold temperatures, etc.) in which monitoring was routinely disabled. However, given that heavy-duty vehicles do not undergo periodic inspections, staff believes this condition is not needed.

Data Stream Parameters:
Staff is proposing some modifications to the data stream parameters that are required to be made available in the HD OBD regulation. First, staff is proposing the addition of three parameters for all 2016 and subsequent model year heavy-duty diesel engines. Specifically, manufacturers would be required to report fuel rate, actual engine torque including fan/accessory torque, and modeled exhaust flow (mass/time). These three parameters are intended to make it easier to conduct valid in-use emission tests with portable emission measurement systems (PEMS) and as such, also are referenced in section 1971.1(h)(4.2.2)(H) as needed to be reported as accurately as available in the applicable electronic control module to facilitate accurate testing. Regarding fuel rate, this parameter is already required on diesel engines 'if equipped' but this change will ensure all diesel engines support it and by including reference in section 1971.1(h)(4.2.2)(H), the resolution of the fuel rate parameter will likely need to be improved beyond what is currently reported on some vehicles as suspect parameter number (SPN) 183 in the SAE J1939 standard. Regarding engine torque, several manufacturers have indicated that the engine torque value commonly available is torque after fan or other engine accessory torque has been subtracted. This effectively underreports the torque being produced by the engine and results in less accurate calculations of a g/bhp-hr emission rate during in-use testing. Accordingly, the amendments would ensure the most accurate total engine torque number is available for testing. Staff is also proposing additional data stream parameters to be made available on engines so equipped – specifically, starting with the 2016 model year, manufacturers of engines equipped with reductant quality sensors would be required to output such sensor data in a standardized format to a scan tool. Further, 2016 and subsequent engines with NOx sensors would be required to output a 'corrected' NOx sensor signal in addition to the raw NOx sensor signal currently available. In discussions with manufacturers, several have indicated that they have corrections or adaptions they apply to the raw signal within the engine or aftertreatment control modules to account for the ammonia cross-sensitivity of the sensor or auto-zero or other adaption strategies that are used to adjust the raw signal. Given the control systems would likely be acting on this corrected signal rather than the raw signal, it could prove to be valuable information for technicians when troubleshooting detected malfunctions.

Lastly, staff is proposing to identify the specific SPNs that manufacturers must use for the required data stream parameters "normalized trigger for PM filter regeneration" and "PM filter regeneration status". In these specific cases, SAE J1939 contains more than one SPN that is related or very similar to these parameters, which may result in an engine utilizing a different SPN than another engine for the same parameter or confusion among manufacturers as to which variant of the parameter they should be supporting. So while manufacturers are required to report both these data parameters starting with the 2013 model year and different manufacturers will likely meet this requirement by supporting different SPNs, staff is proposing to clarify which exact SPN manufacturers should be using to meet these requirements starting in the 2016 model year to ensure consistent implementation across all manufacturers.

Erasure of Emission-Related Information:

Staff is also proposing amendments related to the erasure of emission-related information. Currently, the HD OBD regulation allows permanent fault codes to be erased when the individual control module containing the permanent fault code is reprogrammed and the vehicle/engine readiness status for all monitors (in all emission-related modules) is set to "not complete". The regulation similarly requires all emission-related information (from all emission-related modules) to be erased in conjunction with the reprogramming of the vehicle identification number (VIN) or engine serial number (ESN). Manufacturers have argued that actions that affect only certain control modules (e.g., erasing a permanent fault code stored in just the engine control module) should not require resetting of readiness bits or erasing of emission-related information from "all" control modules, and that such 'coordinated clearing' can be difficult to achieve. The rationale for clearing all information was to reduce the opportunity for selective reprogramming events to be used to evade detection during inspections or avoid necessary repairs. However, staff agrees that a change is appropriate while still meeting the original intent. Specifically, the primary objective was to ensure that readiness status for the major monitors was reset to "not complete" to provide an obvious indication that some or all relevant information to an inspection had recently been altered or erased. Given that many modules do not support readiness bits or only support the comprehensive components readiness bit (which, by design, immediately reports "complete" even after a code clear event), staff is proposing that such reprogramming events must ensure a readiness reset only in modules that support readiness for major components (i.e., any readiness bits other than comprehensive components). While this does still require some form of 'coordinated' code clearing, it limits the number of involved modules. For example, if a vehicle has an engine control unit (ECU) that supports readiness for major components and five auxiliary emission-related modules that don't support readiness for any major components, and if one of the auxiliary modules has a permanent fault code stored and that module is reprogrammed and erases the permanent fault code, the OBD system would only need to ensure that the engine ECU resets all readiness bits and not that all five of the auxiliary modules also reset readiness.

Calibration Verification Number (CVN):

Staff is proposing amendments to the CVN requirements. The HD OBD regulation currently requires the CVN to be stored at all times, calculated, and re-stored at least once per ignition cycle, and to be made immediately available at all times through the data link connector to a generic scan tool in accordance with the requirements in SAE J1979 or J1939. The only exceptions allowed in the regulation are for extreme circumstances where the stored value has been erased and not had an opportunity to be calculated and re-stored yet. Specifically, relief is granted from having the CVN immediately available to a scan tool if it is requested within 60 seconds of the ECU being reprogrammed or having non-volatile memory cleared, or within 30 seconds of a volatile memory clear or battery disconnect. A few manufacturers have indicated that the timeframes of 60 and 30 seconds might be insufficient to recalculate a new CVN and have it available. To address this, staff is proposing to modify the HD OBD regulation to clarify these timeframes and the associated events that are allowed and to clarify that, at all other times, immediately available means the value is returned to the requesting scan tool within the normal message response timing and does not allow for any extended message response timings or negative response codes. Additionally, given the very limited and rare scenarios in which the 60 and 30 second timeframes apply, staff is proposing to extend the timeframe to 120 seconds for both situations.

Q. CERTIFICATION DEMONSTRATION TESTING REQUIREMENTS

The HD OBD and OBD II regulations require manufacturers to conduct emission demonstration testing prior to certification to ensure that the systems are indeed able to detect faults before the thresholds are exceeded. The HD OBD and OBD II regulations currently require manufacturers to perform demonstration testing of the diesel full speed and load misfire monitor on heavy-duty engines and medium-duty vehicles, since the monitors are calibrated to a tailpipe emission threshold and demonstration testing is used to verify such calibrations are correct. However, as explained in section F. above, staff is proposing to require manufacturers to detect misfire when the percentage of misfire exceeds a certain level (i.e., 5 percent) in lieu of the emission threshold-based malfunction criteria. Due to this change, staff is proposing to modify both the HD OBD and OBD II regulations to exempt manufacturers from having to perform demonstration testing of diesel misfire monitors using this new malfunction criterion.

The HD OBD regulation currently contains language detailing the testing required for gasoline fuel system monitoring. Staff, however, forgot to include specific language for the air-fuel ratio cylinder imbalance monitor, which is one part of the gasoline fuel system monitoring requirements, so staff is proposing language detailing the testing requirements for this monitor. Further, the regulation currently requires that "for purposes of fuel system testing, the fault(s) induced may result in uniform distribution of fuel and air among the cylinders" and that "non-uniform distribution of fuel and air used to induce a fault may not cause misfire." While this language works for testing of the main fuel system feedback monitor, it doesn't apply to testing of other fuel system monitors such as the air-fuel cylinder imbalance monitor, which, by definition is 'non-uniform' and in some cases produce misfire. Therefore, staff is proposing amendments to the HD OBD regulation to limit this language to testing of the main fuel system feedback monitor.

Staff is also proposing amendments to the HD OBD testing requirements for gasoline oxygen sensor emission threshold-based monitors to limit the number of tests required to be performed. Specifically, for conventional oxygen sensors, the manufacturer would be required to perform a test for two malfunction cases: (1) the single worst case response rate malfunction among all symmetric and asymmetric patterns, and (2) the worst case asymmetric response rate malfunction that results in delays during transitions from rich-to-lean or lean-to-rich sensor output. For wide range or universal sensors, the manufacturer also would be required to perform a test for two malfunction cases: (1) the single worst case response rate malfunction among all symmetric and asymmetric patterns, and (2) the symmetric response rate malfunction that results in delays during transitions from rich-to-lean and lean-to-rich sensor output. For the worst case malfunctions, staff would require manufacturers to submit data and/or analysis demonstrating that the malfunction will result in the worst case emissions compared to all the other response rate malfunctions.

Lastly, staff is proposing changes to the HD OBD regulatory language to clarify demonstration testing for catalyst faults and other faults where default actions are taken subsequent to fault detection. Staff's proposed modifications provide more direction to manufacturers to handle various scenarios of default actions and incremental levels of fault detection to ensure diesel monitors are appropriately tested.

R. DEFICIENCIES

The HD OBD regulation contains provisions that allow certification of HD OBD systems with "deficiencies" in cases where a good faith effort to fully comply with the OBD requirements has been demonstrated. The deficiency provisions facilitate OBD implementation by mitigating the danger of manufacturers not being able to certify engines with relatively minor implementation problems.

Staff is proposing a clarification to the deficiency language in the HD OBD regulation. Specifically, staff currently does not issue deficiencies (and consequently, certification of the vehicle) for issues that would be subject to an ordered recall under the HD OBD enforcement regulation section 1971.5. Staff is proposing language to make this clear in the regulation. Further, staff is proposing language clarifying that OBD systems that fail to meet the requirements of the HD OBD regulation and that were not granted deficiencies for the requirements they failed to meet would be considered non-compliant and subject to enforcement under section 1971.5.

Staff is also proposing amendments to the required timelines for issuing retroactive deficiencies in the HD OBD regulation. The regulation currently allows manufacturers to request retroactive deficiencies within either the first six months after commencement of the start of engine production or the first three months after commencement of the start of vehicle production, whichever is later. The deadlines are aligned with the required deadlines for production engine/vehicle testing to verify the monitoring requirements (section 1971.1(l)(2)), since such testing may uncover problems with the OBD system that would be considered deficiencies. Manufacturers have expressed concern about meeting the required deadlines for the testing, indicating that they have been having trouble procuring vehicles with their engines soon enough after production begins to complete the testing in time. Staff, therefore, is proposing to extend the deadline for production engine/vehicle testing, and thus the request deadline for retroactive deficiencies, to six months after commencement of the start of engine production or vehicle production, whichever is later.

Additionally, staff is proposing amendments to address the certification of heavy-duty hybrid vehicles. The regulation currently allows manufacturers to carry over a deficiency up to a maximum of three model years from the time it was first issued, provided the manufacturer is able to demonstrate a good faith effort in complying with the HD OBD requirements, among other criteria. As indicated above, engine manufacturers and hybrid system manufacturers have expressed issues about meeting the OBD requirements on hybrid vehicles, citing the lack of experience in developing such OBD systems and the complexities of designing systems considering the various possible hybrid-engine configurations. And as already explained above in section II.A., staff is proposing to provide relaxation for the 2013 model year and require OBD compliance starting from the 2014 model year. However, for those hybrid vehicles that are certified to the HD OBD requirements of section 1971.1 in lieu of this relaxation in the 2013 model year and carried over to the 2014 model year, staff is proposing language to allow the 2014 model year to be considered the first model year for the deficiency. This change should ensure that a manufacturer who elects to certify to the more stringent path (HD OBD) in 2013 will not be at a disadvantage to manufacturers who choose the easier path for items that would take long lead time to resolve. Additionally, as already explained above in section II.A., staff is proposing an additional two free deficiencies for hybrid systems in the 2013 through 2015 model years to help avoid fines for manufacturers that fall short.

Lastly, while staff is not proposing specific language in the regulations, staff would like to clarify the policy for the carry-over of deficiencies for emission threshold-based monitors to address questions raised by manufacturers. Specifically, in cases where there is an interim threshold (e.g, three times the standard) for a few years and then a step down to a final threshold (e.g., two times the standard), manufacturers have asked if a deficiency for the interim threshold 'starts the clock' towards the maximum two or three years of carry-over or if the carry-over clock restarts when the threshold steps down to the final threshold. Initially, staff was concerned that the latter case (i.e., restarting the clock with the final threshold) would allow manufacturers to drag their feet when addressing deficiencies or attempt to carry them over longer than needed. However, given the existing criteria that a manufacturer must meet to qualify for a deficiency, namely a good faith effort to comply in full and to come into compliance as expeditiously as possible, staff believes there are valid cases where it would be appropriate. For example, a manufacturer could make an appropriate attempt to comply with the interim threshold and fall short and again make a valid attempt to comply with the final threshold with a completely different approach or monitor and still come up short. In cases where it is not appropriate and is caused by a manufacturer not putting forth sufficient effort or resources to try and comply, the existing deficiency qualifications would already allow staff to deny such deficiencies and prevent further carry-over. Accordingly, staff believes it is appropriate that, as a general policy, a change in the monitoring threshold would reset the clock for a deficiency. As stated though, this would not, however, obviate the need to make a good faith effort to comply or to come into compliance as expeditiously as possible---both would still be required to qualify both initially and in each subsequent year for a deficiency to be granted.

S. OTHER PROPOSED AMENDMENTS

Staff is proposing other minor amendments to the HD OBD regulation. These include proposed additional items required to be submitted by the manufacturer as part of the HD OBD certification application and minor amendments to the production engine/vehicle evaluation testing procedures, as well as clarification changes throughout the regulation. All the proposed amendments are detailed in the attached regulatory language.

Staff is also proposing amendments related to small volume manufacturers. As described above, staff is proposing amendments to the diesel misfire, NOx catalyst/NOx sensor, and PM filter monitoring requirements that include required phase-in schedules that manufacturers must meet. Small volume manufacturers, however, would likely have trouble meeting the required phase-ins, considering the small volume of engines (and thus, small number of engine families, if more than one) produced every year and the limited resources available to make the necessary changes each year of the phase-in. In some cases, these manufacturers do not have enough different engine families to be able to meet a phase-in on a portion of their families and would be forced to implement the new requirements across their entire product line in the first year of the phase-in. Therefore, staff is proposing to allow small volume manufacturers to meet different schedules than the required phase-in schedules for these monitors. Specifically, for the diesel misfire monitor, staff is proposing to allow these manufacturers to either use an alternate phase-in schedule as defined in section (c) or to meet the requirement on all vehicles in the final year of the required phase-in schedule. For NOx catalyst/NOx sensor and PM filter monitoring, staff is proposing to allow these manufacturers to continue using the 2013 model year malfunction criteria for the 2014 and 2015 model years (i.e., exempt them from the phase-in malfunction criteria required for the 2014 and 2015 model year phase-in engines) and wait until the 2016 model year to comply with the final thresholds that apply to 2016 and subsequent model year engines. These revisions for small volume manufacturers are consistent with what has historically been provided for light-duty vehicle manufacturers in the OBD II program. Further, staff is also proposing similar revisions in the OBD II regulation concerning small volume manufacturers and the new proposed PM filter monitor requirements and phase-in schedule.

Concerning the OBD II regulation, staff is proposing amendments for medium-duty diesel vehicles certified to a chassis dynamometer tailpipe emission standard. The OBD II regulation currently requires manufacturers of these vehicles to request approval of the emission-based malfunction criteria in lieu of the engine dynamometer-based malfunction criteria (e.g., 2.0 times the applicable standards) required for each applicable diesel monitor in section 1968.2(f). At the time of the last amendments in 2006, the vast majority of medium-duty diesels were certified using the engine dynamometer standards and chassis dynamometer-based certifications were extremely rare. However, since then, chassis dynamometer certification has become quite common and staff has developed more experience as to the monitoring capability of these systems with respect to emission levels relative to the emission standards. Therefore, staff is proposing that for most monitors on 2016 and subsequent model year medium-duty diesel vehicles certified to a chassis dynamometer tailpipe emission standard, manufacturers would be required to use the same chassis dynamometer-based malfunction criteria currently required for passenger cars, light-duty trucks, and medium-duty passenger vehicles certified to a chassis dynamometer tailpipe emission standard. For NMHC catalyst conversion efficiency monitoring, since the light-duty malfunction criteria does not have a NOx malfunction threshold while the medium-duty engine dynamometer-based criteria does, staff would require manufacturers to detect a catalyst fault before emissions exceed 1.75 times the applicable FTP NMHC or NOx standards. For diesel misfire monitoring, since the OBD II regulation currently requires light-duty emission threshold-based malfunction criteria and continuous monitoring while the medium-duty engine dynamometer-based criteria does not, staff would require manufacturers to detect a malfunction based on the medium-duty engine dynamometer-based malfunction criteria and monitoring requirements. The proposed language would eliminate the requirement for manufacturers to individually propose chassis-based thresholds and seek Executive Officer approval and instead would provide clear thresholds that all manufacturers would be required to meet.

Lastly, as already stated above in section II.R., staff is proposing amendments to the required timelines for conducting production engine/vehicle testing to verify the monitoring requirements in the HD OBD regulation. The regulation currently allows manufacturers to conduct this testing and submit the results within either the first six months after commencement of the start of engine production or the first three months after commencement of the start of vehicle production, whichever is later. Manufacturers have expressed concern about meeting the required deadlines, indicating that they have been having trouble procuring vehicles with their engines early enough to complete the testing in time. Staff therefore is proposing to extend the deadline for production engine/vehicle testing to six months after commencement of the start of engine production or vehicle production, whichever is later. Additionally, for clarification, staff is proposing amendments to indicate the six month timeline starts when vehicle production using the manufacturer's engine begins to cover cases where vehicle production begins earlier but solely with other engine options.

T. HD OBD AND OBD II ENFORCMENT REGULATIONS

The HD OBD and OBD II enforcement provisions (sections 1971.5 and 1968.5, respectively) help ensure the effectiveness of the HD OBD and OBD II regulations and to address OBD noncompliances in the field. The enforcement regulations detail procedures for evaluating and remediating (where necessary) OBD-specific in-use issues. Specifically, the regulations contain detailed protocols that provide clear direction as to the procurement, testing, sampling, and evaluation criteria that ARB staff uses to determine compliance with the OBD requirements. They include performance testing of emission threshold-related monitors, downloading of data of in-use monitoring performance ratios, and evaluation of other OBD requirements (e.g., diagnostic connector location, communication protocol standards, MIL illumination protocol, etc.). The results of the tests would be compared to the minimum performance levels prescribed in the enforcement regulations, which would determine if the engines/vehicles in question may be subject to remedial action or fines including mandatory recall for the most egregious nonconforming OBD systems.

Currently, the HD OBD and OBD II enforcement regulations dictate specific criteria for procuring engines/vehicles for the test sample group used to perform the evaluation. To determine if a monitor is in compliance with the in-use monitoring performance requirements, the regulations require the test sample group to include engines/vehicles with denominators for that monitor meeting a minimum required value. Currently, many PM filter-related monitors and PM sensor monitors are required to have denominator values of at least 150 or 300, depending on the denominator incrementing criteria being used. Many of these monitors, however, require a PM filter regeneration event to occur, which consequently means the engine/vehicle would have to accumulate very high mileage to have a sufficient number of denominators to be acceptable as part of the test sample group. Given the recent trend in industry to further lengthen the intervals between regeneration events, this criterion will become even more restrictive in the future. Thus, staff is proposing to require engines/vehicles to be part of the test sample group if such PM filter-related monitors or PM sensor monitors have denominators of at least 50.

As stated above, staff is proposing changes to the denominator incrementing criteria for the PM filter filtering performance monitor and PM filter missing substrate monitor in both the HD OBD and OBD II regulations. Specifically, these monitors, which are currently required to increment the denominator when, among other conditions, 800 minutes of engine runtime are met in the HD OBD regulation and 500 miles are met in the OBD II regulation, would be required to increment the denominators using only the general denominator criteria starting in the 2016 model year. Further, the OBD II regulation would allow manufacturers to certify these monitors to a lower interim in-use ratio of 0.100 on 2016 through 2018 model year medium-duty vehicles. Considering the new denominator would increment more often than the current denominator, the resulting ratios would be less than the current ratios, causing manufacturers' concerns about the ability to meet the required minimum in-use performance ratio. To address manufacturers' concerns, staff is proposing to relax enforcement provisions for the first few years the monitors start using this new denominator, specifically to the nonconformance criteria and mandatory recall requirements. The OBD II enforcement regulation already has nonconformance criteria for monitors certified to an in-use ratio of 0.100 and do not subject these monitors to mandatory recall, so minimal changes are needed to address this. For the HD OBD enforcement regulation, staff is proposing changes to allow these monitors on 2016 through 2018 model year engines to use the less stringent criteria to determine nonconformance. Specifically, while other monitors on 2016 and subsequent model year engines would be considered nonconforming if the average in-use monitor performance ratio of engines in the test sample group is less than 0.088 or if at least 66 percent of the engines have an in-use ratio of less than

0.100, the PM filter filtering performance monitor and PM filter missing substrate monitor would be considered nonconforming if the average in-use ratio is less than 0.050 or if at least 66 percent of the engines have an in-use ratio of less than 0.050. Further, staff is proposing that these monitors not be subject to mandatory recall for the 2016 through 2018 model years.

Staff is also proposing changes to the HD OBD and OBD II enforcement regulations to address the proposed changes made to the diesel misfire monitoring requirements. As described above, staff is proposing to require all 2016 and subsequent model year heavy-duty engines and medium-duty vehicles to detect a diesel misfire fault when the percentage of misfire exceeds 5 percent. The enforcement regulations currently do not contain mandatory recall criteria applicable to this new requirement. Thus, staff is proposing to require mandatory recall if the percentage of misfire exceeds 10 percentage points greater than the malfunction criteria (i.e., 15 percent misfire) without the MIL being illuminated for both the HD OBD and OBD II enforcement regulations, starting with the 2019 model year.

Lastly, staff is proposing changes to the HD OBD and OBD II enforcement regulations related to the PM filter. As described above in section II.J., staff is proposing higher interim emission malfunction thresholds for PM filter monitoring, with proposed thresholds around the range of 0.04 or 0.05 g/bhp-hr in the HD OBD regulation. Further, as previously stated, engine manufacturers have been moving towards higher engine-out NOx emission levels, resulting in lower engine-out PM levels that are near 0.05 g/bhp-hr or lower. The HD OBD and OBD II enforcement regulations currently mandate a mandatory recall if a malfunction is not detected before emissions exceed two or three times the malfunction criteria. In the case of the PM filter monitor, that recall level could reach 0.120 to 0.150 g/bhp-hr. Considering that engine-out PM levels are projected to be around the 0.05 g/bhp-hr level for several manufacturers, an engine with no PM filter would have PM emission levels that would be far below the mandatory recall emission level and never be subject to mandatory recall despite a completely non-functional PM filter monitor. Considering how critical of an emission control component that the PM filter is, it would be inappropriate for the monitor to be unable to detect a completely missing PM filter and still not be subject to enforcement action. Thus, staff is proposing to add additional criteria for mandatory recall related to the PM filter monitor. Specifically, starting with the 2013 model year, a mandatory recall shall be ordered if the PM filter monitor is unable to detect any of the following: (1) a missing substrate PM filter fault or (2) a malfunction of the PM filter that causes PM emissions to be equal to or greater than the engine-out PM levels with the PM filter substrate completely removed.

Staff is also proposing additional changes to the mandatory recall criteria for PM filter filtering performance monitoring in the OBD II enforcement regulation. The OBD II enforcement regulation currently mandates a mandatory recall if a malfunction is not detected before emissions exceed two times the malfunction criteria. The OBD II regulation currently requires manufacturers to detect a PM filter fault before emissions exceed 0.03 g/bhp-hr for all 2013 and subsequent model year vehicles. Some manufacturers, however, have indicated that their current monitors would not be able to detect a fault until emissions are quite near 0.06 g/bhp-hr, which would put them very close to the mandatory recall criterion, and have requested accommodations for their near-term model year vehicles. While staff does not think increasing the emission threshold malfunction criteria during these interim years would be appropriate as most manufacturers are on track to meet them, it acknowledges that some accommodation is needed with regards to enforcement to ensure that manufacturers are able to certify their OBD II systems. Thus, staff is proposing to exempt the PM filter filtering performance monitor from the mandatory recall provisions in the OBD II enforcement regulation that are specifically based on meeting the emission threshold malfunction criteria for the 2013 model year.

III. ENVIRONMENTAL IMPACT ANALYSIS

A. INTRODUCTION

This chapter provides an environmental analysis for the proposed regulation. Based on ARB's review, staff has determined that implementation of the proposed amendments to the HD OBD and OBD II regulations would not result in any potentially significant adverse impacts on the environment. This analysis provides the basis for reaching this conclusion. This section of the Staff Report also discusses the environmental benefits resulting from implementation of the proposed regulation.

B. ENVIRONMENTAL REVIEW PROCESS

ARB is the lead agency for the proposed regulation and has prepared this environmental analysis pursuant to its certified regulatory program that was certified by the Secretary of the Natural Resources Agency in 1978.[1] Public Resources Code §21080.5 of the California Environmental Quality Act (CEQA) allows public agencies with regulatory programs to prepare a plan or other written document in lieu of an environmental impact report or negative declaration once the Secretary of the Natural Resources Agency has certified the regulatory program. As required by ARB's certified regulatory program, and the policy and substantive requirements of CEQA, ARB prepares an environmental analysis to assess the potential for significant long or short-term adverse environmental impacts associated with a proposed regulation.[2] In accordance with ARB's regulations, the analysis also describes any beneficial environmental impacts.[3] The CEQA Guidelines environmental checklist was used to consider the potential for significant impacts.[4] In accordance with ARB's certified regulatory program, this environmental analysis is included in the Staff Report: Initial Statement of Reasons (ISOR) for the rulemaking.[5]

[1] CEQA Guidelines §15251(d); Cal. Code Regs., title 17, 60005-60008
[2] Cal. Code Regs., title 17, section 60005(b)
[3] Cal. Code Regs., title 17, 60005(d)

[4] CEQA Guidelines, Appendix G
[5] Cal. Code Regs., title 17, 60005

If comments received during the public review period raise significant environmental issues, staff will summarize and respond to the comments in writing. The written responses will be included in the Final Statement of Reasons for the regulation. In accordance with ARB's certified regulatory program, the decision maker will approve the written responses prior to taking final action on any proposal.[6] If the regulation is adopted, a Notice of Decision will be posted on ARB's website and filed with the Secretary of the Natural Resources Agency for public inspection.[7]

C. ENVIRONMENTAL IMPACTS

Based on ARB's review of the proposed regulation, staff concludes that the proposed regulatory amendments would not have a significant adverse effect on the environment. Compliance with the proposed regulation does not require or result in any physical change to the existing environment. It does not involve new development or require modifications to buildings or other structures, or affect operations at existing facilities, or cause any new land use designation because the action consists of changes to the engine/vehicle software that include changes to the OBD system algorithms using the existing hardware already on the engines/vehicles. These changes do not result in any physical changes to the environment such as adverse impacts to aesthetics, air quality, agricultural and forestry resources, biological resources, cultural resources, geology and soils, greenhouse gases, land use planning, mineral resources, population and housing, public services, recreation, or traffic and transportation. Further, compliance with the proposed regulation does not involve any activity that would involve or affect hazardous material, hydrology and water quality, noise, or population and housing because it does not require any action that could affect these resources. No discussion of alternatives or mitigation measures is necessary because no significant adverse environmental impacts were identified.

This determination was made because the proposed amendments would only affect HD OBD and OBD II requirements that have not yet been implemented. The proposed amendments affect requirements that start in the 2013 or later model year and do include some relaxations in the 2013 through 2015 model years that would allow higher interim malfunction emission thresholds for some monitors. Staff believes these short term interim delays and higher thresholds are necessary considering the diesel emission control technologies involved are new and evolving and have never previously existed on diesel engines. As described in section II of this staff report, these requirements are considered technically feasible for manufacturers to meet, but circumstances such as delays in technology development have prevented manufacturers from implementing the requirements within the required deadlines. For example, in the case of the PM filter monitoring requirement, the delay in the development of the PM sensor, which is expected to be used to meet the future stringent emission threshold requirement, has necessitated some delays in the start

[6] Cal. Code Regs., title 17, 60007(a)
[7] Cal. Code Regs., title 17, 60007(b)

dates. Manufacturers are expected to take advantage of these delays to improve their system strategies and develop robust monitors to meet the requirements.

Additionally, the proposed amendments would also establish more stringent requirements that will encourage manufacturers to design and build more robust engines to comply with the requirements. The proposed HD OBD and OBD II amendments will help ensure that forecasted emission reduction benefits from adopted light-, medium-, and heavy-duty engine emission standards programs are achieved. Given the substantial shortfall in emission reductions still needed to attain the National and State Ambient Air Quality Standards and the difficulty in identifying further sources of cost-effective emission reductions, it is vital that the emission reductions projected for the light-, medium-, and heavy-duty vehicle programs be achieved. The proposed amendments are necessary to accomplish this goal by achieving these emission benefits in two distinct ways: First, to avoid customer dissatisfaction that may be caused by frequent illumination of the MIL because of emission-related malfunctions, it is anticipated that the manufacturers will produce increasingly durable, more robust emission-related components; Second, by alerting vehicle operators of emission-related malfunctions and providing precise information to the service industry for identifying and repairing detected malfunctions, emission systems will be quickly repaired. The benefits of the regulations become increasingly important as certification levels become more and more stringent and as a single malfunction has an increasingly greater impact relative to certification levels.

Overall, the proposed amendments to the HD OBD and OBD II regulations would result in cleaner vehicles than those currently produced and are not expected to impact previously calculated emission benefits or findings. During the 2009 HD OBD regulatory process, the lifetime cumulative emission reductions for HD OBD, on a per engine basis calculated with the most recent version of EMFAC, were calculated to be 165 pounds of ROG, 2000 pounds of NOx, and 14 pounds of PM. For OBD II, during the 2002 OBD II regulatory update, staff calculated a combined benefit for OBD II and LEV II of 57 tons per day of ROG + NOx in the South Coast Air Basin alone. These benefit calculations have not changed.

IV. ENVIRONMENTAL JUSTICE

State law defines environmental justice as the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies (Senate Bill 115, Solis; Stats 1999, Ch. 690; Government Code § 65040.12(c)). The Board has established a framework for incorporating environmental justice into the ARB's programs consistent with the directives of State law. The policies developed apply to all communities in California, but recognize that environmental justice issues have been raised more in the context of low income and minority communities, which sometimes experience higher exposures to some pollutants as a result of the cumulative impacts of air pollution from multiple mobile, commercial, industrial, area-wide, and other sources.

Over the past twenty years, ARB, local air districts, and federal air pollution control programs have made substantial progress towards improving the air quality in California. However, some communities continue to experience higher exposures than others as a result of the cumulative impacts of air pollution from multiple mobile and stationary sources and thus may suffer a disproportionate level of adverse health effects.

Adoption and implementation of the OBD regulations will not result in any adverse environmental impacts on environmental justice communities. The proposed amendments would help ensure that measurable emission benefits are achieved both statewide and in the South Coast and San Joaquin Valley air basins

V. ECONOMIC IMPACT

The proposed amendments to the HD OBD and OBD II requirements and enforcement regulations would apply to manufacturers of California-certified medium-duty and heavy-duty engines and manufacturers of medium and heavy-duty vehicles using the aforementioned engines. There are approximately 11 companies worldwide that manufacture diesel or gasoline California-certified heavy-duty engines, an estimated 10 heavy-duty hybrid system manufacturers, and 9 heavy-duty alternate-fuel conversion manufacturers. Of these, only one manufacturer, an alternate fuel conversion manufacturer, is located in California.

The proposed amendments to the HD OBD and OBD II regulations are not anticipated to have a significant impact on businesses or individuals related to the diesel and gasoline engine manufacturing industry. The proposed amendments primarily affect computer software, and additional lead time would be provided to manufacturers to allow them to implement such changes at the time they normally schedule system updates. The new reporting requirements will result in some additional costs to manufacturers, and the proposed amendments to require manufacturers to implement full OBD on alternate-fueled engines two years earlier than previously required will impose staffing and equipment costs two years earlier than previously anticipated, but will concomitantly provide emission benefits earlier than anticipated. These additional and earlier imposed costs will be passed on nationwide to consumers of heavy-duty vehicles since manufacturers normally certify one version of an engine for the entire nation. Additionally, staff believes that the proposed requirements would cause no noticeable adverse impact in California employment, business status, and competitiveness since all companies that manufacturer medium- and heavy-duty engines are required to meet the same requirements whether they are located in California or elsewhere.

A. LEGAL REQUIREMENTS

Section 11346.3 of the Government Code requires State agencies to assess the potential for adverse economic impacts on California business enterprises and individuals when proposing to adopt or amend any administrative regulation. Section 43101 of the Health and Safety Code similarly requires that the Board consider the impact of adopted standards on the California economy. This assessment shall include a consideration of the impact of the proposed regulation on California jobs, business expansion, elimination, or creation, and the ability of California business to compete.

B. COST AND COST EFFECTIVENESS

The revisions to the OBD II and HD OBD regulations consist primarily of interim relaxation and clarification of existing requirements. The only changes that are expected to affect costs involve the increased reporting requirements for the misfire monitor and the two year earlier implementation schedule of full OBD for alternate-fueled engines. To assess the impact these proposed changes will have on costs, ARB staff has performed a comprehensive cost analysis of the proposed amendments. Since the modifications to the two regulations are similar, and primarily affect diesel and alternate-fueled vehicles, staff concentrated its cost analysis on the HD OBD amendments since this provides the worst-case cost to manufacturers and consumers. This is because over 90 percent of all new vehicles in the heavy-duty sector consist of diesel and alternate-fueled engines while the light-duty and medium-duty sector consists primarily of gasoline-powered vehicles. The analysis was done to estimate the long-term "learned-out" costs of the program to a heavy-duty engine purchaser for a "typical" engine. The analysis estimated the incremental costs of implementing the proposed amendments.

First, staff estimated the costs to manufacturers of heavy-duty diesel engines. These engines make up over 90 percent of all new heavy-duty engines and are manufactured only by large manufacturers. The amendments mainly provide short-term interim relaxed compliance for these manufacturers, with no associated compliance costs. However, there are additional costs associated with the reporting requirements that ensure compliance with the amendments for more comprehensive diesel misfire monitoring that begins with the 2016 model year. This will result in costs of up to $30,000 per manufacturer (for a large manufacturer) annually when the reporting requirements are fully phased in. These costs are expected to be passed on to consumers (new heavy-duty engine/vehicle purchasers) at an incremental retail cost of less than $0.56 per vehicle. For reference, this represents a less than 0.01 percent increase in the retail price of a typical heavy-duty engine. To perform the analysis, staff took the national sales numbers for the top nine engine manufacturers and determined a composite average value of 72,440 engines. This number was rounded to 72,000 in the analysis. Staff then estimated the incremental costs for an engine manufacturer with sales of 72,000 engines. Staff further assumed the engine manufacturer would have three engine families that would require separate misfire monitoring data to be generated and calculated the total costs for such a manufacturer.

Second, staff estimated the costs to manufacturers of alternate-fueled engines. These engines currently make up approximately 2 percent of all new medium and heavy-duty engines but the percentage could increase in the future due to various monetary incentives that could be offered by state and federal organizations, greenhouse gas regulations, and by increased market demand. These engines are usually converted from diesel or gasoline to run on alternate-fuels such as CNG or LPG. As a result, these engines will already have an existing OBD system before being converted. It is projected that manufacturers will only need to recalibrate some of the existing monitors on these engines, and may, in some cases, need to develop a few new monitors for alternate fuel specific components that are added. Manufacturers of these vehicles range from small businesses (less than 250 employees) to large manufacturers. For the analysis, it was assumed that a typical alternate-fueled engine manufacturer will have one engine family with a large manufacturer producing about 5000 alternate-fueled engines per year nationwide and a small manufacturer producing approximately 500 engines per year nationwide. Additionally, it was assumed that a large alternate-fueled manufacturer also produces diesel engines as its primary product.

Since the amendments will require these manufacturers to comply with the alternate-fuel requirements two years earlier than previously required, the majority of costs were already accounted for in the initial 2005 HD OBD rulemaking. The only additional costs would be those costs incurred during these first two years that would not otherwise have been incurred under the original requirements. Specifically, this would cover the hiring of additional staff or equipment needed for earlier compliance and possible two years of annual monitor recalibration. Also, since the alternate-fueled engines will have OBD systems on them two years earlier, buyers of such engines in these two years will see an incremental price increase that otherwise would not have occurred until later. From staff's analysis, the incremental retail cost to buyers of these engines/vehicles for these two years has been estimated to range from $21 per vehicle to $207 per vehicle, depending on the size of the manufacturer (larger manufacturers can spread out the cost across more engines than smaller manufacturers). These costs represent less than a 1.0 percent increase in the retail cost of the smallest vehicles and far less than a 0.1 percent increase for larger vehicles. Generally, large manufacturers and small businesses that convert alternate-fueled engines have not been direct competitors. Large manufacturers have mainly offered alternate-fueled engines for larger work vehicles such as line-haul trucks and buses while small businesses have typically offered alternate fuel conversions for smaller vehicles that perform lighter-duty work such as passenger and cargo vans. The incremental costs for these vehicles are also expected to be offset by financial incentives offered by state and federal governments that have recently ranged from about $7,500 up to $32,000. Future incentives are currently being proposed and may be different from these amounts.

Based on the emission benefit analysis and the additional cost numbers identified above, the cost effectiveness of the OBD regulation was re-calculated to reflect the proposed amendments. For the cost estimation, it was assumed that half of the cost was for PM emission benefit and the other half was for ROG+NOx benefit. Since the amendments applicable to diesel engines only added an incremental cost of $0.56 per engine for diesel engines, newly calculated numbers for cost effectiveness, when rounded to the nearest cent, are identical to the results calculated in the 2009 biennial review. As stated in 2009, the per-engine cost to implement OBD is estimated at $630 per engine. Splitting that in half, $315 was attributed to PM benefit for a cost-effectiveness of $13.13 per pound of PM. The other half of the cost was attributed to ROG+NOx benefit for a cost-effectiveness of $0.08 per pound of ROG+NOx. Both values compare favorably with the cost-effectiveness of other recently adopted regulations.

The amendments applicable to alternate-fueled engines requiring full HD OBD compliance in model year 2018, two years earlier than previously required, would also have a limited impact on cost-effectiveness. While there would be some incremental costs as calculated above that occur from implementing HD OBD two years earlier, there would also be an incremental emission benefit from the OBD system being required earlier. As such, the cost-effectiveness numbers calculated in 2009 for all engines including 2020 and subsequent model year alternate-fueled engines are also appropriate for 2018 and subsequent model year alternate-fueled engines under the proposed amendments. These numbers take into account both the costs to implement and the long-term emission benefits of the program (after the vehicles have been on the road for 20 years). Further, alternate-fueled engines make up a very small fraction of the vehicle fleet so the cost-effectiveness of the program, as a whole, is primarily driven by the cost-effectiveness of diesel engines.

C. AFFECTED BUSINESSES AND POTENTIAL IMPACTS

Any business involved in manufacturing, purchasing, or servicing medium-duty vehicles, and heavy-duty engines and vehicles could be affected by the proposed amendments. Also affected are businesses that supply parts for these vehicles.

With respect to businesses that manufacture engines, there are approximately 11 companies worldwide that manufacture diesel or gasoline California-certified heavy-duty engines. There are also an estimated 10 hybrid system manufacturers and 9 alternate-fuel conversion manufacturers. Only one of these companies, an alternate-fuel conversion manufacturer, is located in California. Staff believes that some of the alternate-fuel conversion manufacturers are "small businesses" but cannot determine the exact number. However, the cost related to these manufacturers is determined to be negligible because these manufacturers are expected to pass the added costs on to consumers (engine and vehicle purchasers) in the form of increased retail prices.

With respect to businesses that purchase medium- or heavy-duty diesel engines, the amendments are not expected to have any material impact as the incremental per engine price increase of $0.56 is insignificant on engines/vehicles that range in price from $20,000 to over $100,000. For businesses that purchase 2018 or 2019 model year heavy-duty alternate-fueled engines, the effect has also been determined to be negligible because the incremental per engine increase in price is less than 0.1 to 1.0 percent and is expected to be more than offset by various financial incentives that exist for purchasing alternate-fueled vehicles.

California accounts for only a small share of total nationwide medium-duty and heavy-duty motor vehicle and parts manufacturing. As stated, only one alternate-fuel conversion company is located in California.

D. POTENTIAL IMPACTS ON VEHICLE OPERATORS

For heavy-duty engines and vehicles, the proposed amendments would provide OBD information and encourage manufacturers to build more durable engines, which would result in the need for fewer repairs and savings for vehicle owners. OBD systems are designed to detect malfunctions that may otherwise go undetected (and unrepaired) by the vehicle owner. A single additional repair was estimated to occur on approximately two-thirds of the trucks over a 21 year lifetime as a result of OBD detection, at an average cost of $741 per repair. This is a conservative cost estimate, since OBD systems will potentially result in savings by catching problems early before they adversely affect other components and systems in the engine. The proposed amendments are anticipated to have a negligible impact on new diesel engine or vehicle prices, since the calculated increase in retail price of an engine is estimated to be $0.56 per engine. The two-year earlier implementation of full OBD on alternate-fueled engines is expected to increase the retail cost of the engine and vehicle for the two year time period by $21 to $207 but these costs are expected to be offset by various financial incentives offered by state and federal agencies that have ranged from $7,500 to $32,000 per vehicle in past years.

For medium-duty vehicles, the proposed amendments would provide improved OBD II information and encourage manufacturers to build more durable vehicles, which should result in the need for fewer vehicle repairs and savings for consumers. The proposed changes involve minimal development and verification of software above what is already incorporated into OBD II systems. Additionally, because manufacturers would be provided sufficient lead time to incorporate the minimal proposed changes, incorporation and verification of the revised OBD II software would be accomplished during the regular design process at virtually no additional cost. Any additional engineering resources needed to comply with the proposed program would be small, and when spread over several years of vehicle production, these costs would be negligible. Thus, the proposed amendments are anticipated to have a negligible impact on manufacturer costs and new vehicle prices.

E. POTENTIAL IMPACTS ON BUSINESS COMPETITIVENESS

The proposed amendments are not expected to adversely impact the ability of California businesses to compete with businesses in other states as the proposed standards are anticipated to have no material impact on retail prices of new engines and vehicles. Additionally, U.S. EPA has adopted federal OBD II and HD OBD requirements that are generally harmonized with those of ARB. To date, virtually all engine and vehicle manufacturers have chosen to design a single OBD system that meets both ARB and U.S. EPA regulations and equipped all vehicles nationwide with the same system. Therefore, any costs incurred by the engine or vehicle manufacturers will be applicable to all engines/vehicles nationwide and these costs will be passed on to purchasers nationwide in the form of higher retail prices as explained above. Thus, any price increases of medium- and heavy-duty vehicles are not expected to dampen the demand for these vehicles in California relative to other states, since price increases would be the same nationwide.

It should be noted that one area of difference between the Federal and California requirements involves heavy-duty hybrids. Specifically, the U.S. EPA has exempted hybrids from OBD compliance for the 2014 through 2016 model years while ARB will require compliance. In theory, this could lead to some heavy-duty hybrid vehicles being more expensive in California than in other states during these three years. However, staff's assessment is that this is not likely to happen for two reasons. First, the heavy-duty hybrid vehicle sales volume is extremely low, which would make it virtually impractical for manufacturers to have sufficient resources to offer two different OBD systems (one that complies for the California market and one that does not comply with California hybrid monitoring requirements that would be available for sale in other states). Past history would suggest that these manufacturers will design and build one system nationwide and as such, the cost to purchasers would be the same nationwide. Second, the ARB's HVIP program already incentivizes (and largely subsidizes) the purchase of a heavy-duty hybrid vehicle for businesses in California and those incentives (typically $20,000 to $40,000 per vehicle) dwarf any increase in cost due to OBD compliance. Thus, even if there were to be an increase specific to hybrids offered for sale in California, the incentives would more than offset them for any purchaser in California.

F. POTENTIAL IMPACTS ON EMPLOYMENT

The proposed amendments are not expected to cause a noticeable change in California employment because California accounts for only a small share of motor vehicle, heavy-duty engine, and parts manufacturing employment, and the minimal additional work done by heavy-duty vehicle manufacturers can be done with existing staff.

G. POTENTIAL IMPACT ON BUSINESS CREATION, ELIMINATION, OR EXPANSION

The proposed amendments are not expected to affect business creation, elimination or expansion.

VI. ANALYSIS OF ALTERNATIVES

As described in the individual sections above detailing the proposed changes, manufacturers suggested alternatives to the proposed amendments, and staff explained why these alternatives were not considered. No alternative considered by the agency would be more effective in carrying out the purpose for which the regulation is proposed or would be as effective or less burdensome to affected private persons than the proposed regulation.

VII. SUMMARY AND RATIONALE FOR PROPOSED AMENDMENTS

In response to manufacturers' concerns about difficulties meeting the requirements within the required timeframes, the proposed amendments mostly include relaxations that would provide manufacturers with more lead time. Manufacturers are expected to take advantage of these delays to improve their system strategies and develop robust monitors to meet the requirements and ensure more robust systems. The proposed amendments also include more stringent requirements that will encourage manufacturers to design and build more robust engines to comply with the requirements. In general, the proposed amendments to the HD OBD and OBD II regulations would help ensure that forecasted emission reduction benefits from adopted medium-duty and heavy-duty engine emission standards programs are achieved.

Proposed amendments to Cal. Code Regs., title 13, section 1971.1:

Subsection (a) The "Purpose" clause of the regulation has been amended to reaffirm and clarify the objectives of the regulation consistent with the longstanding expressed intent when the regulation was first adopted and subsequently amended.

Subsection (c) "Alternate-fueled engine" This new proposed definition is needed to clear up confusion about what constitutes an alternate-fueled engine and thus is exempt from meeting the HD OBD monitoring requirements until the 2018 model year, with the clarification mostly involving engines that utilize more than one type of fuel.

Subsection (c) "Alternate phase-in" This new proposed definition is needed to allow manufacturers some flexibility and allow more time in meeting some requirements with phase-in schedules.

Subsection (c) "Auxiliary Emission Control Device (AECD)" The proposed change to move this definition before the definition of "base fuel schedule" is needed since the definitions in subsection (c) are typically listed in alphabetical order.

Subsection (c) "Calculated load value" The proposed changes to the definition of "calculated load value" is necessary to update the versions of the SAE J1979 and SAE J1939 documents referenced to the most recent versions referenced in section 1971.1(h)(1) of the regulation.

Subsection (c) "Diagnostic or emission critical" The proposed changes to the definition of a "diagnostic or emission critical" electronic control unit is necessary to limit the number of control units that would be subject to report the CAL ID/CVN parameters to the most important control units.

Subsection (c) "Driving cycle" The proposed change to this definition is needed for formatting reasons.

Subsection (c) "Emission standard" The addition of this definition is needed to clarify that the OBD regulations include emission standards. The definition revises the definition set forth at Health and Safety Code section 39028 consistent with the express authorization of the Board to make such a revision in Health and Safety Code sections 39010 and 39601.

Subsection (c) "Evaporative emission standards" The new proposed definition is needed to identify a subcategory of the new definition of emission standard that had previously been identified merely as an emission standard.

Subsection (c) "Exhaust emission standards" or "tailpipe emission standards" The new proposed definition is needed to identify a subcategory of the new definition of emission standard that had previously been identified merely as an emission standard.

Subsection (c) "Fueled engine operation" This new proposed definition is needed to complement the amendments to the in-use monitor performance requirements, where this definition is used.

Subsection (c) "Gasoline engine" This proposed change to delete "or an alternate-fueled engine" from this definition is needed because a separate new definition for "alternate-fueled engine" is being proposed.

Subsection (c) "Hybrid vehicle" This new proposed definition is needed to complement the amendments to the permanent fault code erasure requirements and the in-use monitor performance requirements, where this definition is used.

Subsection (c) "Ignition cycle" The proposed changes to the definition are necessary to account for the proposed changes to the ignition cycle counter requirements for hybrid vehicles in section 1971.1(d)(5.5).

Subsection (c) "Malfunction" The proposed addition of "system" to the definition of "malfunction" is needed since the regulation requires detection of a malfunction that can affect either a component or a system.

Subsection (c) "Permanent fault code" The proposed deletion of the phrase "currently commanding the MIL on" is needed to avoid confusion, since a permanent fault code may not be commanding the MIL on in cases where the fault information in the on-board computer has been cleared by a scan tool or a battery disconnect.

Subsection (c) "Propulsion system active" This new proposed definition is needed to complement the amendments to the permanent fault code erasure requirements and the in-use monitor performance requirements, where this definition is used.

Subsection (c) "Small volume manufacturer" This new proposed definition is needed to complement the proposed changes to the exceptions to monitoring requirements provisions in subsection (g)(5.8.2).

Subsection (c) "Warm-up cycle" The proposed addition of the phrase "a driving cycle with" to this definition is necessary to clarify that a warm-up cycle is referring to a driving cycle with specific conditions met. Additionally, the proposed change to allow manufacturers to use an alternate definition for warm-up cycle is needed to account for vehicles that are unable to warm up the engine coolant temperature to the defined temperatures in the current definition even if it has been sufficiently driven.

Subsection (d)(2.1.2) The purpose of this subsection is to indicate how the functional check of the MIL should work. The proposed change to delete "20" is necessary since the original phrase "minimum of 15-20 seconds" already indicates 15 seconds as the minimum required time.

Subsection (d)(2.1.3) The purpose of this section is to allow manufacturers the option to use the MIL for readiness status indication. The proposed change is needed for formatting reasons, with the old text in subsection (h)(4.1.3) now in subsection (h)(4.1.6).

Subsections (d)(2.2.1)(D) The purpose of this subsection is to indicate the criteria under which freeze frame conditions can be stored and erased for engines using ISO 15765-4. The proposed changes are needed to address concerns about manufacturers inappropriately erasing freeze frame data when a pending fault code matures to a confirmed fault code. Also, the proposed changes to require monitors using alternate strategies to store and erase the freeze frame conditions concurrent with storing and erasing a confirmed fault code are needed since the current language is vague about how to handle one-trip monitors which don't store pending fault codes.

Subsection (d)(2.2.2)(D) The purpose of this subsection is to indicate the criteria under which freeze frame conditions can be stored and erased for engines using SAE J1939. The proposed changes to require monitors using alternate strategies to store and erase the freeze frame conditions with the MIL-on fault code are needed since the current language is vague about how to handle one-trip monitors, which don't store pending fault codes.

Subsection (d)(2.3.1)(A) The purpose of this subsection is to indicate the protocol for extinguishing the MIL for engines using ISO 15765-4. The proposed changes are needed to include reference to diesel monitors that have their own protocol for extinguishing the MIL in lieu of the requirements in this subsection, since the current language only referenced gasoline monitors. The proposed changes are also needed to clarify that the MIL is not allowed to be extinguished after less than three sequential driving cycles, since the original language may be misinterpreted.

Subsections (d)(2.3.1)(B) and (d)(2.3.2)(C) The purpose of these subsections is to indicate the protocol for erasing confirmed fault codes or previously MIL-on fault codes. The proposed changes to require rather than allow manufacturers to erase these fault codes after 40 warm-up cycles are necessary to ensure consistency among manufacturers and require all of them to erase the fault codes in the same timing. The proposed change to delete "engine" from "engine warm-up cycle" is also necessary to be consistent with the terminology used in the definitions in section (c), which states "warm-up cycle."

Subsections (d)(2.3.1)(C)(ii)b.3. and (d)(2.3.2)(D)(ii)b.3 The purpose of these subsections is to indicate the criteria under which a permanent fault code can be erased when the fault information in the on-board computer has been cleared and the OBD system is not commanding the malfunction indicator light on. The proposed changes to subsections (d)(2.3.1)(C)(ii)b.3.i. and (d)(2.3.2)(D)(ii)b.3.i. and the proposed additions of subsections (d)(2.3.1)(C)(ii)b.3.v. and (d)(2.3.2)(D)(ii)b.3.v. are needed to account for hybrid vehicles, which may not start the engine right after the vehicle is turned on and may affect the "cumulative time since engine start" criterion.

Subsection (d)(2.3.2)(A) The purpose of this subsection is to indicate the protocol for extinguishing the MIL for engines using SAE J1939. The proposed changes are needed to clarify that the MIL is not allowed to be extinguished after less than three sequential driving cycles, since the original language may be misinterpreted.

Subsection (d)(2.4.1) The purpose of this subsection is to describe default strategies that manufacturers are allowed to have and not be required to illuminate the MIL when they are invoked. The proposed changes are needed for readability to make the language and criteria easier to understand.

Subsection (d)(4.3.2)(B) The purpose of this subsection is to describe the specifications for incrementing the denominator. The proposed clarification that the requirements in subsections (d)(4.3.2)(F), (I), and (J) may supersede the requirements in subsection (d)(4.3.2)(B) for specific monitors/vehicles is needed since they have certain characteristics that make the current requirements in subsection (d)(4.3.2)(B) inappropriate to use. The proposed change to add "engine" to "start" to subsection (d)(4.3.2)(B)(i) is also necessary to be consistent with the terminology used in the definitions in section (c), which states "engine start".

Subsection (d)(4.3.2)(C) The purpose of this subsection is to describe the specifications for incrementing the denominator for evaporative system monitors. The proposed change is needed to allow other monitors (i.e., engine cooling system input component monitors, comprehensive component input component temperature sensor rationality monitors) that also require a cold start to enable monitoring to use the same denominator. Further, the proposed change to add "engine" to "start" in subsection (d)(4.3.2)(C)(i) is necessary to be consistent with the terminology used in the definitions in section (c), which states "engine start".

Subsection (d)(4.3.2)(E) The purpose of this subsection is to describe the specifications for incrementing the denominator for components that are "commanded" to function. The proposed change to delete "output" from "output components" is needed since some of the component monitors listed under this section are not output components. The proposed additions of the PM filter active/intrusive injection monitor and the PM sensor heater monitor to this section are needed since the previously required denominator incrementing criteria applied to these monitors were not appropriate. Additionally, the proposed change to allow 2010 through 2015 model year engines to use the previously required denominator criteria is needed to allow lead time for manufacturers to meet the new requirement.

Subsection (d)(4.3.2)(F) The purpose of this subsection is to describe the specifications for incrementing the denominator for monitors that require "alternate" criteria. The proposed change to modify the phrase "monitors of the following components" to "the following component monitors" is needed since the items listed in this section refer to monitors, not components. The proposed deletions of "engine cooling system input component" and "comprehensive component input component temperature sensor rationality monitors" and renumbering of the section are needed since these monitors were moved to subsection (d)(4.3.2)(C). The proposed change to add "PM sensor monitoring capability monitor" to this subsection is needed to reflect the current capability of the PM sensor technology, which may regenerate infrequently in-use and thus may result in low ratios for this monitor with the currently required denominator.

Subsection (d)(4.3.2)(G) The purpose of this subsection is to describe the specifications for incrementing the denominator for components or emission controls that experience infrequent regeneration events. The proposed change to modify the phrase "monitors of the following components" to "the following component monitors" is needed since the items listed in this section refer to monitors, not components. The proposed change to limit application of this requirement to the 2010 through 2015 model year for the PM filter filtering performance monitors and the PM filter missing substrate monitors to is needed considering the importance of the PM filter, which controls emissions throughout the driving cycle, not just once every 800 minutes.

Subsection (d)(4.3.2)(H) The purpose of this subsection is to describe the specifications for incrementing the denominator for some monitors based on whether or not a regeneration event occurs. The proposed deletion of "PM filter active/intrusive injection" is needed since this monitor was moved to subsection (d)(4.3.2)(E).

Subsection (d)(4.3.2)(I) The purpose of this subsection is to allow certain vehicles to increment the general denominator based on alternate criteria in lieu of those in subsection (d)(4.3.2)(B). The proposed deletion of the phrase "hybrid vehicles" is necessary since a new proposed requirement for hybrid vehicles has been added (subsection (d)(4.3.2)(J)) that will supersede this requirement. The proposed replacement of the phrase "integrated starter and generators" with the phrase "a vehicle with a start-stop system that does not meet the definition of a hybrid vehicle as defined in section (c)" is needed since the requirement in subsection (d)(4.3.2)(I) no longer applies to hybrid vehicles (a separate section was created specifically for hybrids) and vehicles with integrated starters and generators most commonly will meet the definition of a hybrid vehicle while vehicles with other simpler start-stop systems will not and will still be subject to the requirements of this section. The proposed change of "alternate fuel vehicles" to "alternate-fueled engines" is needed to be consistent with the phrase used in the definitions in subsection (c). The proposed deletion of "(e.g., dedicated, bi-fuel, or dual-fuel applications)" is needed since the phrase "alternate-fueled engine" is now defined in section (c), so the examples here are not needed anymore.

Subsection (d)(4.3.2)(J) The purpose of this new proposed subsection is to indicate the criteria under which the general denominator shall increment for hybrid vehicles. This new requirement is needed to account for the fact that hybrid vehicles need a new definition to recognize trips where the engine starts later in the trip. Additionally, the proposed language to allow 2010 through 2015 model year engines to use the previously required denominator criteria in subsection (d)(4.3.2)(I) is needed to allow lead time for manufacturers to meet the new requirement.

Subsection (d)(4.5.3) The purpose of this subsection is to describe the conditions under which incrementing of all numerators and denominators are allowed to be disabled. The proposed deletions of reference to subsection (d)(4.3.2)(C) and the phrase "engine cold start" are needed since subsection (d)(4.3.2)(C) refers to the denominator incrementing criteria for monitors that require cold start (e.g., evaporative system monitors), so all other monitors that do not require a cold start can and should still accurately increment their numerators and denominators even if an "engine cold start" can no longer be determined.

Subsection (d)(5.1.1) The purpose of this subsection is to indicate the specific diesel components/monitors the HD OBD system is required to report in-use monitor performance data for. The proposed changes to this subsection are needed to be consistent with what is required to be reported in SAE 1979 and SAE J1939.

Subsection (d)(5.5.2)(B) The purpose of this subsection is to indicate the criteria under which the ignition cycle counter shall increment. The proposed changes are needed to ensure that the counters for conventional vehicles and hybrid vehicles are incremented in an equivalent manner.

Subsection (d)(7.5) The purpose of this subsection is to indicate the HD OBD implementation schedule for alternate-fueled engines. The proposed change of the start date to implement HD OBD systems from 2020 to 2018 is needed to address the issue that alternate-fueled engines will comprise a higher percentage of the heavy-duty market than previously thought, thus increasing the importance of making sure the emission controls on these engines are properly working in-use. The proposed additional language in subsection (d)(7.5.3) requiring manufacturers to propose a monitoring plan for alternate-fueled engines is needed to ensure that all emission control components (which may include both diesel-related and gasoline-related components) on the engine are properly monitored.

Subsection (d)(7.6) This new proposed subsection allowing 2013 model year heavy-duty hybrid vehicles to meet less stringent requirements in lieu of the requirements in section 1971.1 is needed to address manufacturers' concerns about implementing compliant HD OBD systems and to allow some interim relaxation from meeting the HD OBD requirements.

Subsection (e)(1.1) The purpose of this subsection is to indicate the general requirement for diesel fuel system monitoring. The proposed change of "emission standard" to "applicable standard" is needed since "applicable standard" is the more appropriate term to use.

Subsection (e)(1.4.2) The purpose of this subsection is to describe the MIL illumination and fault code storage protocol for diesel fuel system monitoring. The proposed change of "vehicle" to "engine" is needed since the reference to "engine" is more appropriate.

Subsection (e)(2.1.1) The purpose of this subsection is to indicate the general requirement for diesel misfire monitoring. The proposed deletion of "causing excess emissions" from "misfire causing excess emissions" is needed since the proposed changes to the diesel misfire monitoring now involve requiring detection of faults when the percentage of misfire exceeds a certain level, not when a specific emission threshold is exceeded.

Subsection (e)(2.2) The purpose of this subsection is to require manufacturers to monitor for misfire on diesel engines. The proposed change to require all diesel engines to meet subsection (e)(2.2.2) with a phase-in starting in the 2016 model year is needed since the current requirement to monitor for misfire only at idle will not detect misfire faults that occur only during other engine speed and load conditions. The proposed change to require misfire detection when the percentage of misfire exceeds 5 percent instead of when specific emission thresholds are exceeded in subsection (e)(2.2.2) is needed to address manufacturers' concerns about difficulties in establishing a level of misfire that equates to a specific tailpipe emission threshold. The proposed change to subsection (e)(2.2.3) is needed for formatting reasons, since the malfunction criteria originally in subsection (e)(2.2.2)(A) is now in subsection (e)(2.2.2). The proposed new subsection (e)(2.2.5) to allow manufacturers to detect misfire at a higher percentage than the required 5 percent if specific emission levels are not exceeded is needed to provide relaxation to manufacturers should their system be abnormally robust to an emission increase due to misfire.

Subsection (e)(2.3.1) The purpose of this subsection is to describe the conditions under which diesel misfire monitoring shall occur. The proposed changes are needed to avoid confusion by indicating that the monitoring conditions under this subsection apply to misfires identified in section (e)(2.2.1).

Subsection (e)(2.3.3) The purpose of this subsection is to describe the conditions under which diesel misfire monitoring shall occur. The proposed change to require monitors for misfires identified in section (e)(2.2.2) to meet subsection (e)(2.3.3) is needed for clarity. The proposed changes to the required monitoring conditions in subsection (e)(2.3.3)(A)(i) are needed to address manufacturers' concerns about the extent to which they can monitor for misfire on diesel engines given the wide range of heavy-duty applications that exist up to the 2018 model year, while the proposed requirement to continuously monitor for misfire under all positive torque engine speed and load conditions with a phase-in starting in the 2019 model year in subsection (e)(2.3.3)(A)(ii) are needed to ensure misfires that occur during the higher operating ranges are robustly detected. Lastly, the proposed change in subsection (e)(2.3.3)(B) is needed to allow manufacturers to disable misfire monitoring under conditions in which robust detection of misfires is at issue.

Subsection (e)(2.4.2) The purpose of this subsection is to describe the MIL illumination and fault code storage protocol for the diesel misfire monitor. The proposed change to require monitors for misfires identified in section (e)(2.2.2) to meet subsection (e)(2.4.2) is for clarity. The proposed change to delete "(A)" from "section (e)(2.2.2)(A)" in subsection (e)(2.4.2)(A) is needed for formatting reasons, since the malfunction criteria originally in subsection (e)(2.2.2)(A) is now in subsection (e)(2.2.2).

Subsection (e)(3.2.6) The purpose of this subsection is to require manufacturers to monitor the EGR catalyst. The proposed addition of subsection (e)(3.2.6)(B), which allows manufacturers to be exempt from monitoring the EGR catalyst if a failure of the catalyst does not cause a measurable emission impact, is needed to provide relaxation to manufacturers due to their concerns that a failure of this catalyst does not directly cause an emissions increase.

Subsection (e)(5.2.3)(B) The purpose of this subsection is to require manufacturers to monitor the NMHC converting catalyst for proper feedgas generation. The proposed delay of the required start date to the 2015 model year is needed to allow manufacturers more time to meet the requirement. The proposed language allowing manufacturers to be exempt from this monitoring requirement if certain conditions are met is needed to allow manufacturers relaxation in meeting this requirement based on their concerns.

Subsections (e)(5.2.2)(B), (e)(6.2.1)(A)(i), (e)(6.2.1)(D)(i), (e)(6.2.2)(A)(i) and (iv), (e)(7.2.1)(A) and(B), (e)(8.2.1)(A) and (B), (e)(8.2.1)(D), (e)(8.2.2)(B), (e)(9.2.1)(B)(i), (e)(9.2.2)(A)(i) and (iv), (g)(3.4.3), and (j)(1.1) The proposed change of "emission standard" to "exhaust emission standard" is needed since "exhaust emission standard" is the more appropriate term to use.

Subsection (e)(5.2.3)(D) The proposed changes to this subsection are needed for readability.

Subsection (e)(6.2.1) The purpose of this subsection is to require manufacturers to monitor the NOx converting catalyst conversion efficiency. The proposed changes to allow higher interim emission thresholds for 2013 through 2015 model year engines in new proposed subsections (e)(6.2.1)(B) and (C) and to delay the final, stringent emission thresholds to 2016 in subsection (e)(6.2.1)(D) are needed to address manufacturers' concerns about meeting the requirements and to allow manufacturers more time to meet the final thresholds. The new proposed subsection (e)(6.2.1)(E), which allows engines first certified in the 2014 or 2015 model year and carried over to the 2016 model year to meet the previous interim thresholds in 2016, is needed so that manufacturers would not have to spend resources to have all engines meet the final thresholds in 2016.

Subsection (e)(6.2.2) The purpose of this subsection is to require manufacturers to monitor the SCR catalyst reductant delivery performance. The proposed changes to allow higher interim emission thresholds for 2013 through 2015 model year engines in new proposed subsections (e)(6.2.2)(A)(ii) through (iii) and to delay the final, stringent emission thresholds to 2016 in subsection (e)(6.2.2)(A)(iv) are needed to address manufacturers' concerns about meeting the requirements and to allow manufacturers more time to meet the final thresholds. The new proposed subsection (e)(6.2.2)(A)(v), which allows engines first certified in the 2014 or 2015 model year and carried over to the 2016 model year to meet the previous interim thresholds in 2016, is needed so that manufacturers would not have to spend resources to have all engines meet the final thresholds in 2016.

Subsection (e)(6.2.2)(D) The purpose of this subsection is to require manufacturers to monitor the SCR catalyst feedback control. The proposed addition of "(e.g., pressure control)" is needed to give an example of a feedback control strategy that is required to be monitored.

Subsection (e)(6.3) The purpose of this subsection is to describe the conditions under which NOx converting catalyst monitoring shall occur. The proposed addition of section (e)(6.2.2)(A) (for reductant delivery performance monitoring) to subsection (e)(6.3.1), which requires monitoring to occur once per trip, is needed since the original requirement for monitoring to occur continuously was found to be inappropriate and too stringent. The proposed deletion of section (e)(6.2.2)(A) (for SCR performance monitoring) from subsection (e)(6.3.2) is needed since this subsection was moved to subsection (e)(6.3.1) as previously described.

Subsection (e)(8.2.1) The purpose of this subsection is to require manufacturers to monitor the PM filter filtering performance. The proposed changes to allow higher interim emission thresholds for 2013 through 2015 model year engines in subsections (e)(8.2.1)(B) and (C) are needed to address manufacturers' concerns about meeting the requirements, given the delay of the availability of PM sensors, and to allow manufacturers more time to meet the final thresholds. The new proposed subsection (e)(8.2.1)(E), which allows engines first certified in the 2014 or 2015 model year and carried over to the 2016 model year to meet the previous interim thresholds in 2016, is needed so that manufacturers would not have to spend resources to have all engines meet the final thresholds in 2016. The new proposed subsection (e)(8.2.1)(F) is needed to prohibit manufacturers from using an alternate phase-in schedule instead of the required phase-in schedule proposed in subsection (e)(8.2.1)(C).

Subsection (e)(8.2.4) The purpose of this subsection is to require manufacturers to monitor the catalyzed PM filter. The proposed delay of the required start date to the 2015 model year in subsection (e)(8.2.4)(A) for monitoring NMHC conversion capability is needed to allow manufacturers more time to meet the requirement. The proposed language in subsection (e)(8.4.2)(A)(iii) allowing manufacturers to be exempt from this monitoring requirement if certain conditions are met is needed to allow manufacturers relaxation in meeting this requirement based on their concerns. The proposed addition of subsection (e)(8.2.4)(B), which requires monitoring of catalyzed PM filter for proper feedgas generation, is needed to ensure monitoring of all components that generate feedgas for the SCR system.

Subsection (e)(8.3.2) The proposed deletion of "II" from "OBD II system" is needed to correct an error, since this regulation does not apply to OBD II systems.

Subsection (e)(9.2.2)(A) The purpose of this subsection is to require manufacturers to monitor the NOx sensor for sensor performance faults. The proposed changes to allow higher interim emission thresholds for 2013 through 2015 model year engines in new proposed subsections (e)(9.2.2)(A)(ii) through (iii) and to delay the final, stringent emission thresholds to 2016 in subsection (e)(9.2.2)(A)(iv) are needed to address manufacturers' concerns about meeting the requirements and to allow manufacturers more time to meet the final thresholds. The new proposed subsection (e)(9.2.2)(A)(v), which allows engines first certified in the 2014 or 2015 model year and carried over to the 2016 model year to meet the previous interim thresholds in 2016, is needed so that manufacturers would not have to spend resources to have all engines meet the final thresholds in 2016. Lastly, the proposed addition of an NMHC threshold in subsection (e)(9.2.2)(A)(iv) is necessary to maintain consistency with the thresholds for the heavy-duty NOx converting catalyst monitors as well as the medium-duty NOx sensor monitoring requirements in the OBD II regulation.

Subsection (e)(9.3.1) The purpose of this subsection is to indicate the conditions under which NOx sensor monitoring shall occur. The proposed addition of section (e)(9.2.2)(D), for sensor monitoring capability monitors, to subsection (e)(9.3.1)(A) is needed since this monitor has been determined to be important based on reviews of manufacturers' OBD systems, so there should be assurance that the in-use monitoring performance data of this monitor is tracked and reported starting in the 2016 model year. The proposed deletion of section (e)(9.2.2)(D) from subsection (e)(9.3.1)(B) is needed since this subsection was moved to subsection (e)(9.3.1)(A) as previously described. The proposed change to delete the requirement for monitoring to occur "every time the monitoring conditions are met during the driving cycle in lieu of once per driving cycle" in subsection (e)(9.3.1)(B) is needed since staff does not see a need for this, and because some monitors currently required to meet this requirement would not be able to meet this if they were intrusive monitors.

Subsection (e)(9.4) The purpose of this subsection is to describe the MIL illumination and fault code storage requirements for exhaust gas sensors. The proposed addition of language to separately detect and store different fault codes for circuit and out-of-range faults is needed for emphasis since some manufacturers have been inappropriately storing the same fault code for different circuit and out-of-range faults, even though section (h)(4.4) currently requires manufacturers to pinpoint the likely cause of a malfunction.

Subsection (e)(11.1) The purpose of this subsection is to require manufacturers to monitor the cold start emission reduction strategy on diesel engines. The proposed changes to subsection (e)(11.1.1) are needed for readability. The new proposed subsection (11.1.2), which would require manufacturers to use different diagnostics to distinguish component/element faults that occur while the cold start strategy is active from faults that occur while the strategy is not active (e.g., warmed-up conditions), is needed to avoid confusion and prevent manufacturers from using only one fault code/monitor to detect both types of faults – this new subsection would prevent premature erase of pending fault codes.

Subsection (f)(1.1) The purpose of this subsection is to indicate the general requirement for gasoline fuel system monitoring. The proposed change of "emission standard" to "applicable standard" is needed since "applicable standard" is the more appropriate term to use.

Subsection (f)(1.2.1) The purpose of this subsection is to describe the malfunction criteria for gasoline fuel system monitoring. The proposed changes of "vehicle" to "engine" in subsections (f)(1.2.1)(B) and (C) are needed since the reference to "engine" is more appropriate.

Subsection (f)(2.3.1) The purpose of this subsection is to describe the conditions under which gasoline misfire monitoring shall occur. The proposed clarification that the requirements in subsection (f)(2.3.6) may supersede the requirements in subsection (f)(2.3.1)(A) is needed since subsection (f)(2.3.6) contains criteria for vehicles that utilize engine shutoff strategies like hybrids, which have certain characteristics that make the current requirements in subsection (f)(2.3.1)(A) inappropriate to use.

Subsection (f)(2.3.6) The purpose of this subsection is to indicate the conditions under which misfire monitoring shall occur for vehicles that employ engine shut-off strategies that do not require the vehicle operator to restart the engine to continue driving. The proposed changes to this subsection are needed since the current usage of "engine start" is not applicable for such vehicles, since the definition of "engine start" in subsection (c) does not comprehend engine restarts.

Subsection (f)(4.1) The purpose of this subsection is to require manufacturers to monitor the cold start emission reduction strategy on gasoline engines. The new proposed subsection (f)(4.1.2), which would require manufacturers to use different diagnostics to distinguish component/element faults that occur while the cold start strategy is active from faults that occur while the strategy is not active (e.g., warmed-up conditions), is needed to avoid confusion and prevent manufacturers from using only one fault code/monitor to detect both types of faults – this new subsection would prevent premature erase of pending fault code.

Subsection (f)(5.2.2) The proposed change is needed for formatting reasons, since the original text in subsection (f)(5.2.3) is now in subsection (f)(5.2.4).

Subsection (f)(5.2.3) The purpose of this subsection is to require manufacturers to detect a functional fault of the secondary air system if a fault does not cause emissions to exceed a specific threshold. The proposed changes are needed to clarify that this subsection is related to faults that cause a decrease in air flow.

Subsection (f)(5.2.4) This new proposed subsection, which requires manufacturers to detect a functional fault of the secondary air system if a fault that causes an increase in air flow does not cause emissions to exceed a specific threshold, is needed to completely cover all faults of the secondary air system and be consistent with what is required for other component/system monitors.

Subsection (f)(7.1) The purpose of this subsection is to require manufacturers to monitor the evaporative system. The proposed changes to change "vehicles not required to be equipped with evaporative emission systems" to "vehicles not subject to evaporative emission standards" is needed since ARB regulations technically do not mandate engines to be equipped with evaporative systems but, instead, establish evaporative emission standards and identify which vehicles are subject to the standards. The proposed additional language requiring manufacturers to propose a monitoring plan for alternate-fueled engines is needed since some alternate-fueled engines are subject to the evaporative emission standards, and thus to evaporative system monitoring, but have evaporative systems that are different from gasoline engines, so the current monitoring requirements are not applicable.

Subsection (f)(7.2.5) The purpose of this subsection is to require manufacturers to monitor multiple purge flow paths on a vehicle. The proposed change of "vehicles" to "engines" is needed since the reference to "engines" is more appropriate. The proposed change of "both purge flow paths" to "all purge flow paths" is needed to correct an error, since vehicles can have more than two purge flow paths and should monitor all these purge flow paths.

Subsection (f)(8.4) The purpose of this subsection is to describe the MIL illumination and fault code storage requirements for exhaust gas sensors. The proposed addition of language to separately detect and store different fault codes for circuit and out-of-range faults is needed for emphasis since some manufacturers have been inappropriately storing the same fault code for different circuit and out-of-range faults, even though section (h)(4.4) currently requires manufacturers to pinpoint the likely cause of a malfunction.

Subsection (g)(1.3.1) The purpose of this subsection is to describe the conditions under which thermostat monitoring shall occur. The proposed changes to subsection (g)(1.3.1)(A) is needed for formatting reasons due to the changes mentioned here. The proposed changes to subsection (g)(1.3.1)(D) and proposed additional subsection (g)(1.3.1)(E) are needed to make the requirement easier to understand and clearly indicate under what conditions the thermostat monitor can be disabled. The proposed change of subsection (g)(1.3.1)(E) to (g)(1.3.1)(F) is needed for formatting reasons.

Subsection (g)(3.1.1) The purpose of this subsection is to require manufacturers to monitor comprehensive components. The proposed change to delete "engine" from "electronic engine powertrain component/system" is needed since the monitoring requirements under this subsection are not limited to component/systems on the engine.

Subsection (g)(3.1.3) The purpose of this subsection is to require manufacturers to require manufacturers to monitor electronic powertrain input or output components/systems associated with systems/components that are driven by the engine and not related to control of fueling or emissions only if the component/system is used as part of the diagnostic strategy of a monitored component/system. The proposed addition of "transmission" is needed to make clear that transmission components/systems are required to meet this subsection.

Subsections (g)(3.1.4) and (g)(3.1.5) The proposed change of "hybrids" to "hybrid vehicles" is needed to be consistent with the terminology used in the definitions in section (c). The proposed change to allow the requirements of subsection (g)(3.1.5) to be superseded by section (d)(7.6) is needed to account for the new proposed subsection (d)(7.6), which allows manufacturers to be exempt from meeting the requirements of section 1971.1 in the 2013 model year.

Subsection (g)(3.2.2)(B)(ii)d. The purpose of this subsection is to require manufacturers to monitor the diesel idle control system. The proposed change to require detection of faults if the fuel injection quantity is not within a certain range necessary to achieve the target idle speed for the "known", not "given", operating conditions is needed to address manufacturers concerns about the inability to know all the "given" operating conditions to determine the appropriate fuel quantity.

Subsection (g)(3.2.2)(F) The purpose of this subsection is to require manufacturers to monitor the fuel control system components for proper compensation. The proposed delay of the required start date to the 2015 model year is needed to allow manufacturers more time to meet the requirement. The new proposed subsection (g)(3.2.2)(F)(ii) allowing manufacturers to be exempt from this monitoring requirement if certain conditions are met is needed to allow manufacturers relaxation in meeting this requirement based on their concerns.

Subsection (g)(5.1) The purpose of this subsection is to allow manufacturers to revise the required malfunction criteria if certain conditions are met. The proposed change of the phrase "prevent significant errors of commission in detecting a malfunction" to "prevent false indications of a malfunction" is needed for clarify and to avoid confusion. The proposed amendments to limit the allowance for manufacturers to exclude detection of specific failure modes for PM filter monitoring up to the 2015 model year is needed since this allowance provides an unknown risk for failures that cause high PM emissions to go undetected, which should not be allowed on all future engines nor needed based on new monitoring techniques being developed for future engines.

Subsection (g)(5.7) The purpose of this new proposed subsection is to allow manufacturers to be exempt from monitoring a component if a failure only affects emissions or other diagnostics when the ambient temperature is below 20 degrees Fahrenheit. This proposed allowance is needed to address manufacturers' concerns about expending resources to monitor such components that only affect emissions during extreme conditions.

Subsection (g)(5.8) The purpose of this new proposed subsection is to allow manufacturers to use an alternate phase-in schedule, in accordance with the definition in subsection (c), and allow small volume manufacturers to use a different implementation schedule (as described in new subsection (g)(5.8.2)) in lieu of the required phase-in schedule. This proposal is needed to allow manufacturers more lead time to meet the requirements.

Subsection (g)(5.9) This proposed change of this subsection from (g)(5.7) to (g)(5.9) is needed for formatting reasons.

Subsection (h)(1) The purpose of this subsection is to indicate the SAE and ISO documents incorporated by reference in the regulation. The proposed updates to the SAE and ISO documents are needed to reference the most recent versions of these documents, which include some clarifications and modifications to the standardized requirements for the HD OBD systems.

Subsection (h)(2) The purpose of this subsection is to specify the requirements for the diagnostic connector. The proposed changes are needed to account for the new 500 kbps baud rate variant of SAE J1939 and its associated connector being allowed for communication protocol. The proposed language in subsections (h)(2.6.1) and (h)(2.6.2) prohibiting additional identical connectors from being located in the same area as the standardized OBD connector is needed to avoid confusion among technicians and inspectors attempting to identify the correct connector to retrieve OBD information from.

Subsection (h)(3.2) The purpose of this subsection is to indicate the communication protocol allowed to be used on the engines. The proposed addition of "including diesel engines converted to alternate-fueled engines" is needed so that the requirement in subsection (h)(7), where the language was originally located, can be deleted. The proposed changes indicating the 250 kbps and 500 kbps baud rates are needed to account for the recent addition of the 500 kbps baud rate variant to SAE J1939. The proposed change to prohibit usage of the 250 kbps baud rate variant starting in the 2016 model year is needed to account for the industry trend towards using the 500 kbps baud rate variant and to mitigate potential problems in the field that may result with allowing multiple variants for communication protocol.

Subsection (h)(4.1) The purpose of this subsection is to describe the requirements for the readiness status. The proposed changes to the language are needed for clarity, to make the requirements easier to understand, and avoid confusion among manufacturers by identifying the specific monitors that are required to be included in the readiness status for a specific monitored component/system.

Subsection (h)(4.2.2) The purpose of this subsection is to describe the data stream parameters required to be made available. The proposed change to subsection (h)(4.2.2)(E) is needed to better ensure standardization by clarifying the specific SPNs to be used. The new proposed subsection (h)(4.2.2)(G) is needed to make it easier to conduct valid in-use emission tests with PEMS. The proposed change in subsection (h)(4.2.2)(H) is needed to account for new subsection (h)(4.2.2)(G).

Subsection (h)(4.2.3)(E) This new proposed subsection, which requires engines equipped with reductant quality sensors and NOx sensors to make the reductant quality sensor output and the corrected NOx sensor output available to a scan tool, is needed since more and more manufacturers are using the reductant quality sensor and technicians will need access to both these signals to help diagnose malfunctions.

Subsections (h)(4.4.1)(F) and (h)(4.4.2)(F) The purpose of these subsections is to describe the standardized requirements for permanent fault codes. The proposed changes to subsections (h)(4.4.1)(F)(iv) and (h)(4.4.2)(F)(iv), which limit the resetting of readiness bits to those modules that report any supported readiness bits except the bit for the comprehensive components when the control module containing the permanent fault code is reprogrammed, are needed to address manufacturers' concerns about the difficulty in resetting the readiness bits in 'all' control modules.

Subsection (h)(4.7) The purpose of this subsection is to describe the standardized requirements for CVN. The proposed deletion of language from subsection (h)(4.7.4) is needed since this language was moved to new proposed subsection (h)(4.7.5). The new proposed subsection (h)(4.7.5) is needed to clarify the requirements for making CVN immediately available through the data link connector and to prevent manufacturers from inappropriately using extended message timing for replies or negative response codes.

Subsection (h)(4.8.3) The purpose of this subsection is to describe the standardized requirements for VIN and ESN. The proposed change to this subsection, which limits the resetting of readiness bits to those modules that report any supported readiness bits except the bit for the comprehensive components when the VIN or ESN is reprogrammed, are needed to address manufacturers' concerns about the difficulty in resetting the readiness bits in 'all' control modules.

Subsection (h)(4.10.2) The purpose of this subsection is to describe the conditions under which all emission-related diagnostic information is required to be erased. The proposed change to this subsection is needed to indicate that the requirements in section (h)(4.4.1)(F)(iv), (h)(4.4.2)(F)(iv), and (h)(4.8.3) supersede the requirements of this subsection.

Subsection (h)(5.2.2) The proposed deletion of this subsection is needed since the specific requirements are already specified in SAE J1979 and J1939.

Subsection (h)(7) The proposed deletion of this subsection is needed since the requirements have been moved to subsection (h)(3.2).

Subsection (i) The purpose of this subsection is to describe the requirements for demonstration testing. The proposed changes throughout the subsection with relation to the term "emission threshold malfunction criteria" and "malfunction limit" are needed to maintain consistency within the section. The proposed deletions of "FTP" from "FTP standard" throughout the subsection are needed to be consistent with the term used throughout subsections (e) and (f).

Subsection (i)(3.1.2) The purpose of this subsection is to describe the demonstration testing requirements for diesel misfire monitoring. The proposed change to exempt manufacturers from testing the diesel misfire monitor is needed since the malfunction criteria for diesel misfire monitoring in subsection (e)(2) is no longer tied to an emission threshold.

Subsection (i)(3.2.1) The purpose of this subsection is to describe the testing requirements for gasoline fuel system monitors. The proposed addition in subsection (i)(3.2.1)(A) and the proposed deletion in subsection (i)(3.2.1)(E) are needed since the language at issue does not apply to all fuel system monitors, such as the air-fuel cylinder imbalance monitor. The new proposed subsection (i)(3.2.1)(C) describing the testing requirements for the air-fuel cylinder imbalance monitor is needed since such language was mistakenly left out.

Subsection (i)(3.2.7) The purpose of this subsection is to describe the testing requirements for gasoline exhaust gas sensor monitors. The proposed changes are needed to allow manufacturers to test only certain response rate malfunctions (e.g., worst case malfunctions) to limit the number of tests performed.

Subsection (i)(3.3.1) The proposed change of "applicable emission standards" to "applicable standards" is needed since "applicable standards" is the more appropriate term to use.

Subsection (i)(3.6) This new proposed subsection is needed to avoid manufacturer confusion by clearly stating that demonstration testing is not required for functional monitors, since they are not tied to an emission threshold.

Subsection (i)(5.1.3) The purpose of this subsection is to describe the procedure that must be taken when the MIL does not illuminate when the malfunction is set at the limits during demonstrating testing. The proposed changes are needed to clarify the testing procedures for catalyst faults and other faults where default actions are taken subsequent to fault detection, since the original language is not clear on this.

Subsection (j)(2.2) The proposed deletion of "July 7, 2009, incorporated by reference" is needed since this phrase was already stated previously in the regulation. The proposed change in subsection (j)(2.2.2)(H) to require diesel engines to use units of "mg/stroke" for all fuel quantity based criteria is needed since "mg/stroke" is already more commonly used and appropriate for diesel engines than the "per crankshaft revolution" units currently required.

Subsection (j)(2.5) The purpose of this subsection is to describe the gasoline misfire monitor information required to be included in the certification application. The proposed changes are needed to indicate that the required data are to be submitted in the standardized formats detailed in ARB Mail-Out #MSC 09-22, which will assist staff during certification review.

Subsection (j)(2.6) The proposed deletion of the requirement to include information related to the heated catalyst system is needed since the original inclusion of this requirement was a mistake, given that the HD OBD regulation does not have monitoring requirements for heated catalyst systems. The new proposed requirement for manufacturers to provide diesel misfire monitor data is needed to support the new diesel misfire monitoring requirements being proposed in subsection (e)(2) and to ensure that the diesel misfire monitor is robust in detecting misfires.

Subsection (j)(2.16) The proposed additional requirement to include information about all other issues that apply to the engine is needed to assist staff in reviewing the application.

Subsection (j)(2.18) Staff is proposing to move the original language in subsection (j)(2.18) to subsection (j)(2.21). The new proposed requirement in subsection (j)(2.18) to include information related to the in-use performance data is needed to assist staff in reviewing the application.

Subsections (j)(2.19) and (j)(2.20) The new proposed requirements to include information related to test results and the required timelines for submitting results for the production engine/vehicle testing are needed to assist staff in reviewing the application.

Subsection (k)(1) The purpose of this subsection is to describe the requirements for certifying with a deficiency. The proposed additional language is needed to make clear that deficiencies will not be granted for issues that would subject to an ordered recall under section 1971.5.

Subsection (k)(6.1) The purpose of this subsection is to describe the criteria and timelines under which a retroactive deficiency can be applied. The proposed change to extend the deadline of "three months after commencement of the start of vehicle production" to "six months after commencement of the start of vehicle production" is needed to align with the proposed deadline in subsection (l)(2.1).

Subsection (k)(7) The purpose of this new proposed subsection is to describe the exceptions to the fine requirements for PM filter and PM sensor-related monitor deficiencies. The proposed change to allow for "free deficiencies" for specific PM filter and PM sensor monitors is needed to account for the fact that PM sensors are a new technology and manufacturers that use them in the early years may have difficulty developing robust monitors to meet the requirements in the current regulation.

Subsection (k)(8) The purpose of this new proposed subsection is to describe the carry-over allowances and the exceptions to the fine requirements for hybrid vehicle deficiencies. The proposed allowances and exceptions are needed to provide relaxation to manufacturers and allow them to certify their hybrid vehicles to the HD OBD requirements in the initial years.

Subsection (k)(9) The purpose of this new proposed subsection is to indicate that OBD systems that fail to meet the requirements of section 1971.1 and have not been granted deficiencies pursuant to subsection (k) are considered non-compliant and subject to enforcement. This language is already implied but its inclusion is necessary to make it clear to manufacturers.

Subsection (l)(1) The purpose of this subsection is to require manufacturers to perform verification testing of the standardized requirements. The proposed change in subsection (l)(1.1) is needed to make clear that the testing is to be done on production engines. The proposed change in (l)(1.4.3)(B) is needed for formatting reasons, since the original requirement in subsection (h)(4.1.3) is now in (h)(4.1.6). The proposed change in subsection (h)(4.1.3)(E) to include MIL command status is needed to ensure the correct information is being made available, and the proposed change to require this information from each diagnostic and emission critical electronic powertrain control unit is needed for better assurance that the OBD system as a whole is working as certified. Finally, the proposed changes to subsection (l)(1.5.1), which would require manufacturers to submit the test results (i.e., the test log file), is needed since this is important data for staff in determining if the system is working correctly.

Subsection (l)(2.1) The purpose of this subsection is to require manufacturers to perform testing to verify the monitoring requirements within a certain timeline. The proposed change to extend the deadline of "three months after the start of vehicle production" to "six months after the start of vehicle production" is needed to allow manufacturers more time to conduct this testing, since they indicated it was difficult to procure the vehicles within the current required timeline.

Subsection (l)(2.3.4) The proposed change of "emission standard" to "emission threshold malfunction criteria (e.g., 2.0 times the standard)" is needed to correct an error.

Subsection (l)(2.3.6) The purpose of this subsection is to allow manufacturers to be exempt from testing specific diagnostics if certain conditions are met. The proposed allowance to exempt testing on monitors where demonstration may jeopardize the safety of the tester is needed to ensure the safety of the individuals conducting the testing.

Subsection (l)(3.4) The purpose of this subsection is to require manufacturers to submit specific information related to their in-use monitor performance testing. The proposed changes are needed to make the required information consistent with what is required in ARB Mail-Out #MSC 09-22.

Proposed amendments to Cal. Code Regs., title 13, section 1968.2:

Subsection (a) The "Purpose" clause of the regulation has been amended to reaffirm and clarify the objectives of the regulation consistent with the longstanding expressed intent when the regulation was first adopted and subsequently amended.

Subsection (c) "Alternate phase-in" The proposed change to the definition is needed since the definition states the percentages described in the phase-in schedules are to be based on the manufacturer's projected sales volume of "all vehicles", while some phase-in schedules described in section (e) and (f) specifically indicate that the percentages are not based on all vehicles (e.g., based on only diesel vehicles).

Subsection (c) "Emission standard" The addition of this definition is needed to clarify that the OBD regulations include emission standards. The definition revises the definition set forth at Health and Safety Code section 39028 consistent with the express authorization of the Board to make such a revision in Health and Safety Code sections 39010 and 39601.

Subsection (c) "Evaporative emission standards" The new proposed definition is needed to identify a subcategory of the new definition of emission standard that had previously been identified merely as an emission standard.

Subsection (c) "Exhaust emission standards" or "tailpipe emission standards" The new proposed definition is needed to identify a subcategory of the new definition of emission standard that had previously been identified merely as an emission standard.

Subsection (d)(3.2.1) The purpose of this subsection is to indicate which monitors are required to meet a minimum in-use performance ratio of 0.100. The proposed change to subsection (d)(3.2.1)(D) of "introductory years" to "interim years" since the new proposed subsection (d)(3.2.1)(D)(vi) does not apply to "introductory years." The new proposed subsection (d)(3.2.1)(D)(vi) requiring a minimum ratio of 0.100 for PM filter monitors on 2015 through 2018 model year medium-duty vehicles is needed to allow interim relaxation for these monitors, which would be required to start using the more frequently incremented general denominator starting in the 2015 model year (as required in subsection (d)(4.3.2)(G)) and thus may result in lower ratios and require the manufacturer to gain some experience before being held to a higher ratio.

Subsection (d)(4.3.2)(F) The purpose of this subsection is to describe the specifications for incrementing the denominator for components that are "commanded" to function. The proposed change to delete "output" from "output components" is needed since some of the component monitors listed under this section are not output components. The proposed addition of the PM filter active/intrusive injection monitor to this section is needed since the previously required denominator incrementing criteria applied to this monitor were not appropriate. Additionally, the proposed changes to allow 2013 through 2015 model year vehicles to use the previously required denominator criteria for the PM filter active/intrusive injection monitor and the PM sensor heater monitor are needed to allow lead time for manufacturers to meet the new requirement.

Subsection (d)(4.3.2)(G) The purpose of this subsection is to describe the specifications for incrementing the denominator for components or emission controls that experience infrequent regeneration events. The proposed change to limit application of this requirement to the 2004 through 2015 model year for the PM filter filtering performance monitors and the PM filter missing substrate monitors to is needed considering the importance of the PM filter, which controls emissions throughout the driving cycle, not just every 500 miles.

Subsection (d)(4.3.2)(I) The purpose of this subsection is to describe the specifications for incrementing the denominator for some monitors based on whether or not a regeneration event occurs. The proposed deletion of "PM filter active/intrusive injection" is needed since this monitor was moved to subsection (d)(4.3.2)(F).

Subsection (e)(6.1.1) The purpose of this subsection is to indicate the general requirement for diesel fuel system monitoring. The proposed change of "emission standard" to "applicable standard" is needed since "applicable standard" is the more appropriate term to use.

Subsection (f)(1.2.3)(B) The purpose of this subsection is to require manufacturers to monitor the NMHC converting catalyst for proper feedgas generation. The proposed language allowing manufacturers to be exempt from this monitoring requirement if certain conditions are met is needed to allow manufacturers relaxation in meeting this requirement based on their concerns.

Subsection (f)(2.2.2)(A)(i) The purpose of this subsection is to require manufacturers to monitor the NOx converting catalyst conversion efficiency. The proposed changes to allow higher interim emission thresholds for 2013 through 2015 model year vehicles in new proposed subsection (f)(2.2.2)(A)(ii)c. and to delay the final, stringent emission thresholds to 2016 in subsection (f)(2.2.2)(A)(ii)d. are needed to address manufacturers' concerns about meeting the requirements and to allow manufacturers more time to meet the final thresholds.

Subsection (f)(3.1.1) The purpose of this subsection is to indicate the general requirement for diesel misfire monitoring. The proposed deletion of "causing excess emissions" from "misfire causing excess emissions" is needed since the proposed changes to the diesel misfire monitoring for medium-duty vehicles now involve detection of faults when the percentage of misfire exceeds a certain level, not when a specific emission threshold is exceeded.

Subsection (f)(3.2.2) The purpose of this subsection is to require manufacturers to monitor for misfire on diesel engines. The proposed change to require all diesel engines to meet subsection (f)(3.2.2) with a phase-in starting in the 2016 model year is needed since the current requirement to monitor for misfire only at idle will not detect misfire faults that occur only during other engine speed and load conditions. The proposed change to require misfire detection when the percentage of misfire exceeds 5 percent instead of when specific emission thresholds are exceeded in subsection (f)(3.2.2)(A)(ii) is needed to address manufacturers' concerns about difficulties in establishing a correlation between a specific misfire level and a tailpipe emission threshold. The proposed change to subsection (f)(3.2.3) is needed for formatting reasons, since the malfunction criteria originally in subsection (f)(3.2.2)(B) is now in subsection (f)(3.2.2). The proposed new subsection (f)(3.2.5) to allow manufacturers to detect misfire at a higher percentage than the required 5 percent if specific emission levels are not exceeded is needed to provide relaxation to manufacturers should their system be abnormally robust to an emission increase due to misfire.

Subsection (f)(3.3.1) The purpose of this subsection is to describe the conditions under which diesel misfire monitoring shall occur. The proposed changes are needed to avoid confusion by indicating that the monitoring conditions under this subsection apply to misfires identified in section (f)(3.2.1).

Subsection (f)(3.3.3) The purpose of this subsection is to describe the conditions under which diesel misfire monitoring shall occur. The proposed change to require monitors for misfires identified in section (f)(3.2.2) to meet subsection (f)(3.3.3) is needed for clarity. The proposed changes to the required monitoring conditions in subsection (f)(3.3.3)(B) are needed to address manufacturers' concerns about the extent to which they can monitor for misfire on diesel engines given the wide range of medium-duty applications that exist up to the 2018 model year, while the proposed requirement to continuously monitor for misfire under all positive torque engine speed and load conditions with a phase-in starting in the 2019 model year in subsection (f)(3.3.3)(B)(ii) is needed to ensure misfires that occur during the higher operating ranges are detected. Lastly, the proposed change in subsection (f)(3.3.3)(C) is needed to allow manufacturers to disable misfire monitoring under conditions in which robust detection of misfires is at issue to prevent misdetections.

Subsection (f)(3.4.2) The proposed change of subsection (f)(3.2.2)(B) to (f)(3.2.2) is needed for formatting reasons.

Subsection (f)(4.1) The purpose of this subsection is to indicate the general requirement for gasoline fuel system monitoring. The proposed change of "emission standard" to "applicable standard" is needed since "applicable standard" is the more appropriate term to use.

Subsection (f)(5.2.2)(A)(ii) The purpose of this subsection is to require manufacturers to monitor the NOx sensor performance. The proposed changes to allow higher interim emission thresholds for 2013 through 2015 model year vehicles in new proposed subsection (f)(5.2.2)(A)(ii)c. and to delay the final, stringent emission thresholds to 2016 in subsection (f)(2.2.2)(A)(ii)d. are needed to address manufacturers' concerns about meeting the requirements and to allow manufacturers more time to meet the final thresholds.

Subsection (f)(5.3.1) The purpose of this subsection is to indicate the conditions under which NOx sensor monitoring shall occur. The proposed addition of section (f)(5.2.2)(D), for sensor monitoring capability monitors, to subsection (f)(5.3.1)(A) is needed since this monitor has been determined to be important based on reviews of manufacturers' OBD systems, so there should be assurance that the in-use monitoring performance data of this monitor is tracked and reported starting in the 2016 model year for medium-duty vehicles. The proposed deletion of section (f)(5.2.2)(D) from subsection (f)(5.3.1)(B) is needed since this subsection was moved to subsection (f)(5.3.1)(A) as previously described.

Subsection (f)(9.2.1) The purpose of this subsection is to require manufacturers to monitor the PM filter filtering performance. The proposed changes to allow exclusion of specific failure modes for 2014 through 2015 model year engines in subsection (f)(9.2.1)(A)(ii)c. and subsection (f)(9.2.1)(A)(iii) are needed to address manufacturers' concerns about meeting the requirements, given the delay of the availability of PM sensors. The new proposed subsection (f)(9.2.1)(A)(iv) is needed to prohibit manufacturers from using an alternate phase-in schedule instead of the required phase-in schedule proposed in subsection (f)(9.2.1)(A)(iii).

Subsection (f)(9.2.4) The purpose of this subsection is to require manufacturers to monitor the catalyzed PM filter. The proposed language allowing manufacturers to be exempt from monitoring the NMHC conversion capability if certain conditions are met is needed to allow manufacturers relaxation in meeting this requirement based on their concerns.

Subsection (f)(15.2.2)(F) The purpose of this subsection is to require manufacturers to monitor the fuel control system components for proper compensation. The new proposed subsection (f)(15.2.2)(F)(ii) allowing manufacturers to be exempt from this monitoring requirement if certain conditions are met is needed to allow manufacturers relaxation in meeting this requirement based on their concerns.

Subsection (f)(17.1) The purpose of this subsection is to allow manufacturers to revise the required malfunction criteria if certain conditions are met. The proposed change of the phrase “prevent significant errors of commission in detecting a malfunction” to “prevent false indications of a malfunction” is needed for clarify and to avoid confusion. The proposed extension of the allowance for manufacturers to exclude detection of specific failure modes for PM filter monitoring is needed to recognize one of the issues with monitoring strategies that do not use a PM sensor and to allow manufacturers to certify the OBD II systems on their medium-duty vehicles up to the 2015 model year.

Subsection (f)(17.1.5) The purpose of this subsection is to describe the monitoring requirements and malfunction criteria for medium-duty diesel vehicles certified to a chassis-dynamometer tailpipe emission standard. The proposed change to limit this subsection to the 2004 through 2015 model years is needed since new requirements for 2016 and subsequent model year vehicles are being proposed in new subsection (f)(17.1.6).

Subsection (f)(17.1.6) The purpose of this new proposed subsection is to describe the monitoring requirements and malfunction criteria for 2016 and subsequent model year medium-duty diesel vehicles certified to a chassis-dynamometer tailpipe emission standard. This subsection is needed to give clear direction to medium-duty manufacturers about what they are required to meet for these vehicles and to eliminate the requirement for manufacturers to individually propose chassis-based thresholds and seek Executive Officer approval.

Subsection (f)(17.2.2) The purpose of this subsection is to allow manufacturers to use an alternate phase-in schedule, in accordance with the definition in subsection (c), in lieu of the required phase-in schedule. The proposed language to meet this language except for what is described for the PM filter monitor in section (f)(9.2.1)(A) is needed since this section specifically prohibits manufacturers from using an alternate phase-in plan for the PM filter monitor.

Subsection (f)(17.2.3) The purpose of this subsection is to allow small volume manufacturers to use a different implementation schedule in lieu of the required phase-in schedule. The proposed additional language is needed to clarify the acceptable phase-in schedule small volume manufacturers can use in lieu of the required phase-in schedule for the diesel PM filter monitor.

Subsection (h)(4.3) The purpose of this subsection is to describe the demonstration testing requirements for diesel misfire monitoring. The proposed change to this subsection is needed to specifically require demonstration testing only for those vehicles with misfire monitors calibrated to an emission malfunction threshold (i.e., those meeting section (f)(3.2.2)(A)(i)).

Subsection (i)(1.1) The purpose of this subsection is to describe the certification documentation requirements. The proposed addition of "exhaust" to "emission standard" is needed since "exhaust emission standard" is the more appropriate term to use.

Subsection (i)(2.5) The purpose of this subsection is to describe the misfire monitor information required to be submitted as part of the certification application. The proposed change to separate the original language into different parts in subsection (i)(2.5.1)(A) through (D) is needed for better readability. The proposed change to subsection (i)(2.5.1)(D) is needed for formatting reasons to account for the change described above. The new proposed subsection (i)(2.5.2) for manufacturers to provide diesel misfire monitor data is needed to support the new diesel misfire monitoring requirements being proposed in subsection (f)(3) and to ensure that the diesel misfire monitor is robust in detecting misfires.

Subsection (j)(2.3.4) The purpose of this subsection is to describe the requirements for verification testing of monitoring requirements. The proposed change of "emission standard" to "malfunction threshold (e.g., 1.5 times the applicable standards)" is needed to correct an error.

Proposed amendments to Cal. Code Regs., title 13, section 1971.5:

Subsection (a)(3) "OBD Emission Testing" The proposed change to add a "d" to "measure" in this definition is needed to correct a grammatical error.

Subsection (b)(3)(C)(i) The purpose of this subsection is to describe the protocol for procuring engines for a test group sample. The proposed deletion in this subsection is needed to correct an error, since the deleted language was mistakenly taken from the OBD II enforcement regulation and not appropriate for the HD OBD enforcement regulation.

Subsection (b)(3)(D)(ii)b. The purpose of this subsection is to describe the criteria for which engines are to be included in a test sample group for OBD ratio testing. The proposed changes to subsection (b)(3)(D)(ii)b.3. are needed to ensure less difficulty in procuring applicable engines, since the engine would have needed to accumulate a very high mileage before the denominators for the diesel PM filter, PM sensor, and NMHC converting catalyst monitors specified were acceptable for inclusion in the test sample group with the original language. The proposed change to subsection (b)(3)(D)(ii)b.4. is needed to make clear what monitors are required to have denominators meeting the value in this subsection versus the value in subsection (b)(3)(D)(ii)b.3.

Subsection (b)(6)(A) The purpose of this subsection is to describe the criteria for determining nonconformance for OBD emission testing. The proposed deletions of "on the applicable standard (i.e., FTP or SET)" is needed to correct wording errors. The proposed changes in subsection (b)(6)(A)(iii) of reference to section 1971.1(e)(8.2.1)(C) to section 1971.1(e)(8.2.1)(D) and (E) are needed for formatting reasons based on the proposed changes to section 1971.1. The proposed changes in subsections (b)(6)(A)(iii) and (b)(6)(A)(iv) of "either" to "any" are needed for clarity.

Subsection (b)(6)(B) The purpose of this subsection is to describe the criteria for determining nonconformance for OBD ratio testing. The proposed changes related to PM filter filtering performance and missing substrate monitors for the 2016 through 2018 model years are needed to allow some relaxation during these model years based on the proposed changes made to subsection 1971.1(d)(4.3.2)(G).

Subsection (b)(6)(C)(ii)b. The proposed change to this subsection is needed for formatting reasons based on the proposed changes to section 1971.1.

Subsection (d)(3)(A)(i) The purpose of this subsection is to describe the mandatory recall criteria for OBD ratio testing. The proposed addition of "and subject to the nonconformance criteria on section (b)(6(B)(ii)" is needed to allow 2016 through 2018 model year PM filter filtering performance and missing substrate monitors to be exempt from mandatory recall and to allow some relaxation during these model years based on the proposed changes made to subsection 1971.1(d)(4.3.2)(G).

Subsection (d)(3)(A)(ii)b.2. The proposed change to this subsection is needed for formatting reasons based on the proposed changes to section 1971.1.

Subsection (d)(3)(A)(iii) The purpose of this subsection is to describe the mandatory recall criteria for misfire monitors. The new proposed subsection (d)(3)(A)(iii)b. is needed to account for the proposed changes made to the diesel misfire monitor requirements in section 1971.1(e)(2).

Subsection (d)(3)(A)(vi) The purpose of this new proposed subsection is to describe additional mandatory recall criteria for the PM filter monitor. This subsection is needed to ensure that monitors unable to detect PM filter missing substrate faults that do not fall under the mandatory recall criteria in subsection (d)(3)(A)(ii) would still be subject to mandatory recalls.

Subsection (d)(3)(A)(vii) The proposed change from (d)(3)(A)(vi) to (d)(3)(A)(vii) is needed for formatting reasons.

Proposed amendments to Cal. Code Regs., title 13, section 1968.5:

Subsection (b)(3)(D)(ii)b. The purpose of this subsection is to describe the criteria for which engines are to be included in a test sample group for OBD II ratio testing. The proposed changes to subsection (b)(3)(D)(ii)b.2. is needed to ensure less difficulty in procuring applicable engines, since the engine would have needed to accumulate a very high mileage before the denominators for the diesel PM filter, PM sensor, and NMHC converting catalyst monitors specified were acceptable for inclusion in the test sample group with the original language. The proposed changes to subsection (b)(3)(D)(ii)b.1. and 3. are needed make clear what monitors are required to have denominators meeting the value in these subsections versus the value in subsection (b)(3)(D)(ii)b.2.

Subsection (b)(6)(A)(ii) The purpose of this subsection is to describe the criteria for determining nonconformance for OBD II emission testing of the intermediate diesel thresholds. The new proposed subsections (b)(6)(A)(ii)d. and e. are needed to account for the new interim thresholds being proposed for the NOx converting catalyst monitor and PM filter monitor in sections 1968.2(f)(2) and (f)(9).

Subsection (b)(6)(A)(iii) The purpose of this subsection is to describe the criteria for determining nonconformance for OBD II emission testing of the final diesel thresholds. The proposed change to this subsection is needed to account for the changes being proposed for subsection (b)(6)(A)(ii) above.

Subsection (b)(6)(B)(i)a. The purpose of this subsection is to describe the criteria for determining nonconformance for OBD II ratio testing of monitors certified to a ratio of 0.100. The proposed change of 2016 to 2018 is needed to account for the proposed addition of section 1968.2(d)(3.2.1)(D)(vi), which allows a minimum ratio of 0.100 for PM filter filtering performance and missing substrate monitors on 2016 through 2018 model year medium-duty vehicles.

Subsection (c)(3)(A)(i) The purpose of this subsection is to describe the mandatory recall criteria for OBD II ratio testing. The proposed change of 2016 through 2018 is needed to account for the proposed addition of section 1968.2(d)(3.2.1)(D)(vi), which allows a minimum ratio of 0.100 for PM filter filtering performance and missing substrate monitors on 2016 through 2018 model year medium-duty vehicles.

Subsection (c)(3)(A)(ii) The purpose of this subsection is to describe the mandatory recall criteria for OBD II emission testing. The proposed change to allow the PM filter filtering performance monitor (section 1968.2(f)(9.2.1)) to be exempt from mandatory recall for 2013 model year medium-duty vehicles is needed to provide some relaxation to manufacturers and to ensure manufacturers are able to certify their OBD II system for the 2013 model year.

Subsection (c)(3)(A)(iii) The purpose of this subsection is to describe the mandatory recall criteria for misfire monitors. The new proposed subsection (c)(3)(A)(iii)b. is needed to account for the proposed changes made to the diesel misfire monitor requirements in section 1968.2(f)(3).

Subsection (c)(3)(A)(vi) The purpose of this new proposed subsection is to describe additional mandatory recall criteria for the PM filter monitor. This subsection is needed to ensure that monitors unable to detect PM filter missing substrate faults that do not fall under the mandatory recall criteria in subsection (c)(3)(A)(ii) would still be subject to mandatory recalls.

Subsection (c)(3)(A)(vii) The proposed change from (c)(3)(A)(vi) to (c)(3)(A)(vii) is needed for formatting reasons.

DOCUMENTS INCORPORATED BY REFERENCE

Below is a list of documents newly incorporated by reference in the HD OBD regulation.

1) ARB Mail-Out #MSC 09-22, "Guidelines for Heavy-Duty On-Board Diagnostic (HD OBD) Certification Data," July 7, 2009.

2) International Standards Organization (ISO) 15765-4:"Road Vehicles – Diagnostics Communications over Controller Area Network (CAN) – Part 4: Requirements for emission-related systems," February 2011.

3) Society of Automotive Engineers (SAE) J1699-3 – "Vehicle OBD II Compliance Test Cases", December 2009.

4) SAE J1930-DA "Electrical/Electronic Systems Diagnostic Terms, Definitions, Abbreviations, and Acronyms Web Tool Spreadsheet", March 2012.

5) SAE J1979 "E/E Diagnostic Test Modes," February 2012.

6) SAE J1979-DA "Digital Annex of E/E Diagnostic Test Modes", October 2011.

7) SAE J2012-DA "Digital Annex of Diagnostic Trouble Code Definitions and Failure Type Byte Definitions", July 2010.

8) SAE J2403 "Medium/Heavy-Duty E/E Systems Diagnosis Nomenclature," February 2011.

9) SAE J1939 Recommended Practice for a Serial Control and Communications Vehicle Network, April 2011.

10) SAE J1939/01 On-Highway Equipment Control and Communication Network, May 2011.

11) SAE J1939/13 Off-Board Diagnostic Connector, October 2011.

12) SAE J1939/21 Data Link Layer, December 2010.

13) SAE J1939/31 Network Layer, May 2010.

14) SAE J1939/71 Vehicle Application Layer (Through May 2010), March 2011.

15) SAE J1939/73 Application Layer—Diagnostics, February 2010.

16) SAE J1939/81 Network Management, June 2011.

17) SAE J1939/84 OBD Communications Compliance Test Cases For Heavy Duty Components and Vehicles, December 2010.

REFERENCES

Staff Report: Initial Statement of Reasons (ISOR): "Malfunction and Diagnostic System Requirements for 2010 and Subsequent Model Year Heavy-Duty Engines (HD OBD)," June 3, 2005

Staff Report: Initial Statement of Reasons (ISOR): "Technical Status and Revisions to Malfunction and Diagnostic System Requirements for Heavy-Duty Engines (HD OBD) and Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines (OBD II)," April 10, 2009

Appendix A

PROPOSED REGULATION ORDER

Amend section 1971.1, title 13, California Code of Regulations, to read as follows:

Note: The proposed amendments are shown in underline to indicate additions and ~~strikeout~~ to indicate deletions from the existing regulatory text. Various portions of the regulations that are not modified by the proposed amendments are omitted from the text shown and indicated by " * * * * ".

§1971.1. On-Board Diagnostic System Requirements--2010 and Subsequent Model-Year Heavy-Duty Engines

(a) *Purpose.*
The purpose of this regulation is to reduce motor vehicle and motor vehicle engine emissions by establishing emission standards and other requirements for onboard diagnostic systems (OBD systems) that are installed on 2010 and subsequent model-year engines certified for sale in heavy-duty applications in California. The OBD systems, through the use of an onboard computer(s), shall monitor emission systems in-use for the actual life of the engine and shall be capable of detecting malfunctions of the monitored emission systems, illuminating a malfunction indicator light (MIL) to notify the vehicle operator of detected malfunctions, and storing fault codes identifying the detected malfunctions. The use and operation of OBD systems will ensure reductions in in-use motor vehicle and motor vehicle engine emissions through improvements of emission system durability and performance.

(b) *Applicability.*
Except as specified in section (d)(7) and elsewhere in this regulation (title 13, CCR section 1971.1), all 2010 and subsequent model-year heavy-duty engines shall be equipped with an OBD system that has been certified by the Executive Officer as meeting all applicable requirements of this regulation (title 13, CCR section 1971.1).[1]

(c) *Definitions.*
"Actual life" refers to the entire period that an engine is operated on public roads in California up to the time an engine is retired from use.
"Alternate-fueled engine" refers to an engine using a fuel different from or in addition to gasoline fuel or diesel fuel (e.g., compressed natural gas (CNG), liquefied petroleum gas). For the purposes of this regulation, alternate-fueled engines include dedicated alternate-fueled engines (i.e., engines designed to operate exclusively on the alternate fuel) and engines that can use more than one type of fuel but cannot be reasonably operated in-use exclusively on gasoline or diesel fuel (e.g., engines with diesel pilot injection and CNG main injection where engine operation is limited to idle if CNG fuel is not available or engines which use

[1] Unless otherwise noted, all section references refer to section 1971.1 of title 13, CCR.

gasoline-only operation during cold start and CNG-only operation for the rest of the driving cycle and engine operation defaults to a limp-home restricted speed and load if CNG fuel is not available). For engines that can use more than one type of fuel but can be operated in-use exclusively on gasoline or diesel fuel, the engines are considered alternate-fueled engines only for the portion of operation the engine uses a fuel other than exclusively gasoline or diesel (e.g., a gasoline and CNG engine that can operate exclusively on gasoline is considered an alternate-fueled engine only while operating on CNG and is not subject to the provisions or relief of this regulation for alternate-fueled engines while operating exclusively on gasoline). For alternate-fueled engines, the manufacturer shall meet the requirements of section (d)(7.5).

"Alternate phase-in", as allowed in section (g)(5.8), is a phase-in schedule that achieves equivalent compliance volume by the end of the last year of a scheduled phase-in provided in this regulation. The compliance volume is the number calculated by multiplying the percent of engines (based on the manufacturer's projected sales volume of all engines unless specifically stated otherwise in section (e), (f), or (g)) meeting the new requirements per year by the number of years implemented prior to and including the last year of the scheduled phase-in and then summing these yearly results to determine a cumulative total (e.g., a three year, 20/50/100 percent scheduled phase-in would be calculated as (20*3 years) + (50*2 years) + (100*1 year) = 260; a two-year 20/50 percent scheduled phase-in would be calculated as (20*2 years) + (50*1 year) = 90). Manufacturers are allowed to include engines introduced before the first year of the scheduled phase-in (e.g., in the previous example, 10 percent introduced one year before the scheduled phase-in begins would be calculated as (10*4 years) and added to the cumulative total). However, manufacturers are only allowed to include engines introduced up to one model year before the first year of the scheduled phase-in. The Executive Officer shall consider acceptable any alternate phase-in that results in an equal or larger cumulative total by the end of the last year of the scheduled phase-in and ensures that all engines subject to the phase-in will comply with the respective requirements no later than two model years following the last year of the scheduled phase-in.

For alternate phase-in schedules resulting in all engines complying one model year following the last year of the scheduled phase-in, the compliance volume shall be calculated as described directly above. For example, a 20/50/100 percent scheduled phase-in during the 2016-2018 model years would have a cumulative total of 260. If the manufacturer's planned alternate phase-in schedule is 40/50/80/100 percent during the 2016-2019 model years, the final compliance volume calculation would be (40*3 years) + (50*2 years) + (80*1 year) = 300, which is greater than 260 and therefore would be acceptable as an alternate phase-in schedule.

For alternate phase-in schedules resulting in all engines complying two model years following the last year of the scheduled phase-in, the compliance volume calculation shall be calculated as described directly above and shall also include a negative calculation for engines not complying until one or two model years following the last year of the scheduled phase-in. The negative calculation shall be calculated by multiplying the percent of engines not meeting the new requirements in the final year of the phase-in by negative one and the percent of engines not meeting the new requirements in the one year after the final year of the phase-in by negative two. For example, if 10 percent of a manufacturer's engines did not comply by the final year of the scheduled phase-in and 5 percent did not comply by the end of the first year after the final year of the scheduled phase-in, the negative calculation result would be (10*(-1 years)) + (5*(-2 years)) = -20. The final compliance volume calculation is the sum of the original compliance volume calculation and the negative calculation. For example, a 20/50/100 percent scheduled phase-in during the 2016-2018 model years would have a cumulative total of 260. If a manufacturer's planned alternate phase-in schedule is 40/70/80/90/100 percent during the 2013-2020 model years, the final compliance volume calculation would be (40*3 years) + (70*2 years) + (80*1 year) + (20*(-1 year)) + (10*(-2 years)) = 300, which is greater than 260 and therefore would be acceptable as an alternate phase-in schedule.

"Applicable standards" refers to the specific exhaust emission standards or family emission limits (FEL), including the Federal Test Procedure (FTP) and Supplemental Emission Test (SET) standards, to which the engine is certified.

"Auxiliary Emission Control Device (AECD)" refers to any approved AECD (as defined by 40 Code of Federal Regulations (CFR) 86.082-2 and 86.094-2).

"Emission Increasing Auxiliary Emission Control Device (EI-AECD)" refers to any approved AECD that: reduces the effectiveness of the emission control system under conditions which may reasonably be expected to be encountered in normal vehicle operation and use; and the need for the AECD is justified in terms of protecting the vehicle against damage or accident. An AECD that is certified as an NTE deficiency shall not be considered an EI-AECD. An AECD that does not sense, measure, or calculate any parameter or command or trigger any action, algorithm, or alternate strategy shall not be considered an EI-AECD. An AECD that is activated solely due to any of the following conditions shall not be considered an EI-AECD: (1) operation of the vehicle above 8000 feet in elevation; (2) ambient temperature; (3) when the engine is warming up and is not reactivated once the engine has warmed up in the same driving cycle; (4) failure detection (storage of a fault code) by the OBD system; (5) execution of an OBD monitor; or (6) execution of an infrequent regeneration event.

"Base fuel schedule" refers to the fuel calibration schedule programmed into the Powertrain Control Module or programmable read-only memory (PROM) when manufactured or when updated by some off-board source, prior to any learned on-board correction.

~~"Auxiliary Emission Control Device (AECD)" refers to any approved AECD (as defined by 40 Code of Federal Regulations (CFR) 86.082-2 and 86.094-2).~~

~~"Emission Increasing Auxiliary Emission Control Device (EI-AECD)" refers to any approved AECD that: reduces the effectiveness of the emission control system under conditions which may reasonably be expected to be encountered in normal vehicle operation and use; and the need for the AECD is justified in terms of protecting the vehicle against damage or accident. An AECD that is certified as an NTE deficiency shall not be considered an EI-AECD. An AECD that does not sense, measure, or calculate any parameter or command or trigger any action, algorithm, or alternate strategy shall not be considered an EI-AECD. An AECD that is activated solely due to any of the following conditions shall not be considered an EI-AECD: (1) operation of the vehicle above 8000 feet in elevation; (2) ambient temperature; (3) when the engine is warming up and is not~~

~~reactivated once the engine has warmed up in the same driving cycle; (4) failure detection (storage of a fault code) by the OBD system; (5) execution of an OBD monitor; or (6) execution of an infrequent regeneration event.~~

"Calculated load value" refers to the percent of engine capacity being used and is defined in Society of Automotive Engineers (SAE) J1979 "E/E Diagnostic Test Modes," ~~May 2007~~February 2012 (SAE J1979), incorporated by reference (section (h)(1.4)). For diesel applications, the calculated load value is determined by the ratio of current engine output torque to maximum engine output torque at current engine speed as defined by parameter definition 5.2.1.7 of SAE J1939-71 "Vehicle Application Layer (Through ~~February 2008~~May 2010)," ~~January 2009~~March 2011.

"Confirmed fault code," for purposes of engines using International Standards Organization (ISO) 15765-4, is defined as the diagnostic trouble code stored when an OBD system has confirmed that a malfunction exists (e.g., typically on the second driving cycle that the malfunction is detected) in accordance with the requirements of sections (d)(2), (f), (g), and (h)(4.4).

"Continuously," if used in the context of monitoring conditions for circuit continuity, lack of circuit continuity, circuit faults, and out-of-range values, means monitoring is always enabled, unless alternate enable conditions have been approved by the Executive Officer in accordance with section (d)(3.1.1), and sampling of the signal used for monitoring occurs at a rate no less than two samples per second. If a computer input component is sampled less frequently for control purposes, the signal of the component may instead be evaluated each time sampling occurs.

"Deactivate" means to turn-off, shutdown, desensitize, or otherwise make inoperable through software programming or other means during the actual life of the engine.

"Diagnostic or emission critical" electronic control unit refers to the engine and any other on-board electronic powertrain control unit containing software that:

(1) determines the commanded value(s) for any of the following:
- (a) Fuel injection quantity
- (b) Fuel injection timing and/or valve timing
- (c) NOx catalyst reductant (e.g., urea) injection quantity; or

(2) is used to control or determine the measured value of an exhaust gas sensor subject to monitoring in section (e)(9) or (f)(8) (e.g., NOx or PM sensor module); or

(3) has primary control over any of the monitors required by sections (e)(1) through (f)(9), (g)(1) through (g)(2), and (g)(4); or

(~~2~~4) excluding anti-lock brake system (ABS) control units or stability/traction control units, has primary control over the diagnostics for more than ~~two~~ four ~~of the~~ input components or more than two output components required to be monitored by section (g)(3).

For purposes of criteria (3) and (4) above, "primary control" over a monitor means the control unit does any of the following: (a) determines if enable conditions are satisfied; (b) calculates the value or statistic that represents the component/system's level of performance; or (c) makes pass or fail decisions. Further, f~~F~~or purposes of criteri~~a~~on (4~~2~~) above, all glow plugs in an engine shall be considered "one" output component in lieu of each glow plug being considered a separate component.

"Diesel engine" refers to an engine using a compression ignition thermodynamic cycle.

"Driving cycle" is defined as a trip that meets any of the four conditions below:

(~~a~~1) Begins with engine start and ends with engine shutoff;

(~~b~~2) Begins with engine start and ends after four hours of continuous engine-on operation;

(~~c~~3) Begins at the end of the previous four hours of continuous engine-on operation and ends after four hours of continuous engine-on operation; or

(~~d~~4) Begins at the end of the previous four hours of continuous engine-on operation and ends with engine shutoff.

For monitors that run during engine-off conditions, the period of engine-off time following engine shutoff and up to the next engine start may be considered part of the driving cycle for conditions (~~a~~1) and (~~d~~4). For vehicles that employ engine shutoff strategies that do not require the vehicle operator to restart the engine to continue driving (e.g., hybrid bus with engine shutoff at idle), the manufacturer may request Executive Officer approval to use an alternate definition for driving cycle (e.g., key on and key off). Executive Officer approval of the alternate definition shall be based on equivalence to engine startup and engine shutoff signaling the beginning and ending of a single driving event for a conventional vehicle. Engine restarts following an engine shut-off that has been neither commanded by the vehicle operator nor by the engine control strategy but caused by an event such as an engine stall may be considered a new driving cycle or a continuation of the existing driving cycle. For engines that are not likely to be routinely operated for long continuous periods of time, a manufacturer may also request Executive Officer approval to use an alternate definition for driving cycle (e.g., solely based on engine start and engine shutoff without regard to four hours of continuous engine-on time). Executive Officer approval of the alternate definition shall be based on manufacturer-submitted data and/or information demonstrating the typical usage, operating habits, and/or driving patterns of these vehicles.

"Emission standard," as it applies to OBD compliance, relates to the emission characteristics of a motor vehicle and engine and means:

(1) a numerical limit on the amount of a given pollutant that a motor vehicle or motor vehicle engine may emit into the atmosphere; or

(2) a requirement that a motor vehicle or motor vehicle engine be equipped with a certain type of pollution-control device or some other design feature related to the control of emissions.

"Engine family" means a grouping of vehicles or engines in a manufacturer's product line determined in accordance with 40 CFR 86.098-24.

"Engine rating" means a unique combination of displacement, rated power, calibration (fuel, emission, and engine control), AECDs, and other engine and emission control components within an engine family.

"OBD parent rating" means the specific engine rating selected according to section (d)(7.1.1) or (d)(7.2.2)(B) for compliance with section 1971.1.

"OBD child rating" means an engine rating (other than the OBD parent rating) within the engine family containing the OBD parent rating selected according to section (d)(7.1.1) or an engine rating within the OBD group(s) defined according to section (d)(7.2.1) and subject to section (d)(7.2.3).

"Evaporative emission standards" are a subset of emission standards that refer to the specific motor vehicle fuel evaporative emission standards and test procedures incorporated by reference in title 13, CCR section 1976 to which the engine is certified.

"Exhaust emission standards" or "tailpipe emission standards" are a subset of emission standards that collectively refer to the specific FTP standards and SET standards to which an engine is certified.

"Engine misfire" means lack of combustion in the cylinder due to absence of spark, poor fuel metering, poor compression, or any other cause. This does not include lack of combustion events in non-active cylinders due to default fuel shut-off or cylinder deactivation strategies.

"Engine start" is defined as the point when the engine reaches a speed 150 rpm below the normal, warmed-up idle speed (as determined in the drive position for vehicles equipped with an automatic transmission). For hybrid vehicles or for engines employing alternate engine start hardware or strategies (e.g., integrated starter and generators), the manufacturer may request Executive Officer approval to use an alternate definition for engine start (e.g., ignition key "on"). Executive Officer approval of the alternate definition shall be based on equivalence to an engine start for a conventional vehicle.

"Family Emission Limit (FEL)" refers to the exhaust emission levels to which an engine family is certified under the averaging, banking, and trading program incorporated by reference in title 13, CCR section 1956.8.

"Fault memory" means information pertaining to malfunctions stored in the onboard computer, including fault codes, stored engine conditions, and MIL status.

"Federal Test Procedure (FTP) test" refers to an exhaust emission test conducted according to the test procedures incorporated by reference in title 13, CCR section 1956.8(b) and (d) that is used to determine compliance with the FTP standard to which an engine is certified.

"FTP cycle". For engines certified on an engine dynamometer, FTP cycle refers to the engine dynamometer schedule in 40 CFR appendix 1 of part 86, section (f)(1), entitled, "EPA Engine Dynamometer Schedule for Heavy-Duty Otto-Cycle Engines," or section (f)(2), entitled, "EPA Engine Dynamometer Schedule for Heavy-Duty Diesel Engines."

"FTP standard" refers to the certification exhaust emission standards and test procedures applicable to the FTP cycle incorporated by reference in title 13, CCR sections 1956.8(b) and (d) to which the engine is certified.

"Fuel trim" refers to feedback adjustments to the base fuel schedule. Short-term fuel trim refers to dynamic or instantaneous adjustments. Long-term fuel trim refers to much more gradual adjustments to the fuel calibration schedule than short-term trim adjustments.

"Fueled engine operation" is the state where any fuel is introduced into the engine for the purposes of combustion.

"Functional check" for an output component or system means verification of proper response of the component and system to a computer command.

"Gasoline engine" refers to an Otto-cycle engine ~~or an alternate-fueled engine~~.

"Heavy-duty engine" means an engine that is used to propel a heavy-duty vehicle.

"Heavy-duty vehicle" means any motor vehicle having a manufacturer's gross vehicle weight rating (GVWR) greater than 14,000 pounds.

"Hybrid vehicle" refers to a vehicle that has both of the following on-vehicle sources of stored energy and can draw propulsion energy from the source mentioned in 2): 1) a consumable fuel and 2) an energy storage device such as a battery, capacitor, pressure reservoir, or flywheel.

"Ignition Cycle" means a driving cycle that begins with engine start, meets the engine start definition for at least two seconds plus or minus one second, and ends with engine shutoff. For hybrid vehicles, "ignition cycle" means a driving cycle that begins when the propulsion system active definition is met for at least two seconds plus or minus one second, and ends when the propulsion system active definition is no longer met.

"Keep-alive memory (KAM)," for the purposes of this regulation, is defined as a type of memory that retains its contents as long as power is provided to the on-board control unit. KAM is not erased upon shutting off the engine but may be erased if power to the on-board control unit is interrupted (e.g., vehicle battery disconnected, fuse to control unit removed). In some cases, portions of KAM may be erased with a scan tool command to reset KAM.

"Key on, engine off position" refers to a vehicle with the ignition key in the engine run position (not engine crank or accessory position) but with the engine not running.

"Malfunction" means any deterioration or failure of a component or system that causes the performance to be outside of the applicable limits in sections (e) through (g).

"Manufacturer" for the purpose of this regulation means the holder of the Executive Order for the engine family.

"MIL-on fault code," for purposes of engines using SAE J1939, refers to the diagnostic trouble code stored when an OBD system has confirmed that a malfunction exists (e.g., typically on the second driving cycle that the malfunction is detected) and has commanded the MIL on in accordance with the requirements of sections (d)(2), (e), (g), and (h)(4.4).

"Non-volatile random access memory (NVRAM)," for the purposes of this regulation, is defined as a type of memory that retains its contents even when power to the on-board control unit is interrupted (e.g., vehicle battery disconnected, fuse to control unit removed). NVRAM is typically made non-volatile either by use of a back-up battery within the control unit or through the use of an electrically erasable and programmable read-only memory (EEPROM) chip.

"Not-To-Exceed (NTE) control area" refers to the bounded region of the engine's torque and speed map, as defined in 40 CFR 86.1370-2007, where emissions must not exceed a specific emission cap for a given pollutant under the NTE requirement.

"Manufacturer-specific NOx NTE carve-out area" refers to regions within the NTE control area for NOx where the manufacturer has limited NTE testing as allowed by 40 CFR 86.1370-2007(b)(7).

"Manufacturer-specific PM NTE carve-out area" refers to regions within the NTE control area for PM where the manufacturer has limited NTE testing as allowed by 40 CFR 86.1370-2007(b)(7).

"NTE deficiency" refers to regions or conditions within the NTE control area for NOx or PM where the manufacturer has received a deficiency as allowed by 40 CFR 86.007-11(a)(4)(iv).

"OBD group" refers to a combination of engines, engine families, or engine ratings that use the same OBD strategies and similar calibrations. A manufacturer is required to submit a grouping plan for Executive Officer review and approval detailing the OBD groups and the engine families and engine ratings within each group for a model year.

"Pending fault code" is defined as the diagnostic trouble code stored upon the initial detection of a malfunction (e.g., typically on a single driving cycle) prior to illumination of the MIL in accordance with the requirements of sections (d)(2), (e) through (g), and (h)(4.4).

"Permanent fault code" is defined as a confirmed or MIL-on fault code that is ~~currently commanding the MIL on and is~~ stored in NVRAM as specified in sections (d)(2) and (h)(4.4).

"Percentage of misfire" as used in sections (e)(2) and (f)(2) means the percentage of misfires out of the total number of firing events for the specified interval.

"Power Take-Off (PTO) unit" refers to an engine driven output provision for the purposes of powering auxiliary equipment (e.g., a dump-truck bed, aerial bucket, or tow-truck winch).

"Previously MIL-on fault code," for purposes of engines using SAE J1939, is defined as the diagnostic trouble code stored when an OBD system has confirmed that a malfunction no longer exists (e.g., after the third consecutive driving cycle in which the corresponding monitor runs and the malfunction is not detected), extinguishes the MIL, and erases the corresponding MIL-on fault code in accordance with the requirements of sections (d)(2), (e), (g), and (h)(4.4).

"Propulsion system active" is the state where the powertrain (e.g., engine, electric machine) is enabled by the driver (e.g., after ignition on for conventional vehicles, after power button pushed for some hybrid vehicles) such that the vehicle is ready to be used (e.g., vehicle is ready to be driven, ready to be shifted from "park" to "drive"). For purposes of this definition, "the state where the powertrain is enabled" does not include activations that are not driver-initiated (e.g., conditions where portions of the vehicle system wake up to perform OBD monitoring).

"Rationality fault diagnostic" for an input component means verification of the accuracy of the input signal while in the range of normal operation and when compared to all other available information.

"Redline engine speed" shall be defined by the manufacturer as either the recommended maximum engine speed as normally displayed on instrument panel tachometers or the engine speed at which fuel shutoff occurs.

"Response rate" for exhaust gas sensors refers to the delay from when the sensor is exposed to a different make-up of exhaust gas constituents until it outputs a signal reflecting the different make-up of exhaust gas constituents. For example, for oxygen sensors, response rate is the delay from when the oxygen sensor is exposed to a change in exhaust gas from richer/leaner than stoichiometric to leaner/richer than stoichiometric to the time when the oxygen sensor indicates the lean/rich condition. Similarly, for wide-range air-fuel (A/F) sensors, response rate is the delay from when the sensor is exposed to a different A/F ratio to the time it indicates the different A/F ratio. For NOx and PM sensors, response rate is the delay from when the sensor is exposed to a different NOx or PM exhaust gas level until it indicates the different NOx or PM exhaust gas level.

"Secondary air" refers to air introduced into the exhaust system by means of a pump or aspirator valve or other means that is intended to aid in the oxidation of HC and CO contained in the exhaust gas stream.

"Similar conditions" as used in sections (e)(1), (e)(2), (f)(1), and (f)(2) means engine conditions having an engine speed within 375 rpm, load conditions within 20 percent, and the same warm-up status (i.e., cold or hot) as the engine conditions stored pursuant to (e)(1.4.2)(E), (e)(2.4.2)(C), (f)(1.4.5), and (f)(2.4.4). The Executive Officer may approve other definitions of similar conditions based on comparable timeliness and reliability in detecting similar engine operation.

"Small volume manufacturer" is defined in title 13, CCR section 1900(b), with the exception that California sales of less than 1200 heavy-duty engines will be used in lieu of 4500 heavy-duty engines.

"Start of production" is the time when the manufacturer has produced two percent of the projected volume for the engine or vehicle, whichever is specified in sections (k) and (l).

"Supplemental Emission Test (SET) cycle" refers to the driving schedule defined as the "supplemental steady state emission test" in 40 CFR 86.1360-2007.

"SET standard" refers to the certification exhaust emission standards and test procedures applicable to the SET cycle incorporated by reference in title 13, CCR sections 1956.8(b) and (d) to which the engine is certified

"Warm-up cycle" means a driving cycle with sufficient vehicle operation such that the coolant temperature has risen by at least 40 degrees Fahrenheit from engine start and reaches a minimum temperature of at least 160 degrees Fahrenheit (140 degrees Fahrenheit for applications with diesel engines). Alternatively, manufacturers may define warm-up cycle as a driving cycle with vehicle operation in which the following criteria are met: for vehicles using the ISO 15765-4 protocol, the manufacturers may use the criteria specified in sections (d)(2.3.1)(C)(ii)b.3.i., ii., and iii. herein, and for vehicles using the SAE J1939 protocol, the manufacturer may use the criteria specified in sections (d)(2.3.2)(D)(ii)b.3.i., ii., and iii. herein.

"Weighted sales number" means a manufacturer's projected sales number for engines to be used in California heavy-duty vehicles multiplied by a weight class factor. Sales numbers for diesel engines for heavy-duty vehicles less than 19,499 pounds GVWR shall be multiplied by 1.0. Sales numbers for diesel engines for heavy-duty vehicles from 19,500 to 33,000 pounds shall be multiplied by 1.68. Sales numbers for diesel engines for heavy-duty vehicles greater than 33,000 pounds and urban buses shall be multiplied by 3.95. Sales numbers for all gasoline engines for heavy-duty vehicles shall be multiplied by 1.0.

(d) *General Requirements.*

Section (d) sets forth the general requirements of the OBD system. Specific performance requirements for components and systems that shall be monitored are set forth in sections (e) through (g) below. The OBD system is required to detect all malfunctions specified in sections (e) through (g). However, except as specified elsewhere, the OBD system is not required to use a unique monitor to detect each malfunction specified.

(1) The OBD System.

(1.1) If a malfunction is present as specified in sections (e) through (g), the OBD system shall detect the malfunction, store a pending, confirmed, MIL-on, or previously MIL-on fault code in the onboard computer's memory, and illuminate the MIL as required.

(1.2) The OBD system shall be equipped with a standardized data link connector to provide access to the stored fault codes as specified in section (h).

(1.3) The OBD system shall be designed to operate, without any required scheduled maintenance, for the actual life of the engine in which it is installed and may not be programmed or otherwise designed to deactivate based on age and/or mileage of the vehicle during the actual life of the engine. This section is not intended to alter existing law and enforcement practice regarding a manufacturer's liability for an engine beyond its 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.

(1.4) Computer-coded engine operating parameters may not be changeable without the use of specialized tools and procedures (e.g. soldered or potted computer components or sealed (or soldered) computer enclosures). Subject to Executive Officer approval, manufacturers may exempt from this requirement those product lines that are unlikely to require protection. Criteria to be evaluated in making an exemption include current availability of performance chips, performance capability of the engine, and sales volume.

(2) MIL and Fault Code Requirements.

(2.1) MIL Specifications.

(2.1.1) The MIL shall be located on the driver's side instrument panel and be of sufficient illumination and location to be readily visible under all lighting conditions and shall be amber in color when illuminated. The MIL, when illuminated, shall display the International Standards Organization (ISO) engine symbol. There shall be only one MIL used to indicate all faults detected by the OBD system on a single vehicle.

(2.1.2) The MIL shall illuminate in the key on, engine off position before engine cranking to indicate that the MIL is functional. The MIL shall continuously illuminate during this functional check for a minimum of 15~~20~~ seconds. During this functional check of the MIL, the data stream value for MIL status shall indicate commanded off (see section (h)(4.2)) unless the MIL has also been 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 stall or other non-commanded engine shutoff).

(2.1.3) At the manufacturer's option, the MIL may be used to indicate readiness status in a standardized format (see section (h)(4.1.~~3~~6)) in the key on, engine off position.

(2.1.4) A manufacturer may request Executive Officer approval to also use the MIL to indicate which, if any, fault codes are currently stored (e.g., to "blink" the stored codes). The Executive Officer shall approve the request upon determining that the manufacturer has demonstrated that the method used to indicate the fault codes will not be unintentionally activated during a California inspection test or during routine driver operation.

(2.1.5) The MIL may not be used for any purpose other than specified in this regulation.

(2.2) MIL Illumination and Fault Code Storage Protocol.

(2.2.1) For vehicles using the ISO 15765-4 protocol for the standardized functions required in section (h):

(A) Upon detection of a malfunction, the OBD system shall store a pending fault code within 10 seconds indicating the likely area of the malfunction.

(B) After storage of a pending fault code, if the identified malfunction is again detected before the end of the next driving cycle in which monitoring occurs, the OBD system shall illuminate the MIL continuously, keep the pending fault code stored, and store a confirmed fault code within 10 seconds. If a malfunction is not detected before the end of the next driving cycle in which monitoring occurs (i.e., there is no indication of the malfunction at any time during the driving cycle), the corresponding pending fault code set according to section (d)(2.2.1)(A) shall be erased at the end of the driving cycle.

(C) A manufacturer may request Executive Officer approval to employ alternate statistical MIL illumination and fault code storage protocols to those specified in these requirements. The Executive Officer shall grant approval upon determining that the manufacturer has provided data and/or engineering evaluation that demonstrate that the alternative protocols can evaluate system performance and detect malfunctions in a manner that is equally effective and timely. Strategies requiring on average more than six driving cycles for MIL illumination may not be accepted.

(D) <u>Storage and erasure of freeze frame conditions.</u>

<u>(i)</u> The OBD system shall store and erase "freeze frame" conditions (as defined in section (h)(4.3)) present at the time a malfunction is detected.

<u>(ii)</u> ~~The storage and erasure of~~ <u>For 2010 through 2015 model year engines, the OBD system shall store and erase</u> freeze frame conditions ~~shall be done~~ in conjunction with the storage and erasure of either pending or confirmed fault codes as required elsewhere in section (d)(2.2).

<u>(iii) For 2016 and subsequent model year engines, except as provided for in section (d)(2.2.1)(D)(iv), the OBD system shall store freeze frame conditions in conjunction with the storage of a pending fault code.</u>

<u>a. If the pending fault code is erased in the next driving cycle in which monitoring occurs and a malfunction is not detected (as described in section (d)(2.2.1)(B)), the OBD system may erase the corresponding freeze frame conditions.</u>

<u>b. If the pending fault code matures to a confirmed fault code (as described in section (d)(2.2.1)(B)), the OBD system shall either retain the currently stored freeze frame conditions or replace the stored freeze frame conditions with freeze frame conditions regarding the confirmed fault code. The OBD system shall erase the freeze frame information in conjunction with the erasure of the confirmed fault code (as described under section (d)(2.3.1)(B)).</u>

(iv) For alternate strategies that do not store pending fault codes (i.e., monitors using alternate statistical strategies described in section (d)(2.2.1)(C) such as monitors that store a confirmed fault code and illuminate the MIL upon the first detection of a malfunction), the OBD system shall store and erase freeze frame conditions in conjunction with the storage and erasure of the confirmed fault code.

(E) The OBD system shall illuminate the MIL and store a confirmed fault code within 10 seconds to inform the vehicle operator whenever the engine enters a default or "limp home" mode of operation that can affect emissions or the performance of the OBD system or in the event of a malfunction of an on-board computer(s) itself that can affect the performance of the OBD system. If the default or "limp home" mode of operation is recoverable (i.e., the diagnostic or control strategy that caused the default or "limp home" mode of operation can run on the next driving cycle and confirm the presence of the condition that caused the default or "limp home" operation), the OBD system may, in lieu of illuminating the MIL within 10 seconds on the first driving cycle where the default or "limp home" mode of operation is entered, delay illumination of the MIL until the condition causing the default or "limp home" mode of operation is again detected before the end of the next driving cycle.

(F) Before the end of an ignition cycle, the OBD system shall store confirmed fault codes that are currently causing the MIL to be illuminated in NVRAM as permanent fault codes (as defined in section (h)(4.4.1)(F)).

(2.2.2) For vehicles using the SAE J1939 protocol for the standardized functions required in section (h):

(A) Upon detection of a malfunction, the OBD system shall store a pending fault code within 10 seconds indicating the likely area of the malfunction.

(B) After storage of a pending fault code, if the identified malfunction is again detected before the end of the next driving cycle in which monitoring occurs, the OBD system shall illuminate the MIL continuously, erase the pending fault code, and store a MIL-on fault code within 10 seconds. If a malfunction is not detected before the end of the next driving cycle in which monitoring occurs (i.e., there is no indication of the malfunction at any time during the driving cycle), the corresponding pending fault code set according to section (d)(2.2.2)(A) shall be erased at the end of the driving cycle.

(C) A manufacturer may request Executive Officer approval to employ alternate statistical MIL illumination and fault code storage protocols to those specified in these requirements. The Executive Officer shall grant approval upon determining that the manufacturer has provided data and/or engineering evaluation that demonstrate that the alternative protocols can evaluate system performance and detect malfunctions in a manner that is equally effective and timely. Strategies requiring on average more than six driving cycles for MIL illumination may not be accepted.

(D) Storage and erasure of freeze frame conditions.

(i) The OBD system shall store and erase "freeze frame" conditions (as defined in section (h)(4.3)) present at the time a malfunction is detected.

(ii) The OBD system shall store freeze frame conditions in conjunction with the storage of a pending fault code.

(iii) If the pending fault code is erased in the next driving cycle in which monitoring occurs and a malfunction is not detected (as described under section (d)(2.2.2)(B)), the OBD system may erase the corresponding freeze frame conditions.

(iv) If the pending fault code matures to a MIL-on fault code (as described under section (d)(2.2.2)(B)), the OBD system shall either retain the currently stored freeze frame conditions or replace the stored freeze frame conditions with freeze frame conditions regarding the MIL-on fault code. The OBD system shall erase the freeze frame information in conjunction with the erasure of the previously MIL-on fault code (as described under section (d)(2.3.2)(C)).

(v) For alternate strategies that do not store pending fault codes (i.e., monitors using alternate statistical strategies described in section (d)(2.2.1)(C) such as monitors that store a MIL-on fault code and illuminate the MIL upon the first detection of a malfunction), the OBD system shall store and erase freeze frame conditions in conjunction with the storage and erasure of the MIL-on fault code.

(E) The OBD system shall illuminate the MIL and store a MIL-on fault code within 10 seconds to inform the vehicle operator whenever the engine enters a default or "limp home" mode of operation that can affect emissions or the performance of the OBD system or in the event of a malfunction of an on-board computer(s) itself that can affect the performance of the OBD system. If the default or "limp home" mode of operation is recoverable (i.e., the diagnostic or control strategy that caused the default or "limp home" mode of operation can run on the next driving cycle and confirm the presence of the condition that caused the default or "limp home" operation), the OBD system may, in lieu of illuminating the MIL within 10 seconds on the first driving cycle where the default or "limp home" mode of operation is entered, delay illumination of the MIL until the condition causing the default or "limp home" mode of operation is again detected before the end of the next driving cycle.

(F) Before the end of an ignition cycle, the OBD system shall store MIL-on fault codes that are currently causing the MIL to be illuminated in NVRAM as permanent fault codes (as defined in section (h)(4.4.2)(F)).

(2.3) MIL Extinguishing and Fault Code Erasure Protocol.

(2.3.1) For vehicles using the ISO 15765-4 protocol for the standardized functions required in section (h):

(A) Extinguishing the MIL. Except as otherwise provided in sections (e)(1.4.2)(F), (e)(2.4.2)(D), (e)(6.4.2), (f)(1.4.6), (f)(2.4.5), and (f)(7.4.2) (for diesel fuel system, diesel misfire, diesel empty reductant tank, gasoline fuel system, gasoline misfire, and gasoline evaporative system malfunctions), once the MIL has been illuminated, it ~~may~~ shall be extinguished after at least three subsequent sequential driving cycles during which the monitoring system responsible for illuminating the MIL functions and the previously detected malfunction is no longer present provided no other malfunction has been detected that would independently illuminate the MIL according to the requirements outlined above.

(B) Erasing a confirmed fault code. For 2010 through 2015 model year engines, ~~T~~the OBD system may erase a confirmed fault code if the identified malfunction has not been again detected in at least 40 ~~engine~~ warm-up cycles and the MIL is presently not illuminated for that malfunction. For 2016 and subsequent model year engines, the OBD system shall erase a confirmed fault code if the identified malfunction has not been again detected in 40 warm-up cycles and the MIL is presently not illuminated for that malfunction.

(C) Erasing a permanent fault code.

(i) If the OBD system is commanding the MIL on, the OBD system shall erase a permanent fault code only if the OBD system itself determines that the malfunction that caused the permanent fault code to be stored is no longer present and is not commanding the MIL on, pursuant to the requirements of section (d)(2.3.1)(A) (which for the purposes of this section shall apply to all monitors). Erasure of the permanent fault code shall occur in conjunction with extinguishing the MIL or no later than the start of the first drive cycle that begins with the MIL commanded off.

(ii) If all fault information in the on-board computer other than the permanent fault code has been cleared (i.e., through the use of a scan tool or battery disconnect) and the OBD system is not commanding the MIL on:

a. Except as provided for in section (d)(2.3.1)(C)(ii)c., if the monitor of the malfunction that caused the permanent fault code to be stored is subject to the minimum ratio requirements of section (d)(3.2) (e.g., catalyst monitor, comprehensive component input component rationality monitors), the OBD system shall erase the permanent fault code at the end of a driving cycle if the monitor has run and made one or more determinations during a driving cycle that the malfunction of the component or the system is not present and has not made any determinations within the same driving cycle that the malfunction is present.

b. If the monitor of the malfunction that caused the permanent fault code to be stored is not subject to the minimum ratio requirements of section (d)(3.2) (e.g., gasoline misfire monitor, gasoline fuel system monitor, comprehensive component circuit continuity monitors), the OBD system shall erase the permanent fault code at the end of a driving cycle if:

1. The monitor has run and made one or more determinations during a driving cycle that the malfunction of the component or the system is not present and has not made any determinations within the same driving cycle that the malfunction is present;

2. The monitor has not made any determinations that the malfunction is present subsequent to the most recent driving cycle in which the criteria of section (d)(2.3.1)(C)(ii)b.1. are met; and
3. The following criteria are satisfied on any single driving cycle (which may be a different driving cycle than that in which the criteria of section (d)(2.3.1)(C)(ii)b.1. are satisfied):
   i. Except as provided in section (d)(2.3.1)(C)(ii)b.3.v. below, ~~C~~cumulative time since engine start is greater than or equal to 600 seconds;
   ii. Cumulative gasoline engine operation at or above 25 miles per hour or diesel engine operation at or above 1150 rpm, either of which occurs for greater than or equal to 300 seconds;
   iii. Continuous vehicle operation at idle (i.e., accelerator pedal released by driver and either vehicle speed less than or equal to one mile per hour or engine speed less than or equal to 200 rpm above normal warmed-up idle (as determined in the drive position for vehicles equipped with an automatic transmission)) for greater than or equal to 30 seconds; and
   iv. The monitor has not made any determinations that the malfunction is present.
   v. For hybrid vehicles, manufacturers shall use "cumulative propulsion system active time" in lieu of "cumulative time since engine start" for the criterion in section (d)(2.3.1)(C)(ii)b.3.i.
4. Monitors required to use "similar conditions" as defined in section (c) to store and erase pending and confirmed fault codes may not require that the similar conditions be met prior to erasure of the permanent fault code.

c. For monitors subject to section (d)(2.3.1)(C)(ii)a., the manufacturer may choose to erase the permanent fault code using the criteria under section (d)(2.3.1)(C)(ii)b. in lieu of the criteria under section (d)(2.3.1)(C)(ii)a.

d. For 2010 through 2012 model year engines, manufacturers may request Executive Officer approval to use alternate criteria to erase the permanent fault code. The Executive Officer shall approve alternate criteria that will not likely require driving conditions that are longer and more difficult to meet than those required under section (d)(2.3.1)(C)(ii)b.

(2.3.2) For vehicles using the SAE J1939 protocol for the standardized functions required in section (h):

(A) Extinguishing the MIL. Except as otherwise provided in sections (e)(1.4.2)(F), (e)(2.4.2)(D) and (e)(6.4.2) for fuel system malfunctions, misfire malfunctions, and empty reductant tanks, once the MIL has been illuminated, it ~~may~~ shall be extinguished after at least three subsequent sequential driving cycles during which the monitoring system responsible for illuminating the MIL functions and the previously detected malfunction is no longer present provided no other malfunction has been detected that would independently illuminate the MIL according to the requirements outlined above.

(B) Erasing a MIL-on fault code. The OBD system may erase a MIL-on fault code in conjunction with extinguishing the MIL as described under section (d)(2.3.2)(A). In addition to the erasure of the MIL-on fault code, the OBD system shall store a previously MIL-on fault code for that failure.

(C) Erasing a previously MIL-on fault code. For 2010 through 2015 model year engines, ~~T~~the OBD system may erase a previously MIL-on fault code if the identified malfunction has not been again detected in at least 40 ~~engine~~ warm-up cycles and the MIL is presently not illuminated for that malfunction. For 2016 and subsequent model year engines, the OBD system shall erase a previously MIL-on fault code if the identified malfunction has not been again detected in 40 warm-up cycles and the MIL is presently not illuminated for that malfunction.

(D) Erasing a permanent fault code. The OBD system shall erase a permanent fault code under the following conditions:

(i) If the OBD system is commanding the MIL on, the OBD system shall erase a permanent fault code only if the OBD system itself determines that the malfunction that caused the permanent fault code to be stored is no longer present and is not commanding the MIL on, pursuant to the requirements of section (d)(2.3.2)(A) (which for the purposes of this section shall apply to all monitors). Erasure of the permanent fault code shall occur in conjunction with extinguishing the MIL or no later than the start of the first drive cycle that begins with the MIL commanded off.

(ii) If all fault information in the on-board computer has been cleared (i.e., through the use of a scan tool or battery disconnect) and the OBD system is not commanding the MIL on:

a. Except as provided for in section (d)(2.3.2)(D)(ii)c., if the monitor of the malfunction that caused the permanent fault code to be stored is subject to the minimum ratio requirements of section (d)(3.2) (e.g., catalyst monitor, comprehensive component input component rationality monitors), the OBD system shall erase the permanent fault code at the end of a driving cycle if the monitor has run and made one or more determinations during a driving cycle that the malfunction of the component or the system is not present and has not made any determinations within the same driving cycle that the malfunction is present.

b. If the monitor of the malfunction that caused the permanent fault code to be stored is not subject to the minimum ratio requirements of section (d)(3.2) (e.g., continuous diesel fuel system monitors, comprehensive component circuit continuity monitors), the OBD system shall erase the permanent fault code at the end of a driving cycle if:

1. The monitor has run and made one or more determinations during a driving cycle that the malfunction of the component or

the system is not present and has not made any determinations within the same driving cycle that the malfunction is present;

2. The monitor has not made any determinations that the malfunction is present subsequent to the most recent driving cycle in which the criteria of section (d)(2.3.2)(D)(ii)b.1. are met; and
3. The following criteria are satisfied on any single driving cycle (which may be a different driving cycle than that in which the criteria of section (d)(2.3.2)(D)(ii)b.1. are satisfied):
   i. Except as provided in section (d)(2.3.2)(D)(ii)b.3.v. below, ~~C~~cumulative time since engine start is greater than or equal to 600 seconds;
   ii. Cumulative gasoline engine operation at or above 25 miles per hour or diesel engine operation at or above 1150 rpm, either of which occurs for greater than or equal to 300 seconds;
   iii. Continuous vehicle operation at idle (i.e., accelerator pedal released by driver and either vehicle speed less than or equal to one mile per hour or engine speed less than or equal to 200 rpm above normal warmed-up idle (as determined in the drive position for vehicles equipped with an automatic transmission)) for greater than or equal to 30 seconds; and
   iv. The monitor has not made any determinations that the malfunction is present.
   v. For hybrid vehicles, manufacturers shall use "cumulative propulsion system active time" in lieu of "cumulative time since engine start" for the criterion in section (d)(2.3.2)(D)(ii)b.3.i.
4. Monitors required to use "similar conditions" as defined in section (c) to store and erase pending and confirmed/MIL-on fault codes may not require that the similar conditions be met prior to erasure of the permanent fault code.

c. For monitors subject to section (d)(2.3.2)(D)(ii)a., the manufacturer may choose to erase the permanent fault code using the criteria under section (d)(2.3.2)(D)(ii)b. in lieu of the criteria under section (d)(2.3.2)(D)(ii)a.

d. For 2010 through 2012 model year engines, manufacturers may request Executive Officer approval to use alternate criteria to erase the permanent fault code. The Executive Officer shall approve alternate criteria that will not likely require driving conditions that are longer and more difficult to meet than those required under section (d)(2.3.2)(D)(ii)b.

(2.4) Exceptions to MIL and Fault Code Requirements.

(2.4.1) If the engine enters a default mode of operation, a manufacturer may request Executive Officer approval to be exempt from illuminating the MIL ~~if any of the following conditions listed below occurs~~. The Executive Officer shall approve the request upon determining that the manufacturer has submitted data and/or engineering evaluation that verify ~~the conditions below~~ either of the following:

(A) The default strategy (1) causes an overt indication (e.g., illumination of a red engine shut-down warning light) such that the driver is certain to respond and have the problem corrected, ~~and~~ (2) is not caused by ~~or invoked to protect~~ a component required to be monitored by the OBD system under sections (e) through (g), and (3) is not invoked to protect a component required to be monitored by the OBD system under sections (e) through (g); or

(B) The default strategy is an AECD that is properly activated due to the occurrence of conditions that have been approved by the Executive Officer.

(2.4.2) For gasoline engines, a manufacturer may elect to meet the MIL and fault code requirements in title 13, CCR section 1968.2(d)(2) in lieu of meeting the requirements of (d)(2).

(3) Monitoring Conditions.

Section (d)(3) sets forth the general monitoring requirements while sections (e) through (g) sets forth the specific monitoring requirements as well as identifies which of the following general monitoring requirements in section (d)(3) are applicable for each monitored component or system identified in sections (e) through (g).

(3.1) For all engines:

(3.1.1) As specifically provided for in sections (e) through (g), manufacturers shall define monitoring conditions, subject to Executive Officer approval, for detecting malfunctions identified in sections (e) through (g). The Executive Officer shall approve manufacturer-defined monitoring conditions that are determined (based on manufacturer-submitted data and/or other engineering documentation) to be: technically necessary to ensure robust detection of malfunctions (e.g., avoid false passes and false indications of malfunctions); designed to ensure monitoring will occur under conditions that may reasonably be expected to be encountered in normal vehicle operation and use; and designed to ensure monitoring will occur during the FTP cycle.

(3.1.2) Monitoring shall occur at least once per driving cycle in which the monitoring conditions are met.

(3.1.3) Manufacturers may request Executive Officer approval to define monitoring conditions that are not encountered during the FTP cycle as required in section (d)(3.1.1). In evaluating the manufacturer's request, the Executive Officer shall 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 in section (d)(3.2), the ability of the manufacturer to demonstrate the monitoring conditions will satisfy the minimum acceptable in-use monitor performance ratio requirement as defined in section (d)(3.2) (e.g., data which show in-use driving meets the minimum requirements).

(3.2) As specifically provided for in sections (e) through (g), manufacturers shall define monitoring conditions in accordance with the criteria in sections (d)(3.2.1) through (3.2.3).

(3.2.1) Manufacturers shall 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 (d)(5):

(A) NMHC converting catalyst (section (e)(5.3.1))

(B) NOx converting catalyst (section (e)(6.3.1))

(C) Catalyst (section (f)(6.3));

(D) Exhaust gas sensor (sections (e)(9.3.1)(A) or (f)(8.3.1)(A));

(E) Evaporative system (section (f)(7.3.2));

(F) EGR system (sections (e)(3.3.2) and (3.3.3) or (f)(3.3.1)) and VVT system (sections (e)(10.3) or (f)(9.3));

(G) Secondary air system (section (f)(5.3.1));

(H) PM filter (section (e)(8.3));

(I) Boost pressure control system (sections (e)(4.3.2) and (e)(4.3.3));

(J) NOx adsorber (section (e)(7.3.1));

(K) Fuel system (section (e)(1.3.3)); and

(L) Secondary oxygen sensor (section (f)(8.3.2)(A)).

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

(3.2.2) For all 2013 and subsequent model year engines, manufacturers shall define monitoring conditions that, in addition to meeting the criteria in sections (d)(3.1) and (d)(3.2.1), ensure that the monitor yields an in-use performance ratio (as defined in section (d)(4)) that meets or exceeds the minimum acceptable in-use monitor performance ratio for in-use vehicles. For purposes of this regulation, the minimum acceptable in-use monitor performance ratio is 0.100 for all monitors specifically required in sections (e) through (g) to meet the monitoring condition requirements of section (d)(3.2).

(3.2.3) 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 (e.g., using a low ratio to enable more frequent monitoring through diagnostic executive priority or modification of other monitoring conditions, or using a high ratio to enable less frequent monitoring).

(3.2.4) Upon request of a manufacturer or upon the best engineering judgment of ARB, the Executive Officer may revise the minimum acceptable in-use monitoring performance ratio specified in section (d)(3.2.2) for a specific monitor if the most reliable monitoring method developed requires a lower ratio.

(4) In-Use Monitor Performance Ratio Definition.

(4.1) For monitors required to meet the requirements in section (d)(3.2), the ratio shall be calculated in accordance with the following specifications for the numerator, denominator, and ratio.

(4.2) Numerator Specifications

(4.2.1) Definition: The numerator is 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.

(4.2.2) Specifications for incrementing:

(A) Except as provided for in section (d)(4.2.2)(E), the numerator, when incremented, shall be incremented by an integer of one. The numerator may not be incremented more than once per driving cycle.

(B) The numerator for a specific monitor shall be incremented within 10 seconds if and only if the following criteria are satisfied on a single driving cycle:

(i) Every monitoring condition necessary for the monitor of the specific component to detect a malfunction and store a pending fault code has been satisfied, including enable criteria, presence or absence of related fault codes, 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 the component is passing may not, by itself, be sufficient to meet this criteria.

(ii) For monitors that require multiple stages or events in a single driving cycle to detect a malfunction, every monitoring condition necessary for all events to have completed must be satisfied.

(iii) For monitors that require intrusive operation of components to detect a malfunction, a manufacturer shall request Executive Officer approval of the strategy used to determine that, had a malfunction been present, the monitor would have detected the malfunction. Executive Officer approval of the request shall be based on the equivalence of the strategy to actual intrusive operation and the ability of the strategy to accurately determine if every monitoring condition necessary for the intrusive event to occur was satisfied.

(iv) For the secondary air system monitor, the criteria in sections (d)(4.2.2)(B)(i) through (iii) above are satisfied during normal operation of the secondary air system. Monitoring during intrusive operation of the secondary air system later in the same driving cycle solely for the purpose of monitoring may not, by itself, be sufficient to meet this criteria.

(C) 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 shall submit a plan for appropriate incrementing of the numerator to the Executive Officer for review and approval. In general, the Executive Officer shall not approve plans that allow the numerator to be incremented when the monitor indicates a result in the "non-detection zone" or prior to the monitor reaching a decision. In reviewing the plan for approval, the Executive Officer shall consider data and/or engineering evaluation submitted by the manufacturer demonstrating the expected frequency of results in the "non-detection zone" and the ability of the monitor to accurately determine if a monitor would have detected a malfunction instead of a result in the "non-detection zone" had an actual malfunction been present.

(D) For monitors that run or complete during engine-off operation, the numerator shall be incremented within 10 seconds after the monitor has completed during engine-off operation or during the first 10 seconds of engine start on the subsequent driving cycle.

(E) Except as specified in section (d)(4.2.2)(F) for exponentially weighted moving averages, manufacturers utilizing alternate statistical MIL illumination protocols as allowed in sections (d)(2.2.1)(C) and (d)(2.2.2)(C) for any of the monitors requiring a numerator shall submit a plan for appropriate incrementing of the numerator to the Executive Officer for review and approval. Executive Officer approval of the plan shall be conditioned upon the manufacturer providing supporting data and/or engineering evaluation demonstrating the equivalence of the incrementing in the manufacturer's plan to the incrementing specified in section (d)(4.2.2) for monitors using the standard MIL illumination protocol and the overall equivalence of the manufacturer's plan in determining that the minimum acceptable in-use performance ratio in section (d)(3.2) is satisfied.

(F) Manufacturers using an exponentially weighted moving average (EWMA) as the alternate statistical MIL illumination protocol approved in accordance with sections (d)(2.2.1)(C) and (d)(2.2.2)(C) shall increment the numerator as follows:

(i) Following a reset or erasure of the EWMA result, the numerator may not be incremented until after the requisite number of decisions necessary for MIL illumination have been fully executed.

(ii) After the number of decisions required in section (d)(4.2.2)(F)(i) above, the numerator, when incremented, shall be incremented by an integer of one and may not be incremented more than once per driving cycle. Incrementing of the numerator shall also be in accordance with sections (d)(4.2.2)(B), (C), and (D).

(4.3) Denominator Specifications

(4.3.1) Definition: The denominator is defined as a measure of the number of times a vehicle has been operated as defined in (d)(4.3.2).

(4.3.2) Specifications for incrementing:

(A) The denominator, when incremented, shall be incremented by an integer of one. The denominator may not be incremented more than once per driving cycle.

(B) Except as provided for in sections (d)(4.3.2)(F), (I), and (J), ~~T~~the denominator for each monitor shall be incremented within 10 seconds if and only if the following criteria are satisfied on a single driving cycle:

(i) Cumulative time since engine start of driving cycle is greater than or equal to 600 seconds while at an elevation of less than 8,000 feet above sea level and at an ambient temperature of greater than or equal to 20 degrees Fahrenheit;

(ii) Cumulative gasoline engine operation at or above 25 miles per hour or diesel engine operation at or above 1150 rpm, either of which occurs for greater than or equal to 300 seconds while at an elevation of less than 8,000 feet above sea level and at an ambient temperature of greater than or equal to 20 degrees Fahrenheit; and

(iii) Continuous vehicle operation at idle (i.e., accelerator pedal released by driver and either vehicle speed less than or equal to one mile per hour or engine speed less than or equal to 200 rpm above normal warmed-up idle (as determined in the drive position for vehicles equipped with an automatic transmission)) for greater than or equal to 30 seconds while at an elevation of less than 8,000 feet above sea level and at an ambient temperature of greater than or equal to 20 degrees Fahrenheit.

(iv) For 2010 through 2012 model year diesel engines, manufacturers may use diesel engine operation at or above 15% calculated load in lieu of 1150 rpm for the criterion in section (d)(4.3.2)(B)(ii) above.

(C) In addition to the requirements of section (d)(4.3.2)(B) above, for the evaporative system monitor ~~denominator(s)~~, the comprehensive component input component temperature sensor rationality monitors (section (g)(3)) (e.g., intake air temperature sensor, ambient temperature sensor, fuel temperature sensor), and the engine cooling system input components (section (g)(1)), the denominator(s) shall be incremented if and only if:

(i) Cumulative time since engine start of driving cycle is greater than or equal to 600 seconds while at an ambient temperature of greater than or equal to 40 degrees Fahrenheit but less than or equal to 95 degrees Fahrenheit; and

(ii) 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.

(D) In addition to the requirements of section (d)(4.3.2)(B) above, the denominator(s) for the following monitors shall be incremented if and only if the component or strategy is commanded "on" for a cumulative time greater than or equal to 10 seconds:

(i) Secondary Air System (section (f)(5))

(ii) Cold Start Emission Reduction Strategy (sections (e)(11) or (f)(4))

(iii) 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" (section (g)(4)) or comprehensive component output components (section (g)(3))

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 driving cycle solely for the purposes of monitoring.

(E) In addition to the requirements of section (d)(4.3.2)(B) above, the denominator(s) for the following component monitors ~~of output components~~ (except those operated only at engine start-up and subject to the requirements of the previous section (d)(4.3.2)(D)) shall be incremented if and only if the component is commanded to function (e.g., commanded "on", "open", "closed", "locked") for a cumulative time greater than or equal to 10 seconds:

(i) Variable valve timing and/or control system (sections (e)(10) or (f)(9))
(ii) "Other emission control systems" (section (g)(4))
(iii) Comprehensive component output component (section (g)(3)) (e.g., turbocharger waste-gates, variable length manifold runners)
(iv) PM filter active/intrusive injection (section (e)(8.2.6))
(v) PM sensor heater (section (e)(9.2.4)(A))

As an alternative, in addition to the requirements of section (d)(4.3.2)(B), the ~~manufacturers~~ manufacturer may use the criteria specified in title 13, CCR section 1968.2(d)(4.3.2)(F) in lieu of the criteria specified in section (d)(4.3.2)(E) above.

For the PM filter active/intrusive injection monitor, as an alternative for 2010 through 2015 model year engines, the manufacturer may use the criteria in section (d)(4.3.2)(H) in lieu of the criteria specified in section (d)(4.3.2)(E) above.

For the PM sensor heater monitor, as an alternative for 2010 through 2015 model year engines, the manufacturer may use the criteria specified in section (d)(4.3.2)(B) in lieu of the criteria specified in section (d)(4.3.2)(E) above.

(F) For ~~monitors of~~ the following ~~components~~ components monitors, the manufacturer may request Executive Officer approval to use alternate or additional criteria to that set forth in section (d)(4.3.2)(B) above for incrementing the denominator. Executive Officer approval of the proposed criteria shall be based on the equivalence of the proposed criteria in measuring the frequency of monitor operation relative to the amount of vehicle operation in accordance with the criteria in section (d)(4.3.2)(B) above:
~~(i) Engine cooling system input components (section (g)(1))~~
~~(ii)~~(i) "Other emission control systems" (section (g)(4))
~~(iii)~~(ii) Comprehensive component input components that require extended monitoring evaluation (section (g)(3)) (e.g., stuck fuel level sensor rationality)
~~(iv)Comprehensive component input component temperature sensor rationality monitors (section (g)(3)) (e.g., intake air temperature sensor, ambient temperature sensor, fuel temperature sensor)~~
~~(v)~~(iii) PM filter frequent regeneration (section (e)(8.2.2))
(iv) PM sensor monitoring capability monitor (section (e)(9.2.2)(D))

(G) For ~~monitors of~~ the following monitors of components or other emission controls that experience infrequent regeneration events, the denominator(s) shall be incremented during a driving cycle in which the following two criteria are met: (1) the requirements of section (d)(4.3.2)(B) are met on the current driving cycle, and (2) the number of minutes of cumulative engine run time since the denominator was last incremented is greater than or equal to 800 minutes. The 800-minute engine run time counter shall be reset to zero and begin counting again after the denominator has been incremented and no later than the start of the next ignition cycle:
(i) Diesel NMHC converting catalyst (section (e)(5.2.2))
(ii) Diesel NMHC converting catalyst other aftertreatment assistance functions (sections (e)(5.2.3)(B) and (D))

(iii) ~~Particulate matter~~ Catalyzed PM filters~~s~~ NMHC conversion (sections ~~(e)(8.2.1),~~ (e)(8.2.4)~~, and (8.2.5)~~)

(iv) 2010 through 2015 model year PM filter filtering performance and missing substrate (sections (e)(8.2.1) and (8.2.5))

As an alternative, for 2010 through 2012 model year engines, the manufacturer may request Executive Officer approval to use alternate or additional criteria to that set forth in section (d)(4.3.2)(G) above for incrementing the denominator. Executive Officer approval of the proposed criteria shall be based on the effectiveness of the proposed criteria in measuring the frequency of monitor operation relative to the amount of vehicle operation.

(H) For 2013 and subsequent model year engines, in addition to the requirements of section (d)(4.3.2)(B) above, the denominator(s) for the following monitors shall be incremented if and only if a regeneration event is commanded for a time greater than or equal to 10 seconds:

(i) Diesel NMHC converting catalyst other aftertreatment assistance functions (sections (e)(5.2.3)(A) and (C))

(ii) PM filter incomplete regeneration (section (e)(8.2.3))

~~(iii) PM filter active/intrusive injection (section (e)(8.2.6))~~

(I) For ~~hybrid vehicles,~~ vehicles that employ alternate engine start hardware or strategies (e.g., ~~integrated starter and generators~~ a vehicle with a start-stop system that does not meet the definition of a hybrid vehicle as defined in section (c))~~,~~ or alternate~~-~~fueled ~~vehicles~~ engines ~~(e.g., dedicated, bi fuel, or dual fuel applications)~~, the manufacturer may request Executive Officer approval to use alternate criteria to that set forth in section (d)(4.3.2)(B) above for incrementing the denominator. In general, the Executive Officer shall not approve alternate criteria for vehicles that only employ engine shut off at or near idle/vehicle stop conditions. Executive Officer approval of the alternate criteria shall be based on the equivalence of the alternate criteria to determine the amount of vehicle operation relative to the measure of conventional vehicle operation in accordance with the criteria in section (d)(4.3.2)(B) above.

(J) For hybrid vehicles, in lieu of the criteria in section (d)(4.3.2)(B) above, the denominator for each monitor shall be incremented within ten seconds if and only if the following criteria are satisfied on a single driving cycle:

(i) Cumulative propulsion system active time is greater than or equal to 600 seconds while at an elevation of less than 8,000 feet above sea level and at an ambient temperature of greater than or equal to 20 degrees Fahrenheit;

(ii) Cumulative gasoline engine operation at or above 25 miles per hour or diesel engine operation at or above 1150 rpm, either of which occurs for greater than or equal to 300 seconds while at an elevation of less than 8,000 feet above sea level and at an ambient temperature of greater than or equal to 20 degrees Fahrenheit;

(iii) Continuous vehicle operation at idle (i.e., accelerator pedal released by driver and either vehicle speed less than or equal to one mile per hour or engine speed less than or equal to 200 rpm above normal warmed-up idle (as determined in the drive position for vehicles equipped with an automatic transmission)) for greater than or equal to 30 seconds while at an elevation of less than 8,000 feet above sea level and at an ambient temperature of greater than or equal to 20 degrees Fahrenheit; and

(iv) Cumulative fueled engine operation for greater than or equal to 10 seconds while at an elevation of less than 8,000 feet above sea level and at an ambient temperature of greater than or equal to 20 degrees Fahrenheit.

As an alternative, for 2010 through 2015 model year hybrid vehicles, the manufacturer may use the criteria specified in section (d)(4.3.2)(I) in lieu of the criteria specified in section (d)(4.3.2)(J) above.

(4.4) Ratio Specifications

(4.4.1) Definition: The ratio is defined as the numerator divided by the denominator.

(4.5) Disablement of Numerators and Denominators

(4.5.1) Within 10 seconds of a malfunction being detected (i.e., a pending, confirmed, or MIL-on fault code being stored) that disables a monitor required to meet the monitoring conditions in section (d)(3.2), the OBD system shall 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 code is erased through self-clearing or through a scan tool command), incrementing of all corresponding numerators and denominators shall resume within 10 seconds.

(4.5.2) Within 10 seconds of the start of a PTO (see section (c)) operation that disables a monitor required to meet the monitoring conditions in section (d)(3.2), the OBD system shall 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 shall resume within 10 seconds.

(4.5.3) The OBD system shall disable further incrementing of all numerators and denominators within 10 seconds if a malfunction of any component used to determine if the criteria ~~in~~ of sections (d)(4.3.2)(B) ~~through (C)~~ are satisfied (i.e., vehicle speed/calculated load, ambient temperature, elevation, idle operation, ~~engine cold start,~~ or time of operation) has been detected (i.e., a pending, confirmed, or MIL-on fault code has been stored). Incrementing of all numerators and denominators shall resume within 10 seconds from when the malfunction is no longer present (e.g., pending code erased through self-clearing or by a scan tool command).

(5) Standardized tracking and reporting of monitor performance.

(5.1) For monitors required to track and report in-use monitor performance in section (d)(3.2), the performance data shall be tracked and reported in accordance with the specifications in sections (d)(4), (d)(5), and (h)(5.1). The OBD system shall separately report an in-use monitor performance numerator and denominator for each of the following components:

(5.1.1) For diesel engines, fuel system, NMHC catalyst ~~bank 1, NMHC catalyst bank 2, NOx catalyst bank 1~~, NOx catalyst ~~bank 2~~, exhaust gas sensor

~~bank 1, exhaust gas sensor bank 2~~, EGR/VVT system, PM filter, boost pressure control system, and NOx adsorber. The OBD system shall also report a general denominator and an ignition cycle counter in the standardized format specified in sections (d)(5.5), (d)(5.6), and (h)(5.1).

(5.1.2) For gasoline engines, catalyst bank 1, catalyst bank 2, primary oxygen sensor bank 1, primary oxygen sensor bank 2, secondary oxygen sensor, evaporative leak detection system, EGR/VVT system, and secondary air system. The OBD system shall also report a general denominator and an ignition cycle counter in the standardized format specified in sections (d)(5.5), (d)(5.6), and (h)(5.1).

(5.2) Numerator

(5.2.1) The OBD system shall report a separate numerator for each of the components listed in section (d)(5.1).

(5.2.2) For specific components or systems that have multiple monitors that are required to be reported under section (e) (e.g., exhaust gas sensor bank 1 may have multiple monitors for sensor response or other sensor characteristics), the OBD system shall 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 shall be reported for the specific component.

(5.2.3) The numerator(s) shall be reported in accordance with the specifications in section (h)(5.1.2)(A).

(5.3) Denominator

(5.3.1) The OBD system shall report a separate denominator for each of the components listed in section (d)(5.1).

(5.3.2) The denominator(s) shall be reported in accordance with the specifications in section (h)(5.1.2)(A).

(5.4) Ratio

(5.4.1) For purposes of determining which corresponding numerator and denominator to report as required in section (d)(5.2.2), the ratio shall be calculated in accordance with the specifications in section (h)(5.1.2)(B).

(5.5) Ignition cycle counter

(5.5.1) Definition:

(A) The ignition cycle counter is defined as a counter that indicates the number of ignition cycles a vehicle has experienced as defined in section (d)(5.5.2)(B).

(B) The ignition cycle counter shall be reported in accordance with the specifications in section (h)(5.1.2)(A).

(5.5.2) Specifications for incrementing:

(A) The ignition cycle counter, when incremented, shall be incremented by an integer of one. The ignition cycle counter may not be incremented more than once per ignition cycle.

(B) The ignition cycle counter shall be incremented within 10 seconds if and only if <u>the following criteria are met:</u>

<u>(i) Except as required in section (d)(5.5.2)(B)(ii) below,</u> 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.

(ii) For hybrid vehicles, the vehicle meets the propulsion system active definition (see section (c)) for at least two seconds plus or minus one second.

(C) The OBD system shall disable further incrementing of the ignition cycle counter within 10 seconds if a malfunction of any component used to determine if the criteria in section (d)(5.5.2)(B) are satisfied (i.e., engine speed or time of operation) has been detected and the corresponding pending fault code has been stored. The ignition cycle counter may not be disabled from incrementing for any other condition. Incrementing of the ignition cycle counter shall resume within 10 seconds when the malfunction is no longer present (e.g., pending code erased through self-clearing or by a scan tool command).

(5.6) General Denominator

(5.6.1) Definition:

(A) The general denominator is defined as a measure of the number of times a vehicle has been operated as defined in section (d)(5.6.2)(B).

(B) The general denominator shall be reported in accordance with the specifications in section (h)(5.1.2)(A).

(5.6.2) Specifications for incrementing:

(A) The general denominator, when incremented, shall be incremented by an integer of one. The general denominator may not be incremented more than once per driving cycle.

(B) The general denominator shall be incremented within 10 seconds if and only if the criteria identified in section (d)(4.3.2)(B) are satisfied on a single driving cycle.

(C) The OBD system shall disable further incrementing of the general denominator within 10 seconds if a malfunction of any component used to determine if the criteria in section (d)(4.3.2)(B) are satisfied (i.e., vehicle speed/load, ambient temperature, elevation, idle operation, or time of operation) has been detected and the corresponding pending fault code has been stored. The general denominator may not be disabled from incrementing for any other condition (e.g., the disablement criteria in sections (d)(4.5.1) and (d)(4.5.2) may not disable the general denominator). Incrementing of the general denominator shall resume within 10 seconds when the malfunction is no longer present (e.g., pending code erased through self-clearing or by a scan tool command).

(6) Malfunction Criteria Determination.

(6.1) In determining the malfunction criteria for diesel engine monitors in sections (e) and (g) that are required to indicate a malfunction before emissions exceed an emission threshold based on any applicable standard (e.g., 2.0 times any of the applicable standards), the manufacturer shall:

(6.1.1) Use the emission test cycle and standard (i.e., FTP or SET) determined by the manufacturer, through use of data and/or engineering analysis, to be more stringent (i.e., to result in higher emissions with the same level of monitored component malfunction) as the "applicable standard". The manufacturer shall use data and/or engineering analysis to determine the test cycle and standard that is more stringent.

(6.1.2) Identify in the certification documentation required under section (j), the test cycle and standard determined by the manufacturer to be more stringent for each applicable monitor.

(6.1.3) If the Executive Officer reasonably believes that a manufacturer has incorrectly determined the test cycle and standard that is more stringent, the Executive Officer shall require the manufacturer to provide emission data and/or engineering analysis showing that the other test cycle and standard are less stringent.

(6.2) On engines equipped with emission controls that experience infrequent regeneration events, a manufacturer shall adjust the emission test results that are used to determine the malfunction criterion for monitors that are required to indicate a malfunction before emissions exceed a certain emission threshold (e.g., 2.0 times any of the applicable standards). Except as provided in section (d)(6.2.3), for each monitor, the manufacturer shall adjust the emission result using the procedure described in CFR title 40, part 86.004-28(i) with the component for which the malfunction criteria is being established deteriorated to the malfunction threshold. The adjusted emission value shall be used for purposes of determining whether or not the specified emission threshold is exceeded (e.g., a malfunction must be detected before the adjusted emission value exceeds 2.0 times any applicable standard).

(6.2.1) For purposes of section (d)(6.2), "regeneration" means an event during which emissions levels change while the emission control performance is being restored by design.

(6.2.2) For purposes of section (d)(6.2), "infrequent" means having an expected frequency of less than once per FTP cycle.

(6.2.3) In lieu of using the procedure described in CFR title 40, part 86.004-28(i), the manufacturer may submit an alternate plan to calculate the adjustment factors for determining the adjusted emission values to the Executive Officer for review and approval. Executive Officer approval of the plan shall be conditioned upon the manufacturer providing data and/or engineering evaluation demonstrating the procedure is consistent with good engineering judgment in determining appropriate modifications to the tailpipe certification adjustment factors.

(6.3) In lieu of meeting the malfunction criteria for gasoline engine monitors in sections (f) and (g), the manufacturer may request Executive Officer approval to utilize OBD systems certified to the requirements of title 13, CCR section 1968.2 on medium-duty engines or vehicles. The Executive Officer shall approve the request upon finding that the manufacturer has used good engineering judgment in determining equivalent malfunction detection criteria on the heavy-duty engine.

(7) Implementation Schedule

(7.1) Except as specified in sections (d)(7.4) and (d)(7.5) for small volume manufacturers and alternate-fueled engines, for the 2010 through 2012 model year engines:

(7.1.1) Full OBD. Except as specified in section (d)(7.1.3) below, a manufacturer shall implement an OBD system meeting the requirements of section 1971.1 on one engine rating (i.e., the OBD parent rating) within one of the manufacturer's engine families. The OBD parent rating shall be from the manufacturer's heavy-duty engine family with the highest weighted sales number for the 2010 model year and shall be the engine rating with the highest weighted sales number within that engine family.

(7.1.2) Extrapolated OBD. For all other engine ratings within the engine family selected according to section (d)(7.1.1) (i.e., the OBD child ratings), except as specified in section (d)(7.1.3) below), a manufacturer shall implement an OBD system meeting the requirements of section 1971.1 with the exception that the OBD system is not required to detect a malfunction prior to exceeding the emission thresholds specified in the malfunction criteria in sections (e) through (g). In lieu of detecting a malfunction prior to exceeding the emission thresholds, a manufacturer shall submit a plan for Executive Officer review and approval detailing the engineering evaluation the manufacturer will use to establish the malfunction criteria for the OBD child ratings. The Executive Officer shall approve the plan upon determining that the manufacturer is using good engineering judgment to establish the malfunction criteria for robust detection of malfunctions, including consideration of differences of base engine, calibration, emission control components, and emission control strategies.

(7.1.3) For all engine ratings (i.e., OBD parent and OBD child ratings) within the engine family selected according to (d)(7.1.1):

(A) The OBD system is exempt from having to comply with the standardization requirements set forth in the incorporated documents to this regulation (e.g., SAE J1939 defined format) within the following sections:

(i) (d)(1.2) and (h)(2) (standardized connector)

(ii) (d)(2.1.1) and (2.1.5) (dedicated standardized MIL)

(iii) (h)(3) (communication protocol)

(iv) (h)(4) (standardized communication functions with respect to the requirements to make the data available in a standardized format or in accordance with SAE J1979/1939 specifications)

(v) (h)(5.1.1) and (h)(5.2.1) with respect to the requirements to make the data available in a standardized format or in accordance with SAE J1979/1939 specifications.

(B) The OBD system shall meet the requirements of either sections (d)(2.2.1) and (2.3.1) or (d)(2.2.2) and (2.3.2) regardless of the communication protocol (e.g., standardized, proprietary) used by the OBD system.

(7.1.4) Engine Manufacturer Diagnostic (EMD) Systems. For all engine ratings in the manufacturer's engine families not selected according to section (d)(7.1.1), a manufacturer shall:

(A) Implement an EMD system meeting the requirements of title 13, CCR section 1971 in lieu of meeting the requirements of section 1971.1; and

(B) Monitor the NOx aftertreatment (i.e., catalyst, adsorber) on engines so-equipped. A malfunction shall be detected if:

(i) The NOx aftertreatment system has no detectable amount of NOx aftertreatment capability (i.e., NOx catalyst conversion or NOx adsorption);

(ii) The NOx aftertreatment substrate is completely destroyed, removed, or missing; or

(iii) The NOx aftertreatment assembly is replaced with a straight pipe.

(7.2) Except as specified in section (d)(7.5) for alternate-fueled engines, for the 2013 through 2015 model year engines:

(7.2.1) A manufacturer shall be required to define one or more OBD groups to cover all engine ratings in all engine families.

(7.2.2) Full OBD. A manufacturer shall implement an OBD system meeting the requirements of section 1971.1:

(A) On all engine ratings (i.e., OBD parent and OBD child ratings) within the engine family selected according to section (d)(7.1.1); and

(B) On one engine rating (i.e., OBD parent rating) within each of the manufacturer's OBD groups. The OBD parent rating shall be the engine rating with the highest weighted sales number for the 2013 model year within each OBD group.

(7.2.3) Extrapolated OBD. For all engine ratings not subject to section (d)(7.2.2) (i.e., OBD child ratings), a manufacturer shall implement an OBD system meeting the requirements of section 1971.1 with the exception that the OBD system is not required to detect a malfunction prior to exceeding the emission thresholds specified in the malfunction criteria in sections (e) through (g). In lieu of detecting a malfunction prior to exceeding the emission thresholds, a manufacturer shall submit a plan for Executive Officer review and approval detailing the engineering evaluation the manufacturer will use to establish the malfunction criteria for the OBD child ratings. The Executive Officer shall approve the plan upon determining that the manufacturer is using good engineering judgment to establish the malfunction criteria for robust detection of malfunctions, including consideration of differences of base engine, calibration, emission control components, and emission control strategies.

(7.3) Except as specified in section (d)(7.5) for alternate-fueled engines, for the 2016 and subsequent model year engines:

(7.3.1) A manufacturer shall implement an OBD system meeting the requirements of section 1971.1 on all engine ratings in all engine families.

(7.4) Small volume manufacturers shall be exempt from the requirements of section 1971.1 for 2010 through 2012 model year engines. For purposes of this requirement, a small volume manufacturer is defined as a manufacturer with projected engine sales for California heavy-duty vehicles of less than 1200 engines per year for the 2010 model year.

(7.5) For alternate-fueled engines:

(7.5.1) For 2010 through 2012 model year engines, a manufacturer shall be exempt from the requirements of section 1971.1.

(7.5.2) For 2013 through ~~2019~~<u>2017</u> model year engines, the manufacturer shall:

(A) Implement an EMD system meeting the requirements of title 13, CCR section 1971 in lieu of meeting the requirements of section 1971.1; and

(B) Monitor the NOx aftertreatment (i.e., catalyst, adsorber) on engines so-equipped. A malfunction shall be detected if:

(i) The NOx aftertreatment system has no detectable amount of NOx aftertreatment capability (i.e., NOx catalyst conversion or NOx adsorption);
(ii) The NOx aftertreatment substrate is completely destroyed, removed, or missing; or
(iii) The NOx aftertreatment assembly is replaced with a straight pipe.

(7.5.3) For ~~2020~~ 2018 and subsequent model year engines, a manufacturer shall implement an OBD system meeting the requirements of section 1971.1. The manufacturer shall submit a plan to the Executive Officer for approval of the monitoring requirements in sections (e) through (g) determined by the manufacturer to be applicable to the engine. Executive Officer approval shall be based on the appropriateness of the monitoring plan with respect to the components and systems on the engine (e.g., a spark-ignited dedicated CNG engine with a particulate matter (PM) filter and a selective catalytic reduction (SCR) system would be monitored in accordance with the misfire monitoring requirements in section (f) for spark-ignited engines and with the PM filter and SCR system monitoring requirements in section (e) for diesel engines typically equipped with the same components).

(7.6) For 2013 model year hybrid vehicles: In lieu of meeting all other requirements of section 1971.1, a manufacturer may meet the alternative requirements set forth in sections (d)(7.6.1) through (d)(7.6.5) below for 2013 model year hybrid vehicles:

(7.6.1) A California-certified 2013 model year engine shall be used as the base engine in the hybrid vehicle design.

(7.6.2) Any modifications made to the base engine's certified OBD system shall be solely for the purpose of preventing false malfunction determinations that could otherwise occur as a result of the integration of the hybrid system hardware and software, and such modifications shall only be made to the extent necessary to achieve this purpose. All modifications are subject to Executive Officer approval. The Executive Officer shall grant approval upon determining that the modifications are necessary and reasonable for the purposes of preventing false malfunction determinations on in-use hybrid vehicles.

(7.6.3) Notwithstanding section (d)(7.6.2) above, no modifications shall be made that would render the certified base engine noncompliant with the EMD plus NOx aftertreatment monitoring requirements set forth in section (d)(7.1.4).

(7.6.4) For all hybrid components, manufacturers shall be exempt from the monitoring requirements of section (g)(3).

(7.6.5) Manufacturers shall apply for certification to the requirements of this section. The application for certification shall identify and describe the certified base engine, the hybrid system mated to it, all changes made to the certified engine along with the rationale describing the need for each change, and the vehicle applications into which the hybrid system will be installed.

(e) *Monitoring Requirements for Diesel/Compression-Ignition Engines.*

(1) Fuel System Monitoring

(1.1) Requirement:

The OBD system shall monitor the fuel delivery system to determine its ability to comply with ~~emission~~ applicable standards. The individual electronic components (e.g., actuators, valves, sensors, pumps) that are used in the fuel system and not specifically addressed in this section shall be monitored in accordance with the comprehensive component requirements in section (g)(3).

(1.2) Malfunction Criteria:

(1.2.1) Fuel system pressure control: The OBD system shall detect a malfunction of the fuel system pressure control system (e.g., fuel, hydraulic fluid) when the fuel system pressure control system is unable to maintain an engine's NMHC, NOx, or CO emissions at or below 2.0 times the applicable standards or the engine's PM emissions at or below the applicable standard plus 0.02 grams per brake horsepower-hour (g/bhp-hr). For engines in which no failure or deterioration of the fuel system pressure control could result in an engine's emissions exceeding these emission levels, the OBD system shall detect a malfunction when the system has reached its control limits such that the commanded fuel system pressure cannot be delivered.

(1.2.2) Injection quantity: The OBD system shall detect a malfunction of the fuel injection system when the system is unable to deliver the commanded quantity of fuel necessary to maintain an engine's NMHC, CO, and NOx emissions at or below 2.0 times the applicable standards or the engine's PM emissions at or below the applicable standard plus 0.02 g/bhp-hr. For engines in which no failure or deterioration of the fuel injection quantity could result in an engine's emissions exceeding these emission levels, the OBD system shall detect a malfunction when the system has reached its control limits such that the commanded fuel quantity cannot be delivered.

(1.2.3) Injection Timing: The OBD system shall detect a malfunction of the fuel injection system when the system is unable to deliver fuel at the proper crank angle/timing (e.g., injection timing too advanced or too retarded) necessary to maintain an engine's NMHC, CO, and NOx emissions at or below 2.0 times the applicable standards or the engine's PM emissions at or below the applicable standard plus 0.02 g/bhp-hr. For engines in which no failure or deterioration of the fuel injection timing could result in an engine's emissions exceeding these emission levels, the OBD system shall detect a malfunction when the system has reached its control limits such that the commanded fuel injection timing cannot be achieved.

(1.2.4) Feedback control: Except as provided for in section (e)(1.2.5), if the engine is equipped with feedback or feed-forward control of the fuel system (e.g., feedback control of pressure or pilot injection quantity), the OBD system shall detect a malfunction:

(A) If the system fails to begin control within a manufacturer specified time interval;

(B) If a failure or deterioration causes open loop or default operation; or

(C) If the control system has used up all of the adjustment allowed by the manufacturer or reached its maximum authority and cannot achieve the target.

(1.2.5) A manufacturer may request Executive Officer approval to temporarily disable monitoring for the malfunction criteria specified in section (e)(1.2.4)(C) during conditions that a manufacturer cannot robustly distinguish between a malfunctioning system and a properly operating system. The Executive Officer shall approve the disablement upon the manufacturer submitting data and/or analysis demonstrating that the control system, when operating as designed on an engine with all emission controls working properly, routinely operates during these conditions with all of the adjustment allowed by the manufacturer used up.

(1.2.6) In lieu of detecting the malfunctions specified in sections (e)(1.2.4)(A) and (B) with a fuel system-specific monitor, the OBD system may monitor the individual parameters or components that are used as inputs for fuel system feedback control provided that the monitors detect all malfunctions that meet the criteria in sections (e)(1.2.4)(A) and (B).

(1.2.7) For purposes of determining the fuel system malfunction criteria in sections (e)(1.2.1) through (1.2.3):

(A) For 2010 through 2012 model year engines, the malfunction criteria shall be established by using a fault that affects either a single injector or all injectors equally.

(B) For 2013 and subsequent model year engines, for section (e)(1.2.1), the malfunction criteria shall be established by using a fault that affects all injectors equally. Additionally, for systems that have single component failures which could affect a single injector (e.g., systems that build injection pressure within the injector that could have a single component pressure fault caused by the injector itself), the malfunction criteria shall also be established by using a fault that affects a single injector.

(C) For 2013 and subsequent model year engines, for sections (e)(1.2.2) through (1.2.3), the malfunction criteria shall be established by both (1) a fault that affects all the injectors equally and (2) a fault that affects only one injector.

(1.3) Monitoring Conditions:

(1.3.1) Except as provided in sections (e)(1.3.2) and (e)(1.3.4), the OBD system shall monitor continuously for malfunctions identified in sections (e)(1.2.1) and (e)(1.2.4) (i.e., fuel pressure control and feedback operation).

(1.3.2) For fuel systems that achieve injection fuel pressure within the injector or increase pressure within the injector (e.g. in the injector of an amplified common rail system), manufacturers may request Executive Officer approval to define the monitoring conditions for malfunctions identified in sections (e)(1.2.1) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements). The Executive Officer shall approve the monitoring conditions upon the manufacturer submitting data and/or analysis identifying all possible failure modes and the effect each has (e.g., failure modes and effects analysis) on fuel pressure across the entire range of engine operating conditions, and upon the Executive Officer determining based on the data and/or analysis that the monitoring conditions allow for robust detection of all causes of fuel pressure malfunctions.

(1.3.3) Manufacturers shall define the monitoring conditions for malfunctions identified in sections (e)(1.2.2) and (e)(1.2.3) (i.e., injection quantity and timing) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements). For all 2013 and subsequent model year engines, for purposes of tracking and reporting as required in section (d)(3.2.1), all monitors used to detect malfunctions identified in sections (e)(1.2.2) and (e)(1.2.3) shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

(1.3.4) Manufacturers may request Executive Officer approval to temporarily disable continuous monitoring under conditions technically necessary to ensure robust detection of malfunctions and to avoid false passes and false indications of malfunctions. The Executive Officer shall approve the request upon determining that the manufacturer has submitted data and/or an engineering evaluation which demonstrate that a properly operating system cannot be distinguished from a malfunctioning system and that the disablement interval is limited only to that which is technically necessary.

(1.4) MIL Illumination and Fault Code Storage:

(1.4.1) General requirements for MIL illumination and fault code storage are set forth in section (d)(2).

(1.4.2) Additionally, for malfunctions identified in section (e)(1.2.1) (i.e., fuel pressure control) on all 2013 and subsequent model year ~~vehicles~~ engines:

(A) A pending fault code shall be stored immediately upon the fuel system exceeding the malfunction criteria established pursuant to section (e)(1.2.1).

(B) Except as provided below, if a pending fault code is stored, the OBD system shall immediately illuminate the MIL and store a confirmed/MIL-on fault code if a malfunction is again detected during either of the following two events: (a) the driving cycle immediately following the storage of the pending fault code, regardless of the conditions encountered during the driving cycle; or (b) on the next driving cycle in which similar conditions (see section (c)) to those that occurred when the pending fault code was stored are encountered.

(C) The pending fault code may be erased at the end of the next driving cycle in which similar conditions have been encountered without an exceedance of the specified fuel system malfunction criteria. The pending code may also be erased if similar conditions are not encountered during the 80 driving cycles immediately after the initial detection of a malfunction for which the pending code was set.

(D) Storage of freeze frame conditions.

(i) A manufacturer shall store and erase freeze frame conditions either in conjunction with storing and erasing a pending fault code or in conjunction with storing and erasing a confirmed/MIL-on fault code.

(ii) If freeze frame conditions are stored for a malfunction other than misfire (see section (e)(2)) or fuel system malfunction when a fault code is stored as specified in section (e)(1.4.2) above, the stored freeze frame information shall be replaced with freeze frame information regarding the fuel system malfunction.

(E) Storage of fuel system conditions for determining similar conditions of operation.

(i) Upon detection of a fuel system malfunction under section (e)(1.4.2), the OBD system shall store the engine speed, load, and warm-up status of the first fuel system malfunction that resulted in the storage of the pending fault code.

(ii) The manufacturer may request Executive Officer approval to use an alternate definition of similar conditions in lieu of the definition specified in section (c). The Executive Officer shall approve the alternate definition upon the manufacturer providing data or analysis demonstrating that the alternate definition provides for equivalent robustness in detection of fuel system faults that vary in severity depending on engine speed, load, and/or warm-up status.

(F) Extinguishing the MIL. The MIL may be extinguished after three sequential driving cycles in which similar conditions have been encountered without a malfunction of the fuel system.

(2) Misfire Monitoring

(2.1) Requirement:

(2.1.1) The OBD system shall monitor the engine for misfire~~ causing excess emissions~~. The OBD system shall be capable of detecting misfire occurring in one or more cylinders. To the extent possible without adding hardware for this specific purpose, the OBD system shall also identify the specific misfiring cylinder.

(2.1.2) If more than one cylinder is continuously misfiring, a separate fault code shall be stored indicating that multiple cylinders are misfiring. When identifying multiple cylinder misfire, the ~~manufacturer~~ OBD system is not required to also identify each of the continuously misfiring cylinders individually through separate fault codes.

(2.2) Malfunction Criteria:

(2.2.1) The OBD system shall detect a misfire malfunction when one or more cylinders are continuously misfiring.

(2.2.2) Additionally, for 2013 ~~and subsequent~~through 2015 model year engines equipped with sensors that can detect combustion or combustion quality (e.g., for use in homogeneous charge compression ignition (HCCI) control systems) and for 20 percent of 2016 model year diesel engines, 50 percent of 2017 model year diesel engines, and 100 percent of 2018 model year diesel engines (percentage based on the manufacturer's projected California sales volume of all diesel engines subject to this regulation), the OBD system shall detect a misfire malfunction when the percentage of misfire is equal to or exceeds five percent~~ causing the engine's NMHC, CO, or NOx emissions to exceed 2.0 times the applicable standards or the engine's PM emissions to exceed the applicable standard plus 0.02 g/bhp-hr~~.

(A) Manufacturers shall ~~determine~~ evaluate the percentage of misfire ~~evaluated~~ in 1000 revolution increments ~~that would cause NMHC, CO, or NOx emissions from an emission durability demonstration engine to exceed 2.0 times any of the applicable standards or PM emissions to exceed the applicable standard plus 0.02 g/bhp-hr if the percentage of misfire were present from the beginning of the test. To establish this percentage of misfire, the manufacturer shall utilize misfire events occurring at equally spaced, complete engine cycle intervals, across randomly selected cylinders throughout each 1000-revolution increment. If this percentage of misfire is determined to be lower than one percent, the manufacturer may set the malfunction criteria at one percent.~~

(B) Subject to Executive Officer approval, a manufacturer may employ other revolution increments. The Executive Officer shall grant approval upon determining that the manufacturer has demonstrated that the strategy would be equally effective and timely in detecting misfire.

(2.2.3) A malfunction shall be detected if the percentage of misfire ~~established~~ specified in section (e)(2.2.2)~~(A)~~ is exceeded regardless of the pattern of misfire events (e.g., random, equally spaced, continuous).

(2.2.4) For multiple cylinder misfire situations that result in a misfire rate greater than or equal to 50 percent of all engine firings, the OBD system shall only be required to detect a misfire malfunction for situations that are caused by a single component failure.

(2.2.5) Upon request by the manufacturer and upon determining that the manufacturer has submitted data and/or engineering evaluation that support the request, the Executive Officer shall revise the percentage of misfire malfunction criteria in section (e)(2.2.2) upward to exclude detection of misfire that cannot cause the engine's NMHC, CO, and NOx emissions to exceed 2.0 times the applicable standards and the engine's PM emissions to exceed the applicable standard plus 0.02 g/bhp-hr.

(2.3) Monitoring Conditions:

(2.3.1) Except as provided in section (e)(2.3.2), ~~T~~the OBD system shall monitor for misfires identified in section (e)(2.2.1) during engine idle conditions at least once per driving cycle in which the monitoring conditions for misfire are met. A manufacturer shall submit monitoring conditions to the Executive Officer for approval. The Executive Officer shall approve manufacturer-defined monitoring conditions that are determined (based on manufacturer-submitted data and/or other engineering documentation) to: (i) be technically necessary to ensure robust detection of malfunctions (e.g., avoid false passes and false detection of malfunctions), (ii) require no more than 1000 cumulative engine revolutions, and (iii) do not require any single continuous idle operation of more than 15 seconds to make a determination that a malfunction is present (e.g., a decision can be made with data gathered during several idle operations of 15 seconds or less); or satisfy the requirements of (d)(3.1) with alternative engine operating conditions.

(2.3.2) Manufacturers may request Executive Officer approval to use alternate monitoring conditions (e.g., off-idle) in lieu of the monitoring conditions specified in section (e)(2.3.1). The Executive Officer shall approve alternate monitoring conditions that are determined (based on manufacturer-submitted data and/or other engineering documentation) to ensure equivalent robust detection of malfunctions and equivalent timeliness in detection of malfunctions.

(2.3.3) ~~Additionally, f~~For misfires identified in section (e)(2.2.2) ~~2013 and subsequent model year engines equipped with sensors that can detect combustion or combustion quality~~:

(A) The OBD system shall continuously monitor for misfire under the following conditions:

(i) For 2013 through 2018 model year engines and 2019 and subsequent model year engines that are not included in the phase-in specified in section (e)(2.3.3)(A)(ii), ~~all~~ under positive torque conditions with engine speeds up to 75 percent of the maximum-rated engine speed and engine load up to 75 percent maximum-rated ~~and~~ load ~~conditions~~ except within the following range~~.~~: the engine operating region bound by the positive torque line (i.e., engine load with transmission in neutral) and the two following engine-operating points: engine speed of 50 percent of maximum-rated engine speed with the engine load at the positive torque line, and 75 percent of the maximum-rated engine speed with the engine load 5 percent above the positive torque line.

(ii) For 20 percent of 2019 model year diesel engines, 50 percent of 2020 model year diesel engines, and 100 percent of 2021 model year diesel engines (percentage based on the manufacturer's projected California sales volume of all diesel engines subject to this regulation), under all positive torque engine speed and load conditions.

(B) If a monitoring system cannot detect all misfire patterns under all required engine speed and load conditions as required in section (e)(2.3.3)(A), the manufacturer may request Executive Officer approval to accept the monitoring system. In evaluating the manufacturer's request, the Executive Officer shall consider the following factors: the magnitude of the region(s) in which misfire detection is limited, the degree to which misfire detection is limited in the region(s) (i.e., the probability of detection of misfire events), the frequency with which said region(s) are expected to be encountered in-use, the type of misfire patterns for which misfire detection is troublesome, ~~and~~ demonstration that the monitoring technology employed is not inherently incapable of detecting misfire under required conditions (i.e., compliance can be achieved on other engines), and the extent to which the most reliable monitoring method developed is unable to ensure robust detection of misfire in the region(s). The evaluation shall be based on the following misfire patterns: equally spaced misfire occurring on randomly selected cylinders, single cylinder continuous misfire, and paired cylinder (cylinders firing at the same crank angle) continuous misfire.

(2.4) MIL Illumination and Fault Code Storage:

(2.4.1) General requirements for MIL illumination and fault code storage are set forth in section (d)(2).

(2.4.2) Additionally, for ~~2013 and subsequent model year engines~~ misfires identified in section (e)(2.2.2)~~equipped with sensors that can detect combustion or combustion quality~~:

(A) Upon detection of the percentage of misfire specified in section (e)(2.2.2)~~(A)~~, the following criteria shall apply for MIL illumination and fault code storage:

(i) A pending fault code shall be stored no later than after the fourth exceedance of the percentage of misfire specified in section (e)(2.2.2) during a single driving cycle.

(ii) If a pending fault code is stored, the OBD system shall illuminate the MIL and store a confirmed/MIL-on fault code within 10 seconds if the percentage of misfire specified in section (e)(2.2.2) is again exceeded four times during: (a) the driving cycle immediately following the storage of the pending fault code, regardless of the conditions encountered during the driving cycle; or (b) on the next driving cycle in which similar conditions (see section (c)) to the engine conditions that occurred when the pending fault code was stored are encountered.

(iii) The pending fault code may be erased at the end of the next driving cycle in which similar conditions to the engine conditions that occurred when the pending fault code was stored have been encountered without an exceedance of the specified percentage of misfire. The pending code may also be erased if similar conditions are not encountered during the next 80 driving cycles immediately following initial detection of the malfunction.

(B) Storage of freeze frame conditions.

(i) The OBD system shall store and erase freeze frame conditions either in conjunction with storing and erasing a pending fault code or in conjunction with storing a confirmed/MIL-on fault code and erasing a confirmed/previously MIL-on fault code.

(ii) If freeze frame conditions are stored for a malfunction other than a misfire malfunction when a fault code is stored as specified in section (e)(2.4.2), the stored freeze frame information shall be replaced with freeze frame information regarding the misfire malfunction.

(C) Storage of misfire conditions for similar conditions determination. Upon detection of misfire under section (e)(2.4.2), the OBD system shall store the following engine conditions: engine speed, load, and warm-up status of the first misfire event that resulted in the storage of the pending fault code.

(D) Extinguishing the MIL. The MIL may be extinguished after three sequential driving cycles in which similar conditions have been encountered without an exceedance of the specified percentage of misfire.

(3) Exhaust Gas Recirculation (EGR) System Monitoring

(3.1) Requirement:

(3.1.1) The OBD system shall monitor the EGR system on engines so-equipped for low flow rate, high flow rate, and slow response malfunctions. For engines equipped with EGR coolers (e.g., heat exchangers), the OBD system shall monitor the cooler system for insufficient cooling malfunctions. The individual electronic components (e.g., actuators, valves, sensors) that are used in the EGR system shall be monitored in accordance with the comprehensive component requirements in section (g)(3).

(3.1.2) For engines with other charge control strategies that affect EGR flow (e.g., systems that modify EGR flow to achieve a desired fresh air flow rate instead of a desired EGR flow rate), the manufacturer shall submit a monitoring plan to the Executive Officer for approval. The Executive Officer shall approve the request upon determining that the manufacturer has submitted data and an engineering evaluation that demonstrate that the monitoring plan is as reliable and effective as the monitoring plan required for EGR systems under section (e)(3).

(3.2) Malfunction Criteria:

(3.2.1) Low Flow: The OBD system shall detect a malfunction of the EGR system prior to a decrease from the manufacturer's specified EGR flow rate that would cause an engine's NMHC, CO, or NOx emissions to exceed 2.0 times any of the applicable standards or the engine's PM emissions to exceed the applicable standard plus 0.02 g/bhp-hr. For engines in which no failure or deterioration of the EGR system that causes a decrease in flow could result in an engine's emissions exceeding these levels, the OBD system shall detect a malfunction when either the EGR system has reached its control limits such that it cannot increase EGR flow to achieve the commanded flow rate or, for non-feedback controlled EGR systems, the EGR system has no detectable amount of EGR flow when EGR flow is expected.

(3.2.2) High Flow: The OBD system shall detect a malfunction of the EGR system, including a leaking EGR valve (i.e., exhaust gas flowing through the valve when the valve is commanded closed), prior to an increase from the manufacturer's specified EGR flow rate that would cause an engine's NMHC, CO, or NOx emissions to exceed 2.0 times any of the applicable standards or the engine's PM emissions to exceed the applicable standard plus 0.02 g/bhp-hr. For engines in which no failure or deterioration of the EGR system that causes an increase in flow could result in an engine's emissions exceeding these levels, the OBD system shall detect a malfunction when either the EGR system has reached its control limits such that it cannot reduce EGR flow to achieve the commanded flow rate or, for non-feedback controlled EGR systems, the EGR system has maximum detectable EGR flow when little or no EGR flow is expected.

(3.2.3) Slow Response: The OBD system shall detect a malfunction of the EGR system prior to any failure or deterioration in the EGR system response (e.g., capability to achieve the specified flow rate within a manufacturer-specified time) that would cause an engine's NMHC, CO, or NOx emissions to exceed 2.0 times any of the applicable standards or the engine's PM emissions to exceed the applicable standard plus 0.02 g/bhp-hr. The OBD system shall monitor the EGR system response under both increasing and decreasing EGR flow rates. For engines in which no failure or deterioration of the EGR system response could result in an engine's emissions exceeding these levels, the OBD system shall detect a malfunction of the EGR system when no detectable response to a change in commanded or expected flow rate occurs.

(3.2.4) Feedback control: Except as provided for in section (e)(3.2.7), if the engine is equipped with feedback or feed-forward control of the EGR system (e.g., feedback control of flow, valve position, pressure differential across the valve via intake throttle or exhaust backpressure), the OBD system shall detect a malfunction:

(A) If the system fails to begin control within a manufacturer specified time interval;

(B) If a failure or deterioration causes open loop or default operation; or

(C) If the control system has used up all of the adjustment allowed by the manufacturer or reached its maximum authority and cannot achieve the target.

(3.2.5) EGR Cooler Performance: The OBD system shall detect a malfunction of the EGR cooler system prior to a reduction from the manufacturer's specified cooling performance that would cause an engine's NMHC, CO, or NOx emissions to exceed 2.0 times any of the applicable standards or the engine's PM emissions to exceed the applicable standard plus 0.02 g/bhp-hr. For engines in which no failure or deterioration of the EGR cooler system could result in an engine's emissions exceeding these levels, the OBD system shall detect a malfunction when the system has no detectable amount of EGR cooling.

(3.2.6) EGR Catalyst Performance: For catalysts located in the EGR system on 2013 and subsequent model year engines and used to convert constituents to reduce emissions or protect or extend the durability of other emission-related components (e.g., to reduce fouling of an EGR cooler or valve)~~,~~:

(A) Except as provided for in section (e)(3.2.6)(B) below, ~~t~~The OBD system shall detect a malfunction when the catalyst has no detectable amount of constituent (e.g., hydrocarbons, soluble organic fractions) oxidation.

(B) Monitoring of the catalyst is not required if there is no measurable emission impact on the criteria pollutants (i.e., NMHC, CO, NOx, and PM) during any reasonable driving condition in which the catalyst is most likely to affect criteria pollutants.

(3.2.7) A manufacturer may request Executive Officer approval to temporarily disable monitoring for the malfunction criteria specified in section (e)(3.2.4)(C) during conditions that a manufacturer cannot robustly distinguish between a malfunctioning system and a properly operating system. The Executive Officer shall approve the disablement upon the manufacturer submitting data and/or analysis demonstrating that the control system, when operating as designed on an engine with all emission controls working properly, routinely operates during these conditions with all of the adjustment allowed by the manufacturer used up.

(3.2.8) In lieu of detecting the malfunctions specified in sections (e)(3.2.4)(A) and (B) with an EGR system-specific monitor, the OBD system may monitor the individual parameters or components that are used as inputs for EGR system feedback control provided that the monitors detect all malfunctions that meet the criteria in sections (e)(3.2.4)(A) and (B).

(3.2.9) For purposes of determining the EGR cooler performance malfunction criteria in section (e)(3.2.5) for EGR cooler systems that consist of more than one cooler (e.g., a pre-cooler and a main cooler, two or more coolers in series), the manufacturer shall submit an EGR cooler system aging and monitoring plan to the Executive Officer for review and approval. The plan shall include the description and location of each component, the monitoring strategy for each component and combination of components, and the method for determining the malfunction criteria of section (e)(3.2.5) including the deterioration/aging process. Executive Officer approval of the plan shall be based on the representativeness of the aging to real world EGR cooler system component deterioration under normal and malfunctioning engine operating conditions and the effectiveness of the method used to determine the malfunction criteria of section (e)(3.2.5).

(3.3) Monitoring Conditions:

(3.3.1) Except as provided in section (e)(3.3.4), the OBD system shall monitor continuously for malfunctions identified in sections (e)(3.2.1), (3.2.2), and (e)(3.2.4) (i.e., EGR low and high flow, feedback control).

(3.3.2) Manufacturers shall define the monitoring conditions for malfunctions identified in section (e)(3.2.3) (i.e., slow response) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements), with the exception that monitoring shall occur every time the monitoring conditions are met during the driving cycle in lieu of once per driving cycle as required in section (d)(3.1.2). For purposes of tracking and reporting as required in section (d)(3.2.1), all monitors used to detect malfunctions identified in section (e)(3.2.3) shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

(3.3.3) Manufacturers shall define the monitoring conditions for malfunctions identified in sections (e)(3.2.5) and (e)(3.2.6) (i.e., cooler performance and EGR catalyst performance) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements). For purposes of tracking and reporting as required in section (d)(3.2.1), all monitors used to detect malfunctions identified in section (e)(3.2.5) shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

(3.3.4) Manufacturers may request Executive Officer approval to temporarily disable continuous monitoring under specific conditions technically necessary to ensure robust detection of malfunctions and to avoid false passes and false indications of malfunctions (e.g., disable EGR low flow monitoring when no or very little flow is commanded, disable EGR high and low flow monitoring when freezing may affect performance of the system). The Executive Officer shall approve the request upon determining that the manufacturer has submitted data and/or an engineering evaluation which demonstrate that a properly operating EGR system cannot be distinguished from a malfunctioning EGR system and that the disablement interval is limited only to that which is technically necessary.

(3.4) MIL Illumination and Fault Code Storage: General requirements for MIL illumination and fault code storage are set forth in section (d)(2).

(4) Boost Pressure Control System Monitoring

(4.1) Requirement:

(4.1.1) The OBD system shall monitor the boost pressure control system (e.g., turbocharger) on engines so-equipped for under and over boost malfunctions and slow response malfunctions. For engines equipped with charge air cooler systems, the OBD system shall monitor the charge air cooler system for cooling system performance malfunctions. The individual electronic components (e.g., actuators, valves, sensors) that are used in the boost pressure control system shall be monitored in accordance with the comprehensive component requirements in section (g)(3).

(4.1.2) For engines with other charge control strategies that affect boost pressure (e.g., systems that modify boost pressure to achieve a desired air-fuel ratio instead of a desired boost pressure), the manufacturer shall submit a monitoring plan to the Executive Officer for approval. The Executive Officer shall approve the request upon determining that the manufacturer has submitted data and an engineering evaluation that demonstrate that the monitoring plan is as reliable and effective as the monitoring plan required for boost pressure control systems under section (e)(4).

(4.2) Malfunction Criteria:

(4.2.1) Underboost: The OBD system shall detect a malfunction of the boost pressure control system prior to a decrease from the manufacturer's commanded or expected boost pressure that would cause an engine's NMHC, CO, or NOx emissions to exceed 2.0 times any of the applicable standards or the engine's PM emissions to exceed the applicable standard plus 0.02 g/bhp-hr. For engines in which no failure or deterioration of the boost pressure control system that causes a decrease in boost could result in an engine's emissions exceeding these levels, the OBD system shall detect a malfunction when either the boost system has reached its control limits such that it cannot increase boost to achieve the commanded boost pressure or, for non-feedback controlled boost systems, the boost system has no detectable amount of boost when boost is expected.

(4.2.2) Overboost: The OBD system shall detect a malfunction of the boost pressure control system prior to an increase from the manufacturer's commanded or expected boost pressure that would cause an engine's NMHC, CO, or NOx emissions to exceed 2.0 times any of the applicable standards or the engine's PM emissions to exceed the applicable standard plus 0.02 g/bhp-hr. For engines in which no failure or deterioration of the boost pressure control system that causes an increase in boost could result in an engine's emissions exceeding these levels, the OBD system shall detect a malfunction when either the boost system has reached its control limits such that it cannot decrease boost to achieve the commanded boost pressure or, for non-feedback controlled boost systems, the boost system has maximum detectable boost when little or no boost is expected.

(4.2.3) Slow response:

(A) For 2010 through 2012 model year engines equipped with variable geometry turbochargers (VGT), the OBD system shall detect a malfunction prior to any failure or deterioration in the capability of the VGT system to achieve the commanded turbocharger geometry within a manufacturer-specified time that would cause an engine's NMHC, CO, or NOx emissions to exceed 2.0 times any of the applicable standards or the engine's PM emissions to exceed the applicable standard plus 0.02 g/bhp-hr. For engines in which no failure or deterioration of the VGT system response could result in an engine's emissions exceeding these levels, the OBD system shall detect a malfunction of the VGT system when no detectable response to a change in commanded turbocharger geometry occurs.

(B) For 2013 and subsequent model year engines, the OBD system shall detect a malfunction prior to any failure or deterioration in the boost pressure control system response (e.g., capability to achieve the commanded or expected boost pressure within a manufacturer-specified time) that would cause an engine's NMHC, CO, or NOx emissions to exceed 2.0 times any of the applicable standards or the engine's PM emissions to exceed the applicable standard plus 0.02 g/bhp-hr. For engines in which no failure or deterioration of the boost system response could result in an engine's emissions exceeding these levels, the OBD system shall detect a malfunction of the boost system when no detectable response to a commanded or expected change in boost pressure occurs.

(4.2.4) Charge Air Undercooling: The OBD system shall detect a malfunction of the charge air cooling system prior to a decrease from the manufacturer's specified cooling rate that would cause an engine's NMHC, CO, or NOx emissions to exceed 2.0 times any of the applicable standards or the engine's PM emissions to exceed the applicable standard plus 0.02 g/bhp-hr. For engines in which no failure or deterioration of the charge air cooling system that causes a decrease in cooling performance could result in an engine's emissions exceeding these levels, the OBD system shall detect a malfunction when the system has no detectable amount of charge air cooling.

(4.2.5) Feedback control: Except as provided for in section (e)(4.2.6), if the engine is equipped with feedback or feed-forward control of the boost pressure system (e.g., control of variable geometry turbocharger position, turbine speed, manifold pressure) the OBD system shall detect a malfunction:

(A) If the system fails to begin control within a manufacturer specified time interval;

(B) If a failure or deterioration causes open loop or default operation; or

(C) If the control system has used up all of the adjustment allowed by the manufacturer or reached its maximum authority and cannot achieve the target.

(4.2.6) A manufacturer may request Executive Officer approval to temporarily disable monitoring for the malfunction criteria specified in section (e)(4.2.5)(C) during conditions that a manufacturer cannot robustly distinguish between a malfunctioning system and a properly operating system. The Executive Officer shall approve the disablement upon the manufacturer submitting data and/or analysis demonstrating that the control system, when operating as designed on an engine with all emission controls working properly, routinely operates during these conditions with all of the adjustment allowed by the manufacturer used up.

(4.2.7) In lieu of detecting the malfunctions specified in sections (e)(4.2.5)(A) and (B) with a boost pressure system-specific monitor, the OBD system may monitor the individual parameters or components that are used as inputs for boost pressure system feedback control provided that the monitors detect all malfunctions that meet the criteria in sections (e)(4.2.5)(A) and (B).

(4.2.8) For purposes of determining the charge air cooling performance malfunction criteria in section (e)(4.2.4) for charge air cooling systems that consist of more than one cooler (e.g., a pre-cooler and a main cooler, two or more coolers in series), the manufacturer shall submit a charge air cooling system aging and monitoring plan to the Executive Officer for review and approval. The plan shall include the description and location of each component, the monitoring strategy for each component and combination of components, and the method for determining the malfunction criteria of section (e)(4.2.4) including the deterioration/aging process. Executive Officer approval of the plan shall be based on the representativeness of the aging to real world charge air cooling system component deterioration under normal and malfunctioning engine operating conditions and the effectiveness of the method used to determine the malfunction criteria of section (e)(4.2.4).

(4.3) Monitoring Conditions:

(4.3.1) Except as provided in section (e)(4.3.4), the OBD system shall monitor continuously for malfunctions identified in sections (e)(4.2.1), (4.2.2), and (4.2.5) (i.e., over and under boost, feedback control).

(4.3.2) Manufacturers shall define the monitoring conditions for malfunctions identified in section (e)(4.2.3) (i.e., slow response) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements), with the exception that monitoring shall occur every time the monitoring conditions are met during the driving cycle in lieu of once per driving cycle as required in section (d)(3.1.2). For purposes of tracking and reporting as required in section (d)(3.2.1), all monitors used to detect malfunctions identified in section (e)(4.2.3) shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

(4.3.3) Manufacturers shall define the monitoring conditions for malfunctions identified in section (e)(4.2.4) (i.e., charge air cooler performance) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements). For purposes of tracking and reporting as required in section (d)(3.2.1), all monitors used to detect malfunctions identified in section (e)(4.2.4) shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

(4.3.4) Manufacturers may request Executive Officer approval to temporarily disable continuous monitoring under conditions technically necessary to ensure robust detection of malfunctions and to avoid false passes and false indications of malfunctions (e.g., disable monitoring of underboost when commanded or expected boost pressure is very low). The Executive Officer shall approve the request upon determining that the manufacturer has submitted data and/or an engineering evaluation which demonstrate that a properly operating system cannot be distinguished from a malfunctioning system and that the disablement interval is limited only to that which is technically necessary.

(4.4) MIL Illumination and Fault Code Storage: General requirements for MIL illumination and fault code storage are set forth in section (d)(2).

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

(5.1) Requirement: The OBD system shall monitor the NMHC converting catalyst(s) for proper NMHC conversion capability. For engines equipped with catalyzed PM filters that convert NMHC emissions, the catalyst function of the PM filter shall be monitored in accordance with the PM filter requirements in section (e)(8).

(5.2) Malfunction Criteria:

(5.2.1) For purposes of section (e)(5), each catalyst in a series configuration that converts NMHC shall be monitored either individually or in combination with others.

(5.2.2) Conversion Efficiency:

(A) For 2010 through 2012 model year engines, the OBD system shall detect an NMHC catalyst malfunction when the catalyst conversion capability decreases to the point that NMHC emissions exceed 2.0 times any of the applicable standards.

(B) For 2013 and subsequent model year engines, the OBD system shall detect an NMHC catalyst malfunction when the catalyst conversion capability decreases to the point that NMHC emissions exceed 2.0 times any of the applicable standards or NOx emissions exceed any of the applicable standards by more than 0.2 g/bhp-hr (e.g., cause emissions to exceed 0.4 g/bhp-hr if the exhaust emission standard is 0.2 g/bhp-hr).

(C) If no failure or deterioration of the catalyst conversion capability could result in an engine's NMHC or NOx emissions exceeding the applicable malfunction criteria of section (e)(5.2.2), the OBD system shall detect a malfunction when the catalyst has no detectable amount of NMHC or NOx conversion capability.

(5.2.3) Other Aftertreatment Assistance Functions:

(A) For catalysts used to generate an exotherm to assist PM filter regeneration, the OBD system shall detect a malfunction when the catalyst is unable to generate a sufficient exotherm to achieve regeneration of the PM filter.

(B) For ~~2013~~ 2015 and subsequent model year engines, for catalysts used to generate a feedgas constituency to assist SCR systems (e.g., to increase NO_2 concentration upstream of an SCR system), the OBD system shall detect a malfunction when the catalyst is unable to generate the necessary feedgas constituents for proper SCR system operation. Catalysts are exempt from feedgas generation monitoring if no malfunction of the catalyst's feedgas generation ability can cause emissions to (1) increase by 15 percent or more of the applicable full useful life standard as measured from an applicable emission test cycle; or (2) exceed the applicable full useful life standard as measured from an applicable emission test cycle.

(C) For catalysts located downstream of a PM filter and used to convert NMHC emissions during PM filter regeneration, the OBD system shall detect a malfunction when the catalyst has no detectable amount of NMHC conversion capability.

(D) For catalysts located downstream of an SCR system (e.g., to prevent ammonia slip), the OBD system shall detect a malfunction when the catalyst has no detectable amount of NMHC, CO, NOx, or PM conversion capability. Monitoring of the catalyst is not required if there is no measurable emission impact on the criteria pollutants (i.e., NMHC, CO, NOx, and PM) during any reasonable driving condition ~~where~~ in which the catalyst is most likely to affect criteria pollutants (e.g., during conditions most likely to result in ammonia generation or excessive reductant delivery).

(5.2.4) Catalyst System Aging and Monitoring

(A) For purposes of determining the catalyst malfunction criteria in sections (e)(5.2.2) and (5.2.3) for individually monitored catalysts, the manufacturer shall 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. If the catalyst system contains catalysts in parallel (e.g., a two bank exhaust system where each bank has its own catalyst), the malfunction criteria shall be determined with the "parallel" catalysts equally deteriorated.

(B) For purposes of determining the catalyst malfunction criteria in sections (e)(5.2.2) and (5.2.3) for catalysts monitored in combination with others, the manufacturer shall submit a catalyst system aging and monitoring plan to the Executive Officer for review and approval. The plan shall 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 malfunction criteria of sections (e)(5.2.2) and (5.2.3) including the deterioration/aging process. If the catalyst system contains catalysts in parallel (e.g., a two bank exhaust system where each bank has its own catalyst), the malfunction criteria shall be determined with the "parallel" catalysts equally deteriorated. Executive Officer approval of the plan shall be based on the representativeness of the aging to real world catalyst system component deterioration under normal and malfunctioning engine operating conditions, the effectiveness of the method used to determine the malfunction criteria of section (e)(5.2), the ability of the component monitor(s) to pinpoint the likely area of malfunction and ensure the correct components are repaired/replaced in-use, and the ability of the component monitor(s) to accurately verify that each catalyst component is functioning as designed and as required in sections (e)(5.2.2) and (5.2.3).

(5.3) Monitoring Conditions:

(5.3.1) Manufacturers shall define the monitoring conditions for malfunctions identified in sections (e)(5.2.2) and (5.2.3) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements). For purposes of tracking and reporting as required in section (d)(3.2.1), all monitors used to detect malfunctions identified in sections (e)(5.2.2) and (5.2.3) shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

(5.4) MIL Illumination and Fault Code Storage:

(5.4.1) General requirements for MIL illumination and fault code storage are set forth in section (d)(2).

(5.4.2) The monitoring method for the catalyst(s) shall be capable of detecting all instances, except diagnostic self-clearing, when a catalyst fault code has been cleared but the catalyst has not been replaced (e.g., catalyst overtemperature histogram approaches are not acceptable).

(6) Oxides of Nitrogen (NOx) Converting Catalyst Monitoring

(6.1) Requirement: The OBD system shall monitor the NOx converting catalyst(s) for proper conversion capability.. For engines equipped with selective catalytic reduction (SCR) systems or other catalyst systems that utilize an active/intrusive reductant injection (e.g., active lean NOx catalysts utilizing diesel fuel injection), the OBD system shall monitor the SCR or active/intrusive reductant injection system for proper performance. The individual electronic components (e.g., actuators, valves, sensors, heaters, pumps) in the SCR or active/intrusive reductant injection system shall be monitored in accordance with the comprehensive component requirements in section (g)(3).

(6.2) Malfunction Criteria: For purposes of section (e)(6), each catalyst in a series configuration that converts NOx shall be monitored either individually or in combination with others.

(6.2.1) Conversion Efficiency:

(A) For 2010 through 2012 model year engines:

(i) The OBD system shall detect a catalyst malfunction when the catalyst conversion capability decreases to the point that would cause an engine's NOx emissions to exceed any of the applicable standards by more than 0.4 g/bhp-hr (e.g., cause emissions to exceed 0.6 g/bhp-hr if the <u>exhaust</u> emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test (i.e., FTP or SET).

(ii) If no failure or deterioration of the catalyst NOx conversion capability could result in an engine's NOx emissions exceeding any of the applicable standards by more than 0.4 g/bhp-hr, the OBD system shall detect a malfunction when the catalyst has no detectable amount of NOx conversion capability.

(B) For all 2013 model year engines and 2014 and 2015 model year engines that are not included in the phase-in specified in section (e)(6.2.1)(C):

(i) The OBD system shall detect a catalyst malfunction when the catalyst conversion capability decreases to the point that would cause an engine's emissions to exceed the applicable NOx standard by more than 0.4 g/bhp-hr (e.g., cause emissions to exceed 0.6 g/bhp-hr if the exhaust emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test or 2.0 times the applicable NMHC standard.

(ii) If no failure or deterioration of the catalyst system NOx conversion capability could result in an engine's NOx or NMHC emissions exceeding the applicable malfunction criteria of section (e)(6.2.1)(B)(i), the OBD system shall detect a malfunction when the catalyst has no detectable amount of NOx or NMHC conversion capability.

(C) For at least 20 percent of 2014 model year diesel engines and at least 50 percent of 2015 model year diesel engines (percentage based on the manufacturer's projected California sales volume of all diesel engines subject to this regulation):

(i) The OBD system shall detect a catalyst malfunction when the catalyst conversion capability decreases to the point that would cause an engine's emissions to exceed the applicable NOx standard by more than 0.3 g/bhp-hr (e.g., cause emissions to exceed 0.5 g/bhp-hr if the exhaust emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test or 2.0 times the applicable NMHC standard.

(ii) If no failure or deterioration of the catalyst system NOx conversion capability could result in an engine's NOx or NMHC emissions exceeding the applicable malfunction criteria of section (e)(6.2.1)(C)(i), the OBD system shall detect a malfunction when the catalyst has no detectable amount of NOx or NMHC conversion capability.

~~(B)~~(D) Except as provided for below in section (e)(6.2.1)(E), ~~F~~for ~~2013~~2016 and subsequent model year engines:

(i) The OBD system shall detect a catalyst malfunction when the catalyst conversion capability decreases to the point that would cause an engine's emissions to exceed the applicable NOx standard by more than 0.2 g/bhp-hr (e.g., cause emissions to exceed 0.4 g/bhp-hr if the exhaust emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test or 2.0 times the applicable NMHC standard.

(ii) If no failure or deterioration of the catalyst system NOx conversion capability could result in an engine's NOx or NMHC emissions exceeding the applicable malfunction criteria of section (e)(6.2.1)(~~B~~D)(i), the OBD system shall detect a malfunction when the catalyst has no detectable amount of NOx or NMHC conversion capability.

(E) In lieu of using the malfunction criteria in section (e)(6.2.1)(D), a manufacturer may continue to use the malfunction criteria in section (e)(6.2.1)(C) for any 2016 model year engine that was previously certified in the 2014 or 2015 model year to the malfunction criteria in section (e)(6.2.1)(C) and carried over to the 2016 model year.

(6.2.2) Selective Catalytic Reduction (SCR) or Other Active/Intrusive Reductant Injection System Performance:

(A) Reductant Delivery Performance:

(i) For 2010 through 2012 model year engines, the OBD system shall detect a malfunction prior to any failure or deterioration of the system to properly regulate reductant delivery (e.g., urea injection, separate injector fuel injection, post injection of fuel, air assisted injection/mixing) that would cause an engine's NOx emissions to exceed any of the applicable standards by more than 0.4 g/bhp-hr (e.g., cause emissions to exceed 0.6 g/bhp-hr if the exhaust emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test (i.e., FTP or SET). If no failure or deterioration of the SCR system could result in an engine's NOx emissions exceeding any of the applicable standards by more than 0.4 g/bhp-hr, the OBD system shall detect a malfunction when the system has reached its control limits such that it is no longer able to deliver the desired quantity of reductant.

(ii) For all 2013 model year engines and 2014 and 2015 model year engines that are not included in the phase-in specified in section (e)(6.2.2)(A)(iii):

a. The OBD system shall detect a malfunction prior to any failure or deterioration of the system to properly regulate reductant delivery (e.g., urea injection, separate injector fuel injection, post injection of fuel, air assisted injection/mixing) that would cause an engine's emissions to exceed the applicable NOx standard by more than 0.4 g/bhp-hr (e.g., cause emissions to exceed 0.6 g/bhp-hr if the exhaust emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test or 2.0 times the applicable NMHC standard.

b. If no failure or deterioration of the SCR system could result in an engine's NOx or NMHC emissions exceeding the applicable malfunction criteria of section (e)(6.2.2)(A)(ii)a., the OBD system shall detect a malfunction when the system has reached its control limits such that it is no longer able to deliver the desired quantity of reductant.

(iii) For at least 20 percent of all 2014 model year diesel engines and at least 50 percent of all 2015 model year diesel engines (percentage based on the manufacturer's projected California sales volume of all diesel engines subject to this regulation):

a. The OBD system shall detect a malfunction prior to any failure or deterioration of the system to properly regulate reductant delivery (e.g., urea injection, separate injector fuel injection, post injection of fuel, air assisted injection/mixing) that would cause an engine's emissions to exceed the applicable NOx standard by more than 0.3 g/bhp-hr (e.g., cause emissions to exceed 0.5 g/bhp-hr if the exhaust emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test or 2.0 times the applicable NMHC standard.

b. If no failure or deterioration of the SCR system could result in an engine's NOx or NMHC emissions exceeding the applicable malfunction criteria of section (e)(6.2.2)(A)(iii)a., the OBD system shall detect a malfunction when the system has reached its control limits such that it is no longer able to deliver the desired quantity of reductant.

~~(ii)~~(iv) Except as provided for below in section (e)(6.2.2)(A)(v), ~~F~~for ~~2013~~ 2016 and subsequent model year engines, the OBD system shall detect a system malfunction prior to any failure or deterioration of the system to properly regulate reductant delivery (e.g., urea injection, separate injector fuel injection, post injection of fuel, air assisted injection/mixing) that would cause an engine's emissions to exceed the applicable NOx standard by more than 0.2 g/bhp-hr (e.g., cause emissions to exceed 0.4 g/bhp-hr if the exhaust emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test or 2.0 times the applicable NMHC standard. If no failure or deterioration of the SCR system could result in an engine's NOx or NMHC emissions exceeding the applicable malfunction criteria above, the OBD system shall detect a malfunction when the system has reached its control limits such that it is no longer able to deliver the desired quantity of reductant.

(v) In lieu of using the malfunction criteria in section (e)(6.2.2)(A)(iv), a manufacturer may continue to use the malfunction criteria in section (e)(6.2.2)(A)(iii) for any 2016 model year engine that was previously certified in the 2014 or 2015 model year to the malfunction criteria in section (e)(6.2.2)(A)(iii) and carried over to the 2016 model year.

(B) If the catalyst system uses a reductant other than the fuel used for the engine or uses a reservoir/tank for the reductant that is separate from the fuel tank used for the engine, the OBD system shall detect a malfunction when there is no longer sufficient reductant available to properly operate the reductant system (e.g., the reductant tank is empty).

(C) If the catalyst system uses a reservoir/tank for the reductant that is separate from the fuel tank used for the engine, the OBD system shall detect a malfunction when an improper reductant is used in the reductant reservoir/tank (e.g., the reductant tank is filled with something other than the reductant).

(D) Feedback control: Except as provided for in section (e)(6.2.2)(E), if the engine is equipped with feedback or feed-forward control of the reductant injection (e.g., pressure control), the OBD system shall detect a malfunction:

(i) If the system fails to begin control within a manufacturer specified time interval;

(ii) If a failure or deterioration causes open loop or default operation; or

(iii) If the control system has used up all of the adjustment allowed by the manufacturer or reached its maximum authority and cannot achieve the target.

(E) A manufacturer may request Executive Officer approval to temporarily disable monitoring for the malfunction criteria specified in section (e)(6.2.2)(D)(iii) during conditions that a manufacturer cannot robustly distinguish between a malfunctioning system and a properly operating system. The Executive Officer shall approve the disablement upon the manufacturer submitting data and/or analysis demonstrating that the control system, when operating as designed on an engine with all emission controls working properly, routinely operates during these conditions with all of the adjustment allowed by the manufacturer used up.

(F) In lieu of detecting the malfunctions specified in sections (e)(6.2.2)(D)(i) and (ii) with a reductant injection system-specific monitor, the OBD system may monitor the individual parameters or components that are used as inputs for reductant injection feedback control provided that the monitors detect all malfunctions that meet the criteria in sections (e)(6.2.2)(D)(i) and (ii).

(6.2.3) Catalyst System Aging and Monitoring

(A) For purposes of determining the catalyst malfunction criteria in section (e)(6.2.1) for individually monitored catalysts, the manufacturer shall 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. If the catalyst system contains catalysts in parallel (e.g., a two bank exhaust system where each bank has its own catalyst), the malfunction criteria shall be determined with the "parallel" catalysts equally deteriorated.

(B) For purposes of determining the catalyst malfunction criteria in section (e)(6.2.1) for catalysts monitored in combination with others, the manufacturer shall submit a catalyst system aging and monitoring plan to the Executive Officer for review and approval. The plan shall 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 malfunction criteria of section (e)(6.2.1) including the deterioration/aging process. If the catalyst system contains catalysts in parallel (e.g., a two bank exhaust system where each bank has its own catalyst), the malfunction criteria shall be determined with the "parallel" catalysts equally deteriorated. Executive Officer approval of the plan shall be based on the representativeness of the aging to real world catalyst system component deterioration under normal and malfunctioning engine operating conditions, the effectiveness of the method used to determine the malfunction criteria of section (e)(6.2.1), the ability of the component monitor(s) to pinpoint the likely area of malfunction and ensure the correct components are repaired/replaced in-use, and the ability of the component monitor(s) to accurately verify that each catalyst component is functioning as designed and as required in section (e)(6.2.1).

(6.3) Monitoring Conditions:

(6.3.1) Manufacturers shall define the monitoring conditions for malfunctions identified in sections (e)(6.2.1), (e)(6.2.2)(A), and (e)(6.2.2)(C) (i.e., catalyst efficiency, reductant delivery performance, and improper reductant) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements). For purposes of tracking and reporting as required in section (d)(3.2.1), all monitors used to detect malfunctions identified in section (e)(6.2.1) shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

(6.3.2) Except as provided in section (e)(6.3.3), the OBD system shall monitor continuously for malfunctions identified in sections (e)(6.2.2)~~(A),~~ (B)~~,~~ and (D) (~~e.g.~~i.e., ~~SCR performance,~~ insufficient reductant, feedback control).

(6.3.3) Manufacturers may request Executive Officer approval to temporarily disable continuous monitoring under conditions technically necessary to ensure robust detection of malfunctions and to avoid false passes and false indications of malfunctions. The Executive Officer shall approve the request upon determining that the manufacturer has submitted data and/or an engineering evaluation which demonstrate that a properly operating system cannot be distinguished from a malfunctioning system and that the disablement interval is limited only to that which is technically necessary.

(6.4) MIL Illumination and Fault Code Storage:

(6.4.1) Except as provided below for reductant faults, general requirements for MIL illumination and fault code storage are set forth in section (d)(2).

(6.4.2) If the OBD system is capable of discerning that a system fault is being caused by a empty reductant tank:

(A) The manufacturer may request Executive Officer approval to delay illumination of the MIL if the vehicle is equipped with an alternative indicator for notifying the vehicle operator of the malfunction. The Executive Officer shall approve the request upon determining the alternative indicator is of sufficient illumination and location to be readily visible under all lighting conditions and provides equivalent assurance that a vehicle operator will be promptly notified and that corrective action will be undertaken.

(B) If the vehicle is not equipped with an alternative indicator and the MIL illuminates, the MIL may be immediately extinguished and the corresponding fault codes erased once the OBD system has verified that the reductant tank has been properly refilled and the MIL has not been illuminated for any other type of malfunction.

(C) The Executive Officer may approve other strategies that provide equivalent assurance that a vehicle operator will be promptly notified and that corrective action will be undertaken.

(6.4.3) The monitoring method for the catalyst(s) shall be capable of detecting all instances, except diagnostic self-clearing, when a catalyst fault code has been cleared but the catalyst has not been replaced (e.g., catalyst overtemperature histogram approaches are not acceptable).

(7) NOx Adsorber Monitoring

(7.1) Requirement: The OBD system shall monitor the NOx adsorber(s) on engines so-equipped for proper performance. For engines equipped with active/intrusive injection (e.g., in-exhaust fuel and/or air injection) to achieve desorption of the NOx adsorber(s), the OBD system shall monitor the active/intrusive injection system for proper performance. The individual electronic components (e.g., injectors, valves, sensors) that are used in the active/intrusive injection system shall be monitored in accordance with the comprehensive component requirements in section (g)(3).

(7.2) Malfunction Criteria:

(7.2.1) NOx adsorber capability:

(A) For 2010 through 2012 model year engines, the OBD system shall detect a NOx adsorber system malfunction when the NOx adsorber system capability decreases to the point that would cause an engine's NOx emissions to exceed any of the applicable standards by more than 0.3 g/bhp-hr (e.g., cause emissions to exceed 0.5 g/bhp-hr if the <u>exhaust</u> emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test (i.e., FTP or SET). If no failure or deterioration of the NOx adsorber system capability could result in an engine's NOx emissions exceeding any of the applicable standards by more than 0.3 g/bhp-hr, the OBD system shall detect a malfunction when the system has no detectable amount of NOx adsorber capability.

(B) For 2013 and subsequent model year engines, the OBD system shall detect a NOx adsorber system malfunction when the NOx adsorber capability decreases to the point that would cause an engine's emissions to exceed the applicable NOx standards by more than 0.2 g/bhp-hr (e.g., cause emissions to exceed 0.4 g/bhp-hr if the <u>exhaust</u> emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test (i.e., FTP or SET) or 2.0 times the applicable NMHC standard. If no failure or deterioration of the NOx adsorber capability could result in an engine's NOx or NMHC emissions exceeding the applicable malfunction criteria above, the OBD system shall detect a malfunction when the system has no detectable amount of NOx adsorber capability.

(7.2.2) For systems that utilize active/intrusive injection (e.g., in-cylinder post fuel injection, in-exhaust air-assisted fuel injection) to achieve desorption of the NOx adsorber, the OBD system shall detect a malfunction if any failure or deterioration of the injection system's ability to properly regulate injection causes the system to be unable to achieve desorption of the NOx adsorber.

(7.2.3) Feedback control: Except as provided for in section (e)(7.2.4), if the engine is equipped with feedback or feed-forward control of the NOx adsorber or active/intrusive injection system (e.g., feedback control of injection quantity, time), the OBD system shall detect a malfunction:

(A) If the system fails to begin control within a manufacturer specified time interval;

(B) If a failure or deterioration causes open loop or default operation; or

(C) If the control system has used up all of the adjustment allowed by the manufacturer or reached its maximum authority and cannot achieve the target.

(7.2.4) A manufacturer may request Executive Officer approval to temporarily disable monitoring for the malfunction criteria specified in section (e)(7.2.3)(C) during conditions that a manufacturer cannot robustly distinguish between a malfunctioning system and a properly operating system. The Executive Officer shall approve the disablement upon the manufacturer submitting data and/or analysis demonstrating that the control system, when operating as designed on an engine with all emission controls working properly, routinely operates during these conditions with all of the adjustment allowed by the manufacturer used up.

(7.2.5) In lieu of detecting the malfunctions specified in sections (e)(7.2.3)(A) and (B) with a NOx adsorber-specific monitor, the OBD system may monitor the individual parameters or components that are used as inputs for NOx adsorber or active/intrusive injection system feedback control provided that the monitors detect all malfunctions that meet the criteria in sections (e)(7.2.3)(A) and (B).

(7.2.6) For purposes of determining the NOx adsorber system malfunction criteria in section (e)(7.2.1) for NOx adsorber systems that consist of more than one NOx adsorber (e.g., two or more adsorbers in series), the manufacturer shall submit a system aging and monitoring plan to the Executive Officer for review and approval. The plan shall include the description and location of each component, the monitoring strategy for each component and/or combination of components, and the method for determining the malfunction criteria of section (e)(7.2.1) including the deterioration/aging process. Executive Officer approval of the plan shall be based on the representativeness of the aging to real world NOx adsorber system component deterioration under normal and malfunctioning engine operating conditions, the effectiveness of the method used to determine the malfunction criteria of section (e)(7.2.1), the ability of the component monitor(s) to pinpoint the likely area of malfunction and ensure the correct components are repaired/replaced in-use, and the ability of the component monitor(s) to accurately verify that each NOx adsorber system component is functioning as designed and as required in section (e)(7.2.1).

(7.3) Monitoring Conditions:

(7.3.1) Manufacturers shall define the monitoring conditions for malfunctions identified in sections (e)(7.2.1) (i.e., adsorber capability) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements). For purposes of tracking and reporting as required in section (d)(3.2.1), all monitors used to detect malfunctions identified in sections (e)(7.2.1) shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

(7.3.2) Except as provided in section (e)(7.3.3), the OBD system shall monitor continuously for malfunctions identified in sections (e)(7.2.2) and (7.2.3) (e.g., injection function, feedback control).

(7.3.3) Manufacturers may request Executive Officer approval to temporarily disable continuous monitoring under conditions technically necessary to ensure robust detection of malfunctions and to avoid false passes and false indications of malfunctions. The Executive Officer shall approve the request upon determining that the manufacturer has submitted data and/or an engineering evaluation which demonstrate that a properly operating system cannot be distinguished from a malfunctioning system and that the disablement interval is limited only to that which is technically necessary.

(7.4) MIL Illumination and Fault Code Storage: General requirements for MIL illumination and fault code storage are set forth in section (d)(2).

(8) Particulate Matter (PM) Filter Monitoring

(8.1) Requirement: The OBD system shall monitor the PM filter on engines so-equipped for proper performance. For engines equipped with active regeneration systems that utilize an active/intrusive injection (e.g., in-exhaust fuel injection, in-exhaust fuel/air burner), the OBD system shall monitor the active/intrusive injection system for proper performance. The individual electronic components (e.g., injectors, valves, sensors) that are used in the active/intrusive injection system shall be monitored in accordance with the comprehensive component requirements in section (g)(3).

(8.2) Malfunction Criteria:

(8.2.1) Filtering Performance:

(A) For 2010 through 2012 model year engines, the OBD system shall detect a malfunction prior to a decrease in the filtering capability of the PM filter (e.g., cracking) that would cause an engine's PM emissions to exceed either of the following thresholds, whichever is higher: 0.07 g/bhp-hr as measured from an applicable emission test cycle (i.e., FTP or SET); or the applicable standard plus 0.06 g/bhp-hr (e.g., 0.07 g/bhp-hr if the exhaust emission standard is 0.01 g/bhp-hr). If no failure or deterioration of the PM filtering performance could result in an engine's PM emissions exceeding these levels, the OBD system shall detect a malfunction when no detectable amount of PM filtering occurs.

(B) ~~Except as specified in section (e)(8.2.1.)(C) below, f~~For all 2013 model year engines and 2014 and ~~through~~ 2015 model year engines that are not included in the phase-in specified in section (e)(8.2.1)(C)~~,~~ the OBD system shall detect a malfunction prior to a decrease in the filtering capability of the PM filter ~~(e.g., cracking)~~ that would cause an engine's PM emissions to exceed either of the following thresholds, whichever is higher: 0.05 g/bhp-hr as measured from an applicable emission test cycle (i.e., FTP or SET); or the applicable standard plus 0.04 g/bhp-hr (e.g., 0.05 g/bhp-hr if the exhaust emission standard is 0.01 g/bhp-hr). If no failure or deterioration of the PM filtering performance could result in an engine's PM emissions exceeding these levels, the OBD system shall detect a malfunction when no detectable amount of PM filtering occurs.

(C) For 2014 through 2015 model year engines, the manufacturer shall meet one of the following two options below:

(i) For at least 20 percent of 2014 model year diesel engines and at least 20 percent of 2015 model year diesel engines (percentage based on the manufacturer's projected California sales volume of all diesel engines subject to this regulation), the OBD system shall use the malfunction criteria of section (e)(8.2.1)(B) without using the provisions of section (g)(5.1) to exclude specific failure modes.

(ii) For at least 50 percent of 2015 model year diesel engines (percentage based on the manufacturer's projected California sales volume of all diesel engines subject to this regulation), the OBD system shall detect a malfunction prior to a decrease in the filtering capability of the PM filter that would cause an engine's PM emissions to exceed either of the following thresholds, whichever is higher, without using the provisions of section (g)(5.1) to exclude specific failure modes: 0.03 g/bhp-hr as measured from an applicable emission test cycle (i.e., FTP or SET); or the applicable standard plus 0.02 g/bhp-hr (e.g., 0.03 g/bhp-hr if the exhaust emission standard is 0.01 g/bhp-hr). If no failure or deterioration of the PM filtering performance could result in an engine's PM emissions exceeding these levels, the OBD system shall detect a malfunction when no detectable amount of PM filtering occurs.

~~(C)~~(D) ~~For 2013 through 2015 model year engines subject to (d)(7.2.2)(A) and~~Except as provided in section (e)(8.2.1)(E), for all 2016 and subsequent model year engines, the OBD system shall detect a malfunction prior to a decrease in the filtering capability of the PM filter that would cause an engine's PM emissions to exceed either of the following thresholds, whichever is higher: 0.03 g/bhp-hr as measured from an applicable emission test cycle (i.e., FTP or SET); or the applicable standard plus 0.02 g/bhp-hr (e.g., 0.03 g/bhp-hr if the exhaust emission standard is 0.01 g/bhp-hr). If no failure or deterioration of the PM filtering performance could result in an engine's PM emissions exceeding these levels, the OBD system shall detect a malfunction when no detectable amount of PM filtering occurs.

(E) In lieu of the malfunction criteria in section (e)(8.2.1)(D), a manufacturer may continue to use the malfunction criteria in section (e)(8.2.1)(C)(i) for any 2016 model year engine that was previously certified in the 2014 or 2015 model year to the malfunction criteria in section (e)(8.2.1)(C)(i) and carried over to the 2016 model year.

(F) For the phase-in schedules described in section (e)(8.2.1)(C) above, the manufacturer may not use an alternate phase-in schedule as defined in section (c) in lieu of the required phase-in schedules.

(8.2.2) Frequent Regeneration: The OBD system shall detect a malfunction when the PM filter regeneration occurs more frequently than (i.e., occurs more often than) the manufacturer's specified regeneration frequency to a level such that it would cause an engine's emissions to exceed the following:

(A) For 2010 through 2012 model year engines, 2.0 times the applicable NMHC standards.

(B) For 2013 and subsequent model year engines, 2.0 times the applicable NMHC standards or the applicable NOx standard by more than 0.2 g/bhp-hr (e.g., cause NOx emissions to exceed 0.4 g/bhp-hr if the exhaust emission standard is 0.2 g/bhp-hr).

(C) If no failure or deterioration causes an increase in the PM filter regeneration frequency that could result in an engine's emissions exceeding the emission levels specified above, the OBD system shall detect a malfunction when the PM filter regeneration frequency exceeds the manufacturer's specified design limits for allowable regeneration frequency.

(8.2.3) Incomplete regeneration: The OBD system shall detect a regeneration malfunction when the PM filter does not properly regenerate under manufacturer-defined conditions where regeneration is designed to occur.

(8.2.4) Catalyzed PM Filter:

(A) NMHC conversion: For ~~2013~~ 2015 and subsequent model year engines~~,~~ ~~for~~ with catalyzed PM filters that convert NMHC emissions~~,~~:

(i) ~~t~~The OBD system shall monitor the catalyst function of the PM filter and detect a malfunction when the NMHC conversion capability decreases to the point that NMHC emissions exceed 2.0 times the applicable standards.

(ii) If no failure or deterioration of the NMHC conversion capability could result in an engine's NMHC emissions exceeding 2.0 times the applicable standards, the OBD system shall detect a malfunction when the system has no detectable amount of NMHC conversion capability.

(iii) Catalyzed PM filters are exempt from NMHC conversion capability monitoring if no malfunction of the catalyzed PM filter's NMHC conversion capability can cause emissions to (1) increase by 15 percent or more of the applicable full useful life standard as measured from an applicable emission test cycle; or (2) exceed the applicable full useful life standard as measured from an applicable emission test cycle.

(B) Feedgas generation: For 2016 and subsequent model year engines with catalyzed PM filters used to generate a feedgas constituency to assist SCR systems (e.g., to increase NO_2 concentration upstream of an SCR system), the OBD system shall detect a malfunction when the system is unable to generate the necessary feedgas constituents for proper SCR system operation. Catalyzed PM filters are exempt from feedgas generation monitoring if no malfunction of the catalyzed PM filter's feedgas generation ability can cause emissions to (1) increase by 15 percent or more of the applicable full useful life standard as measured from an applicable emission test cycle; or (2) exceed the applicable full useful life standard as measured from an applicable emission test cycle.

(8.2.5) Missing substrate: The OBD system shall detect a malfunction if either the PM filter substrate is completely destroyed, removed, or missing, or if the PM filter assembly is replaced with a muffler or straight pipe.

(8.2.6) Active/Intrusive Injection: For systems that utilize active/intrusive injection (e.g., in-cylinder post fuel injection, in-exhaust air-assisted fuel injection) to achieve regeneration of the PM filter, the OBD system shall detect a malfunction if any failure or deterioration of the injection system's ability to properly regulate injection causes the system to be unable to achieve regeneration of the PM filter.

(8.2.7) Feedback Control: Except as provided for in section (e)(8.2.8), if the engine is equipped with feedback or feed-forward control of the PM filter regeneration (e.g., feedback control of oxidation catalyst inlet temperature, PM filter inlet or outlet temperature, in-cylinder or in-exhaust fuel injection), the OBD system shall detect a malfunction:

(A) If the system fails to begin control within a manufacturer specified time interval;

(B) If a failure or deterioration causes open loop or default operation; or

(C) If the control system has used up all of the adjustment allowed by the manufacturer or reached its maximum authority and cannot achieve the target.

(8.2.8) A manufacturer may request Executive Officer approval to temporarily disable monitoring for the malfunction criteria specified in section (e)(8.2.7)(C) during conditions that a manufacturer cannot robustly distinguish between a malfunctioning system and a properly operating system. The Executive Officer shall approve the disablement upon the manufacturer submitting data and/or analysis demonstrating that the control system, when operating as designed on an engine with all emission controls working properly, routinely operates during these conditions with all of the adjustment allowed by the manufacturer used up.

(8.2.9) In lieu of detecting the malfunctions specified in sections (e)(8.2.7)(A) and (B) with a PM filter-specific monitor, the OBD system may monitor the individual parameters or components that are used as inputs for PM filter regeneration feedback control provided that the monitors detect all malfunctions that meet the criteria in sections (e)(8.2.7)(A) and (B).

(8.3) Monitoring Conditions:

(8.3.1) Manufacturers shall define the monitoring conditions for malfunctions identified in sections (e)(8.2.1) through (8.2.6) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements), with the exception that monitoring shall occur every time the monitoring conditions are met during the driving cycle in lieu of once per driving cycle as required in section (d)(3.1.2). For purposes of tracking and reporting as required in section (d)(3.2.1), all monitors used to detect malfunctions identified in sections (e)(8.2.1) shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

(8.3.2) Except as provided in section (e)(8.3.3), the OBD-II system shall monitor continuously for malfunctions identified in section (e)(8.2.7) (i.e., PM filter feedback control).

(8.3.3) Manufacturers may request Executive Officer approval to temporarily disable continuous monitoring under conditions technically necessary to ensure robust detection of malfunctions and to avoid false passes and false indications of malfunctions. The Executive Officer shall approve the request upon determining that the manufacturer has submitted data and/or an engineering evaluation which demonstrate that a properly operating system cannot be distinguished from a malfunctioning system and that the disablement interval is limited only to that which is technically necessary.

(8.4) MIL Illumination and Fault Code Storage: General requirements for MIL illumination and fault code storage are set forth in section (d)(2).

(9) Exhaust Gas Sensor Monitoring

(9.1) Requirement:

(9.1.1) The OBD system shall monitor all exhaust gas sensors (e.g., oxygen, air-fuel ratio, NOx) used for emission control system feedback (e.g., EGR control/feedback, SCR control/feedback, NOx adsorber control/feedback) or as a monitoring device for proper output signal, activity, response rate, and any other parameter that can affect emissions.

(9.1.2) For engines equipped with heated exhaust gas sensors, the OBD system shall monitor the heater for proper performance.

(9.2) Malfunction Criteria:

(9.2.1) Air-Fuel Ratio Sensors:

(A) For sensors located upstream of the exhaust aftertreatment:

(i) Sensor performance faults: The OBD system shall detect a malfunction prior to any failure or deterioration of the sensor voltage, resistance, impedance, current, response rate, amplitude, offset, or other characteristic(s) that would cause an engine's NMHC, CO, or NOx emissions to exceed 2.0 times any of the applicable standards or the engine's PM emissions to exceed any of the applicable standards plus 0.02 g/bhp-hr.

(ii) Circuit faults: The OBD system shall detect malfunctions of the sensor caused by either a lack of circuit continuity or out-of-range values.

(iii) Feedback faults: The OBD system shall detect a malfunction of the sensor when a sensor failure or deterioration causes an emission control system (e.g., EGR, SCR, or NOx adsorber) to stop using that sensor as a feedback or feed-forward input (e.g., causes default or open-loop operation).

(iv) Monitoring capability: To the extent feasible, the OBD system shall detect a malfunction of the sensor when the sensor output voltage, resistance, impedance, current, amplitude, activity, offset, or other characteristics are no longer sufficient for use as an OBD system monitoring device (e.g., for catalyst, EGR, SCR, or NOx adsorber monitoring).

(B) For sensors located downstream of the exhaust aftertreatment:

(i) Sensor performance faults:

a. For 2010 through 2012 model year engines, the OBD system shall detect a malfunction prior to any failure or deterioration of the sensor voltage, resistance, impedance, current, response rate, amplitude, offset, or other characteristic(s) that would cause an engine's NMHC emissions to exceed 2.5 times any of the applicable standards, cause an engine's NOx emissions to exceed any of the applicable standards by more than 0.3 g/bhp-hr (e.g., cause emissions to exceed 0.5 g/bhp-hr if the <u>exhaust</u> emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test (i.e., FTP or SET), or cause an engine's PM emissions to exceed (whichever is higher): 0.05 g/bhp-hr as measured from an applicable cycle emission test (i.e., FTP or SET); or any of the applicable standards by more than 0.04 g/bhp-hr (e.g., cause emissions to exceed 0.05 g/bhp-hr if the exhaust emission standard is 0.01 g/bhp-hr).

b. For 2013 and subsequent model year engines, the OBD system shall detect a malfunction prior to any failure or deterioration of the sensor voltage, resistance, impedance, current, response rate, amplitude, offset, or other characteristic(s) that would cause an engine's NMHC emissions to exceed 2.0 times any of the applicable standards, cause an engine's NOx emissions to exceed any of the applicable standards by more than 0.2 g/bhp-hr (e.g., cause emissions to exceed 0.4 g/bhp-hr if the exhaust emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test (i.e., FTP or SET), or cause an engine's PM emissions to exceed (whichever is higher): 0.03 g/bhp-hr as measured from an applicable cycle emission test (i.e., FTP or SET); or any of the applicable standards by more than 0.02 g/bhp-hr (e.g., cause emissions to exceed 0.03 g/bhp-hr if the exhaust emission standard is 0.01 g/bhp-hr).

(ii) Circuit faults: The OBD system shall detect malfunctions of the sensor caused by either a lack of circuit continuity or out-of-range values.

(iii) Feedback faults: The OBD system shall detect a malfunction of the sensor when a sensor failure or deterioration causes an emission control system (e.g., EGR, SCR, or NOx adsorber) to stop using that sensor as a feedback or feed-forward input (e.g., causes default or open-loop operation).

(iv) Monitoring capability: To the extent feasible, the OBD system shall detect a malfunction of the sensor when the sensor output voltage, resistance, impedance, current, amplitude, activity, offset, or other characteristics are no longer sufficient for use as an OBD system monitoring device (e.g., for catalyst, EGR, SCR, or NOx adsorber monitoring).

(9.2.2) NOx and PM sensors:

(A) Sensor performance faults:

(i) For 2010 through 2012 model year engines, the OBD system shall detect a malfunction prior to any failure or deterioration of the sensor voltage, resistance, impedance, current, response rate, amplitude, offset, or other characteristic(s) that would cause an engine's NOx emissions to exceed any of the applicable standards by more than 0.4 g/bhp-hr (e.g., cause emissions to exceed 0.6 g/bhp-hr if the exhaust emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test (i.e., FTP or SET), or cause an engine's PM emissions to exceed (whichever is higher): 0.05 g/bhp-hr as measured from an applicable cycle emission test (i.e., FTP or SET); or any of the applicable standards by more than 0.04 g/bhp-hr (e.g., cause emissions to exceed 0.05 g/bhp-hr if the exhaust emission standard is 0.01 g/bhp-hr).

(ii) For all 2013 model year engines and 2014 and 2015 model year engines that are not included in the phase-in specified in section (e)(9.2.2)(A)(iii), the OBD system shall detect a malfunction prior to any failure or deterioration of the sensor voltage, resistance, impedance, current, response rate, amplitude, offset, or other characteristic(s) that would cause an engine's NOx emissions to exceed the applicable NOx standard by more than 0.4 g/bhp-hr (e.g., cause emissions to exceed 0.6 g/bhp-hr if the exhaust emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test or cause an engine's PM emissions to exceed (whichever is higher): 0.03 g/bhp-hr as measured from an applicable cycle emission test (i.e., FTP or SET); or any of the applicable standards by more than 0.02 g/bhp-hr (e.g., cause emissions to exceed 0.03 g/bhp-hr if the exhaust emission standard is 0.01 g/bhp-hr).

(iii) For at least 20 percent of 2014 model year diesel engines and at least 50 percent of 2015 model year diesel engines (percentage based on the manufacturer's projected California sales volume of all diesel engines subject to this regulation), the OBD system shall detect a malfunction prior to any failure or deterioration of the sensor voltage, resistance, impedance, current, response rate, amplitude, offset, or other characteristic(s) that would cause an engine's NOx emissions to exceed the applicable NOx standard by more than 0.3 g/bhp-hr (e.g., cause emissions to exceed 0.5 g/bhp-hr if the exhaust emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test or cause an engine's PM emissions to exceed (whichever is higher): 0.03 g/bhp-hr as measured from an applicable cycle emission test (i.e., FTP or SET); or any of the applicable standards by more than 0.02 g/bhp-hr (e.g., cause emissions to exceed 0.03 g/bhp-hr if the exhaust emission standard is 0.01 g/bhp-hr).

~~(ii)~~(iv) Except as provided for below in section (e)(9.2.2)(A)(v), ~~F~~for ~~2013~~ 2016 and subsequent model year engines, the OBD system shall detect a malfunction prior to any failure or deterioration of the sensor voltage, resistance, impedance, current, response rate, amplitude, offset, or other characteristic(s) that would cause an engine's NOx emissions to exceed ~~any of~~ the applicable NOx standards by more than 0.2 g/bhp-hr (e.g., cause emissions to exceed 0.4 g/bhp-hr if the exhaust emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test (i.e., FTP or SET), cause an engine's NMHC emissions to exceed 2.0 times the applicable NMHC standard, or cause an engine's PM emissions to exceed (whichever is higher): 0.03 g/bhp-hr as measured from an applicable cycle emission test (i.e., FTP or SET); or any of the applicable standards by more than 0.02 g/bhp-hr (e.g., cause emissions to exceed 0.03 g/bhp-hr if the exhaust emission standard is 0.01 g/bhp-hr).

(v) In lieu of using the malfunction criteria in section (e)(9.2.2)(A)(iv), a manufacturer may continue to use the malfunction criteria in section (e)(9.2.2)(A)(iii) for any 2016 model year engine that was previously certified in the 2014 or 2015 model year to the malfunction criteria in section (e)(9.2.2)(A)(iii) and carried over to the 2016 model year.

(B) Circuit faults: The OBD system shall detect malfunctions of the sensor caused by either a lack of circuit continuity or out-of-range values.

(C) Feedback faults: The OBD system shall detect a malfunction of the sensor when a sensor failure or deterioration causes an emission control system (e.g., EGR, SCR, or NOx adsorber) to stop using that sensor as a feedback or feed-forward input (e.g., causes default or open-loop operation).

(D) Monitoring capability: To the extent feasible, the OBD system shall detect a malfunction of the sensor when the sensor output voltage, resistance, impedance, current, amplitude, activity, offset, or other characteristics are no longer sufficient for use as an OBD system monitoring device (e.g., for catalyst, EGR, PM filter, SCR, or NOx adsorber monitoring).

(9.2.3) Other exhaust gas sensors:

(A) For other exhaust gas sensors, the manufacturer shall submit a monitoring plan to the Executive Officer for approval. The Executive Officer shall approve the request upon determining that the manufacturer has submitted data and an engineering evaluation that demonstrate that the monitoring plan is as reliable and effective as the monitoring plan required for air-fuel ratio sensors, NOx sensors, and PM sensors under sections (e)(9.2.1) and (e)(9.2.2).

(9.2.4) Sensor Heaters:

(A) The OBD system shall detect a malfunction of the heater performance when the current or voltage drop in the heater circuit is no longer within the manufacturer's specified limits for normal operation (i.e., within the criteria required to be met by the component vendor for heater circuit performance at high mileage). Subject to Executive Officer approval, other malfunction criteria for heater performance malfunctions may be used upon the Executive Officer determining that the manufacturer has submitted data and/or an engineering evaluation that demonstrate the monitoring reliability and timeliness to be equivalent to the stated criteria in section (e)(9.2.4)(A).

(B) The OBD system shall detect malfunctions of the heater circuit including open or short circuits that conflict with the commanded state of the heater (e.g., shorted to 12 Volts when commanded to 0 Volts (ground)).

(9.3) Monitoring Conditions:

(9.3.1) Exhaust Gas Sensors

(A) Manufacturers shall define the monitoring conditions for malfunctions identified in sections (e)(9.2.1)(A)(i), (9.2.1)(B)(i), ~~and~~ (9.2.2)(A), and (9.2.2)(D) (e.g., sensor performance faults) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements). For purposes of tracking and reporting as required in section (d)(3.2.1), all monitors used to detect malfunctions identified in sections (e)(9.2.1)(A)(i), (9.2.1)(B)(i), ~~and~~ (9.2.2)(A), and for 2016 and subsequent model year engines, section

<u>(e)(9.2.2)(D),</u> shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

(B) Manufacturers shall define the monitoring conditions for malfunctions identified in sections <u>(e)</u>(9.2.1)(A)(iv)~~,~~ <u>and</u> (9.2.1)(B)(iv), ~~and (9.2.2)(D)~~ (e.g., monitoring capability) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements) ~~with the exception that monitoring shall occur every time the monitoring conditions are met during the driving cycle in lieu of once per driving cycle as required in section (d)(3.1.2)~~.

(C) Except as provided in section (e)(9.3.1)(D), monitoring for malfunctions identified in sections (e)(9.2.1)(A)(ii), (9.2.1)(A)(iii), (9.2.1)(B)(ii), (9.2.1)(B)(iii), (9.2.2)(B), and (9.2.2)(C) (i.e., circuit continuity and open-loop malfunctions) shall be conducted continuously.

(D) A manufacturer may request Executive Officer approval to disable continuous exhaust gas sensor monitoring when an exhaust gas sensor malfunction cannot be distinguished from other effects (e.g., disable out-of-range low monitoring during fuel cut conditions). The Executive Officer shall approve the disablement upon determining that the manufacturer has submitted test data and/or documentation that demonstrate a properly functioning sensor cannot be distinguished from a malfunctioning sensor and that the disablement interval is limited only to that necessary for avoiding false detection.

(9.3.2) Sensor Heaters

(A) Manufacturers shall define monitoring conditions for malfunctions identified in section (e)(9.2.4)(A) (i.e., sensor heater performance) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements).

(B) Monitoring for malfunctions identified in section (e)(9.2.4)(B) (i.e., circuit malfunctions) shall be conducted continuously.

(9.4) MIL Illumination and Fault Code Storage: General requirements for MIL illumination and fault code storage are set forth in section (d)(2). <u>To the extent feasible, the OBD system shall separately detect lack of circuit continuity and out-of-range faults as required under sections (e)(9.2.1)(A)(ii), (e)(9.2.1)(B)(ii), and (e)(9.2.2)(B) and store different fault codes for each distinct malfunction (e.g., out-of-range low, out-of-range high, open circuit). Manufacturers are not required to store separate fault codes for lack of circuit continuity faults that cannot be distinguished from other out-of-range circuit faults.</u>

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

(10.1) Requirement: The OBD system shall monitor the VVT system on engines so-equipped for target error and slow response malfunctions. The individual electronic components (e.g., actuators, valves, sensors) that are used in the VVT system shall be monitored in accordance with the comprehensive components requirements in section (g)(3).

(10.2) Malfunction Criteria:

(10.2.1) Target Error: The OBD system shall detect a malfunction prior to any failure or deterioration in the capability of the VVT system to achieve the commanded valve timing and/or control within a crank angle and/or lift tolerance that would cause an engine's NHMC, NOx, or CO emissions to exceed 2.0 times any of the applicable standards or an engine's PM emissions to exceed a threshold of the applicable standard plus 0.02 g/bhp-hr.

(10.2.2) Slow Response: The OBD system shall detect a malfunction prior to any failure or deterioration in the capability of the VVT system to achieve the commanded valve timing and/or control within a manufacturer-specified time that would cause an engine's NHMC, NOx, or CO emissions to exceed 2.0 times any of the applicable standards or an engine's PM emissions to exceed a threshold of the applicable standard plus 0.02 g/bhp-hr.

(10.2.3) For engines in which no failure or deterioration of the VVT system could result in an engine's emissions exceeding the thresholds of sections (e)(10.2.1) or (10.2.2), the OBD system shall detect a malfunction of the VVT system when proper functional response of the system to computer commands does not occur.

(10.3) Monitoring Conditions: Manufacturers shall define the monitoring conditions for VVT system malfunctions identified in section (e)(10.2) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements), with the exception that monitoring shall occur every time the monitoring conditions are met during the driving cycle in lieu of once per driving cycle as required in section (d)(3.1.2). For purposes of tracking and reporting as required in section (d)(3.2.1), all monitors used to detect malfunctions identified in section (e)(10.2) shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

(10.4) MIL Illumination and Fault Code Storage: General requirements for MIL illumination and fault code storage are set forth in section (d)(2).

(11) Cold Start Emission Reduction Strategy Monitoring

(11.1) Requirement:

(11.1.1) For all 2013 and subsequent model year engines that~~, if an engine~~ incorporates~~s~~ a specific engine control strategy to reduce cold start emissions, the OBD system shall monitor the ~~system~~ strategy to verify ~~the strategy~~that it achieves the desired effect (e.g., to achieve accelerated catalyst light-off temperature) and monitor the commanded elements/components for proper function (e.g., injection timing, increased engine idle speed, increased engine load via intake or exhaust throttle activation) while the control strategy is active to ensure proper operation of the control strategy.

(11.1.2) For an element/component associated with the cold start emission reduction control strategy under section (e)(11) that is also required to be monitored elsewhere in section (e) or (g) (e.g., fuel injection timing), the manufacturer shall use different diagnostics to distinguish faults detected under section (e)(11) (i.e., faults associated with the cold start strategy) from faults detected under sections other than section (e)(11) (i.e., faults not associated with the cold start strategy).

(11.2) Malfunction Criteria: The OBD system shall, to the extent feasible, detect a malfunction if either of the following occurs:

(11.2.1) Any single commanded element/component does not properly respond to the commanded action while the cold start strategy is active. For purposes of this section, "properly respond" is defined as when the element responds:

(A) by a robustly detectable amount by the monitor; and

(B) in the direction of the desired command; and

(C) above and beyond what the element/component would achieve on start-up without the cold start strategy active (e.g., if the cold start strategy commands a higher idle engine speed, a fault must be detected if there is no detectable amount of engine speed increase above what the system would achieve without the cold start strategy active);

(11.2.2) Any failure or deterioration of the cold start emission reduction control strategy that would cause an engine's NMHC, NOx, or CO emissions to exceed 2.0 times the applicable standards or the engine's PM emissions to exceed the applicable standard plus 0.02 g/bhp-hr.

(11.2.3) For section (e)(11.2.2), to the extent feasible (without adding hardware for this purpose), the OBD system shall monitor the ability of the system to achieve the desired effect (e.g., strategies used to accelerate catalyst light-off by increasing catalyst inlet temperature shall verify the catalyst inlet temperature actually achieves the desired temperatures within an Executive Officer approved time interval after starting the engine) for failures that cause emissions to exceed the applicable emission levels specified in section (e)(11.2.2). For strategies where it is not feasible to be monitored as a system, the OBD system shall monitor the individual elements/components (e.g., increased engine speed, increased engine load from restricting an exhaust throttle) for failures that cause emissions to exceed the applicable emission levels specified in section (e)(11.2.2).

(11.3) Monitoring Conditions: Manufacturers shall define the monitoring conditions for malfunctions identified in section (e)(11.2) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements).

(11.4) MIL Illumination and Fault Code Storage: General requirements for MIL illumination and fault code storage are set forth in section (d)(2).

(f) *Monitoring Requirements for Gasoline/Spark-Ignited Engines.*

(1) Fuel System Monitoring

(1.1) Requirement: The OBD system shall monitor the fuel delivery system to determine its ability to provide compliance with ~~emission~~ <u>applicable</u> standards.

(1.2) Malfunction Criteria:

(1.2.1) The OBD system shall detect a malfunction of the fuel delivery system when:

(A) The fuel delivery system is unable to maintain an engine's emissions at or below 1.5 times the applicable standards; or

(B) If equipped, the feedback control based on a secondary oxygen or exhaust gas sensor is unable to maintain a<u>n</u> ~~vehicle~~<u>engine</u>'s emissions (except as a result of a malfunction specified in section (f)(1.2.1)(C)) at or below 1.5 times any of the applicable standards; or

(C) For 2014 and subsequent model year ~~vehicles~~ engines, an air-fuel ratio cylinder imbalance (e.g., the air-fuel ratio in one or more cylinders is different than the other cylinders due to a cylinder specific malfunction such as an intake manifold leak at a particular cylinder, fuel injector problem, an individual cylinder EGR runner flow delivery problem, an individual variable cam lift malfunction such that an individual cylinder is operating on the wrong cam lift profile, or other similar problems) occurs in one or more cylinders such that the fuel delivery system is unable to maintain an ~~vehicle~~engine's emissions at or below: 3.0 times the applicable standards for the 2014 through 2016 model years; and 1.5 times the applicable FTP standards for all 2017 and subsequent model year ~~vehicles~~ engines.

(1.2.2) Except as provided for in section (f)(1.2.3) below, if the engine is equipped with adaptive feedback control, the OBD system shall detect a malfunction when the adaptive feedback control has used up all of the adjustment allowed by the manufacturer.

(1.2.3) If the engine is equipped with feedback control that is based on a secondary oxygen (or equivalent) sensor, the OBD system is not required to detect a malfunction of the fuel system solely when the feedback control based on a secondary oxygen sensor has used up all of the adjustment allowed by the manufacturer. However, if a failure or deterioration results in engine emissions that exceed the malfunction criteria in section (f)(1.2.1)(B), the OBD system is required to detect a malfunction.

(1.2.4) The OBD system shall detect a malfunction whenever the fuel control system fails to enter closed-loop operation within an Executive Officer-approved time interval after engine start. Executive Officer approval of the time interval shall be granted upon determining that the data and/or engineering evaluation submitted by the manufacturer supports the specified times.

(1.2.5) For engines that employ engine shutoff strategies that do not require the vehicle operator to restart the engine to continue driving (e.g., hybrid bus with engine shutoff at idle), the OBD system shall detect whenever the fuel control system fails to enter closed-loop operation within an Executive Officer-approved time interval after an engine restart. Executive Officer approval of the time interval shall be granted upon determining that the data and/or engineering evaluation submitted by the manufacturer supports the specified times.

(1.3) Monitoring Conditions:

(1.3.1) Except as provided in section (f)(1.3.5), the OBD system shall monitor continuously for malfunctions identified in sections (f)(1.2.1)(A), (f)(1.2.1)(B), and (f)(1.2.2) (i.e., fuel delivery system, secondary feedback control, adaptive feedback control).

(1.3.2) Manufacturers shall define monitoring conditions for malfunctions identified in section (f)(1.2.1)(C) (i.e., air-fuel ratio cylinder imbalance malfunctions) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements).

(1.3.3) Manufacturers shall define monitoring conditions for malfunctions identified in section (f)(1.2.4) in accordance with sections (d)(3.1).

(1.3.4) Manufacturers shall define monitoring conditions for malfunctions identified in section (f)(1.2.5) in accordance with sections (d)(3.1) with the exception that monitoring shall occur every time the monitoring conditions are met during the driving cycle in lieu of once per driving cycle as required in section (d)(3.1.2).

(1.3.5) Manufacturers may request Executive Officer approval to temporarily disable continuous monitoring under conditions technically necessary to ensure robust detection of malfunctions and to avoid false passes and false indications of malfunctions (e.g., for temporary introduction of large amounts of purge vapor). The Executive Officer shall approve the request upon determining that the manufacturer has submitted data and/or an engineering evaluation which demonstrate that a properly operating system cannot be distinguished from a malfunctioning system and that the disablement interval is limited only to that which is technically necessary.

(1.4) MIL Illumination and Fault Code Storage: For malfunctions described under section (f)(1.2.1)(C) (i.e., air-fuel ratio cylinder imbalance malfunctions), general requirements for MIL illumination and fault code storage are set forth in section (d)(2). For all other fuel system malfunctions, the MIL illumination and fault code storage requirements are set forth in sections (f)(1.4.1) through (1.4.6) below.

(1.4.1) A pending fault code shall be stored immediately upon the fuel system exceeding the malfunction criteria established pursuant to section (f)(1.2).

(1.4.2) Except as provided below, if a pending fault code is stored, the OBD system shall immediately illuminate the MIL and store a confirmed fault code if a malfunction is again detected during either of the following two events: (a) the driving cycle immediately following the storage of the pending fault code, regardless of the conditions encountered during the driving cycle; or (b) on the next driving cycle in which similar conditions (see section (c)) to those that occurred when the pending fault code was stored are encountered.

(1.4.3) The pending fault code may be erased at the end of the next driving cycle in which similar conditions have been encountered without an exceedance of the specified fuel system malfunction criteria. The pending code may also be erased if similar conditions are not encountered during the 80 driving cycles immediately after the initial detection of a malfunction for which the pending code was set.

(1.4.4) Storage of freeze frame conditions.

(A) The OBD system shall store and erase freeze frame conditions either in conjunction with storing and erasing a pending fault code or in conjunction with storing and erasing a confirmed fault code.

(B) If freeze frame conditions are stored for a malfunction other than a misfire (see section (f)(2)) or fuel system malfunction when a fault code is stored as specified in section (f)(1.4.1) or (f)(1.4.2) above, the stored freeze frame information shall be replaced with freeze frame information regarding the fuel system malfunction.

(1.4.5) Storage of fuel system conditions for determining similar conditions of operation.

(A) Upon detection of a fuel system malfunction under section (f)(1.2), the OBD system shall store the engine speed, load, and warm-up status of the first fuel system malfunction that resulted in the storage of the pending fault code.

(B) For fuel system faults detected using feedback control that is based on a secondary oxygen (or equivalent) sensor, the manufacturer may request Executive Officer approval to use an alternate definition of similar conditions in lieu of the definition specified in section (c). The Executive Officer shall approve the alternate definition upon the manufacturer providing data or analysis demonstrating that the alternate definition provides for equivalent robustness in detection of fuel system faults that vary in severity depending on engine speed, load, and/or warm-up status.

(1.4.6) Extinguishing the MIL. The MIL may be extinguished after three sequential driving cycles in which similar conditions have been encountered without a malfunction of the fuel system.

(2) Misfire Monitoring

(2.1) Requirement:

(2.1.1) The OBD system shall monitor the engine for misfire causing catalyst damage and misfire causing excess emissions.

(2.1.2) The OBD system shall identify the specific cylinder that is experiencing misfire. Manufacturers may request Executive Officer approval to store a general misfire fault code instead of a cylinder specific fault code under certain operating conditions. The Executive Officer shall approve the request upon determining that the manufacturer has submitted data and/or an engineering evaluation that demonstrate that the misfiring cylinder cannot be reliably identified when the conditions occur.

(2.1.3) If more than one cylinder is misfiring, a separate fault code shall be stored indicating that multiple cylinders are misfiring except as allowed below. When identifying multiple cylinder misfire, the OBD system is not required to also identify each of the misfiring cylinders individually through separate fault codes. If more than 90 percent of the detected misfires occur in a single cylinder, the OBD system may elect to store the appropriate fault code indicating the specific misfiring cylinder in lieu of the multiple cylinder misfire fault code. If, however, two or more cylinders individually have more than 10 percent of the total number of detected misfires, a multiple cylinder fault code must be stored.

(2.2) Malfunction Criteria: The OBD system shall detect a misfire malfunction pursuant to the following:

(2.2.1) Misfire causing catalyst damage:

(A) Manufacturers shall determine the percentage of misfire evaluated in 200 revolution increments for each engine speed and load condition that would result in a temperature that causes catalyst damage. The manufacturer shall submit documentation to support this percentage of misfire as required in section (j)(2.5). For every engine speed and load condition that this percentage of misfire is determined to be lower than five percent, the manufacturer may set the malfunction criteria at five percent.

(B) Subject to Executive Officer approval, a manufacturer may employ a longer interval than 200 revolutions but only for determining, on a given driving cycle, the first misfire exceedance as provided in section (f)(2.4.1)(A) below. Executive Officer approval shall be granted upon determining that the manufacturer has submitted data and/or an engineering evaluation that demonstrate that catalyst damage would not occur due to unacceptably high catalyst temperatures before the interval has elapsed.

(C) A misfire malfunction shall be detected if the percentage of misfire established in section (f)(2.2.1)(A) is exceeded. For multiple cylinder misfire situations that result in a misfire rate greater than or equal to 50 percent, the OBD system shall only be required to detect a misfire malfunction for situations that are caused by a single component failure.

(D) For purposes of establishing the temperature at which catalyst damage occurs as required in section (f)(2.2.1)(A), manufacturers may not define catalyst damage at a temperature more severe than what the catalyst system could be operated at for 10 consecutive hours and still meet the applicable standards.

(2.2.2) Misfire causing emissions to exceed 1.5 times the applicable standards:

(A) Manufacturers shall determine the percentage of misfire evaluated in 1000 revolution increments that would cause emissions from an emission durability demonstration engine to exceed 1.5 times any of the applicable standards if the percentage of misfire were present from the beginning of the test. To establish this percentage of misfire, the manufacturer shall utilize misfire events occurring at equally spaced, complete engine cycle intervals, across randomly selected cylinders throughout each 1000-revolution increment. If this percentage of misfire is determined to be lower than one percent, the manufacturer may set the malfunction criteria at one percent.

(B) Subject to Executive Officer approval, a manufacturer may employ other revolution increments. The Executive Officer shall grant approval upon determining that the manufacturer has demonstrated that the strategy would be equally effective and timely in detecting misfire.

(C) A malfunction shall be detected if the percentage of misfire established in section (f)(2.2.2)(A) is exceeded regardless of the pattern of misfire events (e.g., random, equally spaced, continuous).

(2.3) Monitoring Conditions:

(2.3.1) The OBD system shall continuously monitor for misfire under the following conditions:

(A) Except as provided for in section (f)(2.3.6) below, f~~F~~rom no later than the end of the second crankshaft revolution after engine start,

(B) While under positive torque conditions during the rise time and settling time for engine speed to reach the desired idle engine speed at engine start-up (i.e., "flare-up" and "flare-down"), and

(C) Under all positive torque engine speeds and load conditions except within the following range: the engine operating region bound by the positive torque line (i.e., engine load with the transmission in neutral), and the two following engine operating points: an engine speed of 3000 rpm with the engine load at the positive torque line, and the redline engine speed (defined in section (c)) with the engine's manifold vacuum at four inches of mercury lower than that at the positive torque line.

(2.3.2) If a monitoring system cannot detect all misfire patterns under all required engine speed and load conditions as required in section (f)(2.3.1) above, the manufacturer may request Executive Officer approval to accept the monitoring system. In evaluating the manufacturer's request, the Executive Officer shall consider the following factors: the magnitude of the region(s) in which misfire detection is limited, the degree to which misfire detection is limited in the region(s) (i.e., the probability of detection of misfire events), the frequency with which said region(s) are expected to be encountered in-use, the type of misfire patterns for which misfire detection is troublesome, and demonstration that the monitoring technology employed is not inherently incapable of detecting misfire under required conditions (i.e., compliance can be achieved on other engines). The evaluation shall be based on the following misfire patterns: equally spaced misfire occurring on randomly selected cylinders, single cylinder continuous misfire, and paired cylinder (cylinders firing at the same crank angle) continuous misfire.

(2.3.3) A manufacturer may request Executive Officer approval of a monitoring system that has reduced misfire detection capability during the portion of the first 1000 revolutions after engine start that a cold start emission reduction strategy that reduces engine torque (e.g., spark retard strategies) is active. The Executive Officer shall approve the request upon determining that the manufacturer has demonstrated that the probability of detection is greater than or equal to 75 percent during the worst case condition (i.e., lowest generated torque) for a vehicle operated continuously at idle (park/neutral idle) on a cold start between 50 and 86 degrees Fahrenheit and that the technology cannot reliably detect a higher percentage of the misfire events during the conditions.

(2.3.4) A manufacturer may request Executive Officer approval to disable misfire monitoring or employ an alternate malfunction criterion when misfire cannot be distinguished from other effects.

(A) Upon determining that the manufacturer has presented documentation that demonstrates the disablement interval or period of use of an alternate malfunction criterion is limited only to that necessary for avoiding false detection, the Executive Officer shall approve the disablement or use of the alternate malfunction criterion for conditions involving:

(i) rough road,

(ii) fuel cut,

(iii) gear changes for manual transmission vehicles,

(iv) traction control or other vehicle stability control activation such as anti-lock braking or other engine torque modifications to enhance vehicle stability,

(v) off-board control or intrusive activation of vehicle components or diagnostics during service or assembly plant testing,

(vi) portions of intrusive evaporative system or EGR diagnostics that can significantly affect engine stability (i.e., while the purge valve is open during the vacuum pull-down of a evaporative system leak check but not while the purge valve is closed and the evaporative system is sealed or while an EGR diagnostic causes the EGR valve to be intrusively cycled on and off during positive torque conditions), or

(vii) engine speed, load, or torque transients due to throttle movements more rapid than occurs over the FTP cycle for the worst case engine within each engine family.

(B) Additionally, the Executive Officer will approve a manufacturer's request in accordance with sections (g)(5.3), (g)(5.4), and (g)(5.6) to disable misfire monitoring when the fuel level is 15 percent or less of the nominal capacity of the fuel tank, when PTO units are active, or while engine coolant temperature is below 20 degrees Fahrenheit. The Executive Officer will approve a request to continue disablement on engine starts when engine coolant temperature is below 20 degrees Fahrenheit at engine start until engine coolant temperature exceeds 70 degrees Fahrenheit.

(C) In general, the Executive Officer shall not approve disablement for conditions involving normal air conditioning compressor cycling from on-to-off or off-to-on, automatic transmission gear shifts (except for shifts occurring during wide open throttle operation), transitions from idle to off-idle, normal engine speed or load changes that occur during the engine speed rise time and settling time (i.e., "flare-up" and "flare-down") immediately after engine starting without any vehicle operator-induced actions (e.g., throttle stabs), or excess acceleration (except for acceleration rates that exceed the maximum acceleration rate obtainable at wide open throttle while the vehicle is in gear due to abnormal conditions such as slipping of a clutch).

(D) The Executive Officer may approve misfire monitoring disablement or use of an alternate malfunction criterion for any other condition on a case by case basis upon determining that the manufacturer has demonstrated that the request is based on an unusual or unforeseen circumstance and that it is applying the best available computer and monitoring technology.

(2.3.5) For engines with more than eight cylinders that cannot meet the requirements of section (f)(2.3.1), a manufacturer may request Executive Officer approval to use alternative misfire monitoring conditions. The Executive Officer shall approve the request upon determining that the manufacturer has submitted data and/or an engineering evaluation that demonstrate that misfire detection throughout the required operating region cannot be achieved when employing proven monitoring technology (i.e., a technology that provides for compliance with these requirements on other engines) and provided misfire is detected to the fullest extent permitted by the technology. However, the Executive Officer may not grant the request if the misfire detection system is unable to monitor during all positive torque operating conditions encountered during an FTP cycle.

(2.3.6) For engines that employ engine shutoff strategies that do not require the vehicle operator to restart the engine to continue driving (e.g., hybrid bus with engine shutoff at idle), the OBD system shall monitor for misfire from no later than the end of the second crankshaft revolution after ~~each engine restart~~ engine fueling begins for the initial start and after each time fueling resumes.

(2.4) MIL Illumination and Fault Code Storage:

(2.4.1) Misfire causing catalyst damage. Upon detection of the percentage of misfire specified in section (f)(2.2.1) above, the following criteria shall apply for MIL illumination and fault code storage:

(A) Pending fault codes

(i) A pending fault code shall be stored immediately if, during a single driving cycle, the specified percentage of misfire is exceeded three times when operating in the positive torque region encountered during an FTP cycle or is exceeded on a single occasion when operating at any other engine speed and load condition in the positive torque region defined in section (f)(2.3.1).

(ii) Immediately after a pending fault code is stored as specified in section (f)(2.4.1)(A)(i) above, the MIL shall blink once per second at all times while misfire is occurring during the driving cycle.

a. The MIL may be extinguished during those times when misfire is not occurring during the driving cycle.

b. If, at the time a misfire malfunction occurs, the MIL is already illuminated for a malfunction other than misfire, the MIL shall blink as previously specified in section (f)(2.4.1)(A)(ii) while misfire is occurring. If misfiring ceases, the MIL shall stop blinking but remain illuminated as required by the other malfunction.

(B) Confirmed fault codes

(i) If a pending fault code for exceeding the percentage of misfire set forth in section (f)(2.2.1) is stored, the OBD system shall immediately store a confirmed fault code if the percentage of misfire specified in section (f)(2.2.1) is again exceeded one or more times during either: (a) the driving cycle immediately following the storage of the pending fault code, regardless of the conditions encountered during the driving cycle; or (b) on the next driving cycle in which similar conditions (see section (c)) to the engine conditions that occurred when the pending fault code was stored are encountered.

(ii) If a pending fault code for exceeding the percentage of misfire set forth in section (f)(2.2.2) is stored from a previous driving cycle, the OBD system shall immediately store a confirmed fault code if the percentage of misfire specified in section (f)(2.2.1) is exceeded one or more times regardless of the conditions encountered.

(iii) Upon storage of a confirmed fault code, the MIL shall blink as specified in subparagraph (f)(2.4.1)(A)(ii) above as long as misfire is occurring and the MIL shall remain continuously illuminated if the misfiring ceases.

(C) Erasure of pending fault codes
Pending fault codes shall be erased at the end of the next driving cycle in which similar conditions to the engine conditions that occurred when the pending fault code was stored have been encountered without any exceedance of the specified percentage of misfire. The pending code may also be erased if similar driving conditions are not encountered during the next 80 driving cycles subsequent to the initial detection of a malfunction.

(D) Exemptions for engines with fuel shutoff and default fuel control.
Notwithstanding sections (f)(2.4.1)(A) and (B) above, in engines that provide for fuel shutoff and default fuel control to prevent over fueling during catalyst damage misfire conditions, the MIL is not required to blink. Instead, the MIL may illuminate continuously in accordance with the requirements for continuous MIL illumination in sections (f)(2.4.1)(B)(iii) above upon detection of misfire, provided that the fuel shutoff and default control are activated as soon as misfire is detected. Fuel shutoff and default fuel control may be deactivated only to permit fueling outside of the misfire range. Manufacturers may also periodically, but not more than once every 30 seconds, deactivate fuel shutoff and default fuel control to determine if the specified catalyst damage percentage of misfire is still being exceeded. Normal fueling and fuel control may be resumed if the specified catalyst damage percentage of misfire is no longer being exceeded.

(E) Manufacturers may request Executive Officer approval of strategies that continuously illuminate the MIL in lieu of blinking the MIL during extreme catalyst damage misfire conditions (i.e., catalyst damage misfire occurring at all engine speeds and loads). Executive Officer approval shall be granted upon determining that the manufacturer employs the strategy only when catalyst damage misfire levels cannot be avoided during reasonable driving conditions and the manufacturer has demonstrated that the strategy will encourage operation of the vehicle in conditions that will minimize catalyst damage (e.g., at low engine speeds and loads).

(2.4.2) Misfire causing emissions to exceed 1.5 times the FTP standards. Upon detection of the percentage of misfire specified in section (f)(2.2.2), the following criteria shall apply for MIL illumination and fault code storage:

(A) Misfire within the first 1000 revolutions after engine start.

(i) A pending fault code shall be stored no later than after the first exceedance of the specified percentage of misfire during a single driving cycle if the exceedance occurs within the first 1000 revolutions after engine start (defined in section (c)) during which misfire detection is active.

(ii) If a pending fault code is stored, the OBD system shall illuminate the MIL and store a confirmed fault code within 10 seconds if an exceedance of the specified percentage of misfire is again detected in the first 1000 revolutions during any subsequent driving cycle, regardless of the conditions encountered during the driving cycle.

(iii) The pending fault code shall be erased at the end of the next driving cycle in which similar conditions to the engine conditions that occurred when the pending fault code was stored have been encountered without an exceedance of the specified percentage of misfire. The pending code may also be erased if similar conditions are not encountered during the next 80 driving cycles immediately following the initial detection of the malfunction.

(B) Exceedances after the first 1000 revolutions after engine start.

(i) A pending fault code shall be stored no later than after the fourth exceedance of the percentage of misfire specified in section (f)(2.2.2) during a single driving cycle.

(ii) If a pending fault code is stored, the OBD system shall illuminate the MIL and store a confirmed fault code within 10 seconds if the percentage of misfire specified in section (f)(2.2.2) is again exceeded four times during: (a) the driving cycle immediately following the storage of the pending fault code, regardless of the conditions encountered during the driving cycle; or (b) on the next driving cycle in which similar conditions (see section (c)) to the engine conditions that occurred when the pending fault code was stored are encountered.

(iii) The pending fault code may be erased at the end of the next driving cycle in which similar conditions to the engine conditions that occurred when the pending fault code was stored have been encountered without an exceedance of the specified percentage of misfire. The pending code may also be erased if similar conditions are not encountered during the next 80 driving cycles immediately following initial detection of the malfunction.

(2.4.3) Storage of freeze frame conditions.

(A) The OBD system shall store and erase freeze frame conditions either in conjunction with storing and erasing a pending fault code or in conjunction with storing and erasing a confirmed fault code.

(B) If freeze frame conditions are stored for a malfunction other than a misfire or fuel system malfunction (see section (f)(1)) when a fault code is stored as specified in section (f)(2.4) above, the stored freeze frame information shall be replaced with freeze frame information regarding the misfire malfunction.

(2.4.4) Storage of misfire conditions for similar conditions determination. Upon detection of misfire under sections (f)(2.4.1) or (2.4.2), the OBD system shall store the following engine conditions: engine speed, load, and warm-up status of the first misfire event that resulted in the storage of the pending fault code.

(2.4.5) Extinguishing the MIL. The MIL may be extinguished after three sequential driving cycles in which similar conditions have been encountered without an exceedance of the specified percentage of misfire.

(3) Exhaust Gas Recirculation (EGR) System Monitoring

(3.1) Requirement: The OBD system shall monitor the EGR system on engines so-equipped for low and high flow rate malfunctions. The individual electronic components (e.g., actuators, valves, sensors) that are used in the EGR system shall be monitored in accordance with the comprehensive component requirements in section (g)(3).

(3.2) Malfunction Criteria:

(3.2.1) The OBD system shall detect a malfunction of the EGR system prior to a decrease from the manufacturer's specified EGR flow rate that would cause an engine's emissions to exceed 1.5 times any of the applicable standards. For engines in which no failure or deterioration of the EGR system that causes a decrease in flow could result in an engine's emissions exceeding 1.5 times any of the applicable standards, the OBD system shall detect a malfunction when the system has no detectable amount of EGR flow.

(3.2.2) The OBD system shall detect a malfunction of the EGR system prior to an increase from the manufacturer's specified EGR flow rate that would cause an engine's emissions to exceed 1.5 times any of the applicable standards. For engines in which no failure or deterioration of the EGR system that causes an increase in flow could result in an engine's emissions exceeding 1.5 times any of the applicable standards, the OBD system shall detect a malfunction when the system has reached its control limits such that it cannot reduce EGR flow.

(3.3) Monitoring Conditions:

(3.3.1) Manufacturers shall define the monitoring conditions for malfunctions identified in section (f)(3.2) (i.e., flow rate) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements). For purposes of tracking and reporting as required in section (d)(3.2.1), all monitors used to detect malfunctions identified in section (f)(3.2) shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

(3.3.2) Manufacturers may request Executive Officer approval to temporarily disable the EGR system check under conditions when monitoring may not be reliable (e.g., when freezing may affect performance of the system). The Executive Officer shall approve the request upon determining that the manufacturer has submitted data and/or an engineering evaluation which demonstrate that a reliable check cannot be made when these conditions exist.

(3.4) MIL Illumination and Fault Code Storage: General requirements for MIL illumination and fault code storage are set forth in section (d)(2).

(4) Cold Start Emission Reduction Strategy Monitoring

(4.1) Requirement:

<u>(4.1.1)</u> If an engine incorporates a specific engine control strategy to reduce cold start emissions, the OBD system shall monitor the commanded elements/components for proper function (e.g., increased engine idle speed, mass air flow, commanded ignition timing retard), other than secondary air, while the control strategy is active to ensure proper operation of the control strategy. Secondary air systems shall be monitored under the provisions of section (f)(5).

<u>(4.1.2) For an element/component associated with the cold start emission reduction control strategy under section (f)(4) that is also required to be</u>

monitored elsewhere in section (f) or (g) (e.g., fuel injection timing), the manufacturer shall use different diagnostics to distinguish faults detected under section (f)(4) (i.e., faults associated with the cold start strategy) from faults detected under sections other than section (f)(4) (i.e., faults not associated with the cold start strategy).

(4.2) Malfunction Criteria:

(4.2.1) For 2010 through 2012 model year engines:

(A) The OBD system shall detect a malfunction prior to any failure or deterioration of the individual elements/components associated with the cold start emission reduction control strategy that would cause an engine's emissions to exceed 1.5 times the applicable standards. Manufacturers shall:

(i) Establish the malfunction criteria based on data from one or more representative engine(s).

(ii) Provide an engineering evaluation for establishing the malfunction criteria for the remainder of the manufacturer's product line. The Executive Officer shall waive the evaluation requirement each year if, in the judgment of the Executive Officer, technological changes do not affect the previously determined malfunction criteria.

(B) For components where no failure or deterioration of the element/component used for the cold start emission reduction strategy could result in an engine's emissions exceeding 1.5 times the applicable standards, the individual element/component shall be monitored for proper functional response in accordance with the malfunction criteria in section (g)(3.2) while the control strategy is active.

(4.2.2) For 2013 and subsequent model year engines, the OBD system shall, to the extent feasible, detect a malfunction if either of the following occurs:

(A) Any single commanded element/component does not properly respond to the commanded action while the cold start strategy is active. For elements/components involving spark timing (e.g., retarded spark timing), the monitor may verify final commanded spark timing in lieu of verifying actual delivered spark timing. For purposes of this section, "properly respond" is defined as when the element responds:

(i) by a robustly detectable amount; and

(ii) in the direction of the desired command; and

(iii) above and beyond what the element/component would achieve on start-up without the cold start strategy active (e.g., if the cold start strategy commands a higher idle engine speed, a fault must be detected if there is no detectable amount of engine speed increase above what the system would achieve without the cold start strategy active);

(B) Any failure or deterioration of the cold start emission reduction control strategy that would cause an engine's emissions to be equal to or above 1.5 times the applicable standards. For this requirement, the OBD system shall either monitor the combined effect of the elements/components of the system as a whole (e.g., measuring air flow and modeling overall heat into the exhaust) or the individual elements/components (e.g., increased engine speed, commanded final spark timing) for failures that cause engine emissions to exceed 1.5 times the applicable standards.

(4.3) Monitoring Conditions: Manufacturers shall define the monitoring conditions for malfunctions identified in section (f)(4.2) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements).

(4.4) MIL Illumination and Fault Code Storage: General requirements for MIL illumination and fault code storage are set forth in section (d)(2).

(5) Secondary Air System Monitoring

(5.1) Requirement:

(5.1.1) The OBD system on engines equipped with any form of secondary air delivery system shall monitor the proper functioning of the secondary air delivery system including all air switching valve(s). The individual electronic components (e.g., actuators, valves, sensors) in the secondary air system shall be monitored in accordance with the comprehensive component requirements in section (g)(3).

(5.1.2) For purposes of section (f)(5), "air flow" is defined as the air flow delivered by the secondary air system to the exhaust system. For engines using secondary air systems with multiple air flow paths/distribution points, the air flow to each bank (i.e., a group of cylinders that share a common exhaust manifold, catalyst, and control sensor) shall be monitored in accordance with the malfunction criteria in section (f)(5.2) unless complete blocking of air delivery to one bank does not cause a measurable increase in emissions.

(5.1.3) For purposes of section (f)(5), "normal operation" is defined as the condition when the secondary air system is activated during catalyst and/or engine warm-up following engine start. "Normal operation" does not include the condition when the secondary air system is intrusively turned on solely for the purpose of monitoring.

(5.2) Malfunction Criteria:

(5.2.1) Except as provided in section (f)(5.2.3), the OBD system shall detect a secondary air system malfunction prior to a decrease from the manufacturer's specified air flow during normal operation that would cause an engine's emissions to exceed 1.5 times any of the applicable standards.

(5.2.2) Except as provided in section (f)(5.2.~~3~~4), the OBD system shall detect a secondary air system malfunction prior to an increase from the manufacturer's specified air flow during normal operation that would cause an engine's emissions to exceed 1.5 times any of the applicable standards.

(5.2.3) For engines in which no deterioration or failure of the secondary air system that causes a decrease in air flow would result in an engine's emissions exceeding 1.5 times any of the applicable standards, the OBD system shall detect a malfunction when no detectable amount of air flow is delivered during normal operation~~ of the secondary air system~~.

(5.2.4) For 2016 and subsequent model year engines in which no deterioration or failure of the secondary air system that causes an increase in air flow would result in an engine's emissions exceeding 1.5 times any of the

<ins>applicable standards, the OBD system shall detect a malfunction when the secondary air system has reached its control limits such that it cannot reduce air flow during normal operation.</ins>

(5.3) Monitoring Conditions:

(5.3.1) Manufacturers shall define the monitoring conditions in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements). For purposes of tracking and reporting as required in section (d)(3.2.1), all monitors used to detect malfunctions identified in section (f)(5.2) during normal operation of the secondary air system shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

(5.4) MIL Illumination and Fault Code Storage: General requirements for MIL illumination and fault code storage are set forth in section (d)(2).

(6) Catalyst Monitoring

(6.1) Requirement: The OBD system shall monitor the catalyst system for proper conversion capability.

(6.2) Malfunction Criteria:

(6.2.1) The OBD system shall detect a catalyst system malfunction when the catalyst system's conversion capability decreases to the point that any of the following occurs:

(A) Non-Methane Hydrocarbon (NMHC) emissions exceed 1.75 times the applicable standards to which the engine has been certified.

(B) The average FTP test NMHC conversion efficiency of the monitored portion of the catalyst system falls below 50 percent (i.e., the cumulative NMHC emissions measured at the outlet of the monitored catalyst(s) are more than 50 percent of the cumulative engine-out emissions measured at the inlet of the catalyst(s)). With Executive Officer approval, manufacturers may use a conversion efficiency malfunction criteria of less than 50 percent if the catalyst system is designed such that the monitored portion of the catalyst system must be replaced along with an adjacent portion of the catalyst system sufficient to ensure that the total portion replaced will meet the 50 percent conversion efficiency criteria. Executive Officer approval shall be based on data and/or engineering evaluation demonstrating the conversion efficiency of the monitored portion and the total portion designed to be replaced, and the likelihood of the catalyst system design to ensure replacement of the monitored and adjacent portions of the catalyst system.

(C) Oxides of nitrogen (NOx) emissions exceed 1.75 times the applicable NOx standard to which the engine has been certified.

(6.2.2) For purposes of determining the catalyst system malfunction criteria in section (f)(6.2.1):

(A) The manufacturer shall use a catalyst system deteriorated to the malfunction criteria using methods established by the manufacturer to represent real world catalyst deterioration under normal and malfunctioning operating conditions.

(B) Except as provided below in section (f)(6.2.2)(C), the malfunction criteria shall be established by using a catalyst system with all monitored and unmonitored (downstream of the sensor utilized for catalyst monitoring) catalysts simultaneously deteriorated to the malfunction criteria.

(C) For engines using fuel shutoff to prevent over-fueling during misfire conditions (see section (f)(2.4.1)(D)), the malfunction criteria shall be established by using a catalyst system with all monitored catalysts simultaneously deteriorated to the malfunction criteria while unmonitored catalysts shall be deteriorated to the end of the engine's useful life.

(6.3) Monitoring Conditions: Manufacturers shall define the monitoring conditions for malfunctions identified in section (f)(6.2) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements). For purposes of tracking and reporting as required in section (d)(3.2.1), all monitors used to detect malfunctions identified in section (f)(6.2) shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

(6.4) MIL Illumination and Fault Code Storage:

(6.4.1) General requirements for MIL illumination and fault code storage are set forth in section (d)(2).

(6.4.2) The monitoring method for the catalyst(s) shall be capable of detecting when a catalyst fault code has been cleared (except OBD system self-clearing), but the catalyst has not been replaced (e.g., catalyst overtemperature histogram approaches are not acceptable).

(7) Evaporative System Monitoring

(7.1) Requirement: The OBD system shall verify purge flow from the evaporative system and shall monitor the complete evaporative system, excluding the tubing and connections between the purge valve and the intake manifold, for vapor leaks to the atmosphere. Individual components of the evaporative system (e.g. valves, sensors) shall be monitored in accordance with the comprehensive components requirements in section (g)(3) (e.g., for circuit continuity, out of range values, rationality, proper functional response). Vehicles not ~~required to be equipped with~~ subject to evaporative emission standards ~~systems~~ shall be exempt from monitoring of the evaporative system. For alternate-fueled engines subject to evaporative emission standards, manufacturers shall submit a monitoring plan to the Executive Officer for approval. The Executive Officer shall approve the request upon determining that the manufacturer has submitted data and an engineering evaluation that demonstrate that the monitoring plan is as reliable and effective as the monitoring plan required for gasoline engines under section (f)(7).

(7.2) Malfunction Criteria:

(7.2.1) For purposes of section (f)(7), an "orifice" is defined as an O'Keefe Controls Co. precision metal "Type B" orifice with NPT connections with a diameter of the specified dimension (e.g., part number B-31-SS for a stainless steel 0.031 inch diameter orifice).

(7.2.2) The OBD system shall detect an evaporative system malfunction when any of the following conditions exist:

(A) No purge flow from the evaporative system to the engine can be detected by the OBD system; or

(B) The complete evaporative system contains a leak or leaks that cumulatively are greater than or equal to a leak caused by a 0.150 inch diameter orifice.

(7.2.3) A manufacturer may request the Executive Officer to revise the orifice size in section (f)(7.2.2)(B) if the most reliable monitoring method available cannot reliably detect a system leak of the magnitudes specified. The Executive Officer shall approve the request upon determining that the manufacturer has provided data and/or engineering analysis that demonstrate the need for the request.

(7.2.4) Upon request by the manufacturer and upon determining that the manufacturer has submitted data and/or engineering evaluation which support the request, the Executive Officer shall revise the orifice size in section (f)(7.2.2)(B) upward to exclude detection of leaks that cannot cause evaporative or running loss emissions to exceed 1.5 times the applicable evaporative emission standards.

(7.2.5) For ~~vehicles~~ engines that utilize more than one purge flow path (e.g., a turbo-charged engine with a low pressure purge line and a high pressure purge line), the OBD system shall verify the criteria of (f)(7.2.2)(A) (i.e., purge flow to the engine) for ~~both~~ all purge flow paths. If a manufacturer demonstrates that blockage, leakage, or disconnection of one of the purge flow paths cannot cause a measurable emission increase during any reasonable in-use driving conditions, monitoring of that flow path is not required.

(7.3) Monitoring Conditions:

(7.3.1) Manufacturers shall define the monitoring conditions for malfunctions identified in section (f)(7.2.2)(A) (i.e., purge flow) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements).

(7.3.2) Manufacturers shall define the monitoring conditions for malfunctions identified in section (f)(7.2.2)(B) (i.e., 0.150 inch leak detection) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements). For purposes of tracking and reporting as required in section (d)(3.2.1), all monitors used to detect malfunctions identified in section (f)(7.2.2)(B) shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

(7.3.3) Manufacturers may disable or abort an evaporative system monitor when the fuel tank level is over 85 percent of nominal tank capacity or during a refueling event.

(7.3.4) Manufacturers may request Executive Officer approval to execute the evaporative system monitor only on driving cycles determined by the manufacturer to be cold starts if the condition is needed to ensure reliable monitoring. The Executive Officer shall approve the request upon determining that data and/or an engineering evaluation submitted by the manufacturer demonstrate that a reliable check can only be made on driving cycles when the cold start criteria are satisfied. However, in making a decision, the Executive Officer will not approve conditions that exclude engine starts from being considered as cold starts solely on the basis that ambient temperature exceeds (i.e., indicates a higher temperature than) engine coolant temperature at engine start.

(7.3.5) Manufacturers may temporarily disable the evaporative purge system to perform an evaporative system leak check.

(7.4) MIL Illumination and Fault Code Storage:

(7.4.1) Except as provided below for fuel cap leaks, general requirements for MIL illumination and fault code storage are set forth in section (d)(2).

(7.4.2) If the OBD system is capable of discerning that a system leak is being caused by a missing or improperly secured fuel cap:

(A) The manufacturer is not required to illuminate the MIL or store a fault code if the vehicle is equipped with an alternative indicator for notifying the vehicle operator of the malfunction. The alternative indicator shall be of sufficient illumination and location to be readily visible under all lighting conditions.

(B) If the vehicle is not equipped with an alternative indicator and the MIL illuminates, the MIL may be extinguished and the corresponding fault codes erased once the OBD system has verified that the fuel cap has been securely fastened and the MIL has not been illuminated for any other type of malfunction.

(C) The Executive Officer may approve other strategies that provide equivalent assurance that a vehicle operator will be promptly notified of a missing or improperly secured fuel cap and that corrective action will be undertaken.

(8) Exhaust Gas Sensor Monitoring

(8.1) Requirement:

(8.1.1) The OBD system shall monitor the output signal, response rate, and any other parameter which can affect emissions of all primary (fuel control) oxygen sensors (conventional switching sensors and wide range or universal sensors) for malfunction.

(8.1.2) The OBD system shall also monitor all secondary oxygen sensors (those used for fuel trim control or as a monitoring device) for proper output signal, activity, and response rate.

(8.1.3) For engines equipped with heated oxygen sensors, the OBD system shall monitor the heater for proper performance.

(8.1.4) For other types of sensors (e.g., hydrocarbon sensors, NOx sensors), the manufacturer shall submit a monitoring plan to the Executive Officer for approval. The Executive Officer shall approve the request upon determining that the manufacturer has submitted data and an engineering evaluation that demonstrate that the monitoring plan is as reliable and effective as the monitoring plan required for conventional sensors under section (f)(8).

(8.2) Malfunction Criteria:

(8.2.1) Primary Sensors:

(A) The OBD system shall detect a malfunction prior to any failure or deterioration of the oxygen sensor output voltage, resistance, impedance, current, response rate, amplitude, offset, or other characteristic(s) (including drift or bias corrected for by secondary sensors) that would cause an engine's emissions to exceed 1.5 times any of the applicable standards. For response rate (see section (c)), the OBD system shall detect asymmetric malfunctions (i.e., malfunctions that primarily affect only the lean-to-rich response rate or only the rich-to-lean response rate) and symmetric malfunctions (i.e., malfunctions that affect both the lean-to-rich and rich-to-lean response rates). As defined in section (c), response rate includes delays in the sensor to initially react to a change in exhaust gas composition as well as delays during the transition from a rich-to-lean (or lean-to-rich) sensor output. For 2013 and subsequent model year engines, the manufacturer shall submit data and/or engineering analysis to demonstrate that the calibration method used ensures proper detection of all symmetric and asymmetric response rate malfunctions as part of the certification application.

(B) The OBD system shall detect malfunctions of the oxygen sensor caused by either a lack of circuit continuity or out-of-range values.

(C) The OBD system shall detect a malfunction of the oxygen sensor when a sensor failure or deterioration causes the fuel system to stop using that sensor as a feedback input (e.g., causes default or open-loop operation) or causes the fuel system to fail to enter closed-loop operation within a manufacturer-specified time interval.

(D) The OBD system shall detect a malfunction of the oxygen sensor when the sensor output voltage, resistance, impedance, current, amplitude, activity, or other characteristics are no longer sufficient for use as an OBD system monitoring device (e.g., for catalyst monitoring).

(8.2.2) Secondary Sensors:

(A) The OBD system shall detect a malfunction prior to any failure or deterioration of the oxygen sensor voltage, resistance, impedance, current, response rate, amplitude, offset, or other characteristic(s) that would cause an engine's emissions to exceed 1.5 times any of the applicable standards.

(B) The OBD system shall detect malfunctions of the oxygen sensor caused by a lack of circuit continuity.

(C) Sufficient sensor performance for other monitors.

(i) The OBD system shall detect a malfunction of the oxygen sensor when the sensor output voltage, resistance, impedance, current, amplitude, activity, offset, or other characteristics are no longer sufficient for use as an OBD system monitoring device (e.g., for catalyst monitoring). For this requirement, "sufficient" is defined as the capability of the worst performing acceptable sensor to detect the best performing unacceptable other monitored system or component (e.g., catalyst).

(ii) For systems where it is not technically feasible to satisfy the criteria of section (f)(8.2.2)(C)(i) completely, the OBD system shall, at a minimum, detect a slow rich-to-lean response malfunction during a fuel shut-off event (e.g., deceleration fuel cut event) on all 2013 and subsequent model year engines. The rich-to-lean response check shall monitor both the sensor response time from a rich condition (e.g., 0.7 Volts) prior to the start of fuel shut-off to a lean condition (e.g., 0.1 Volts) expected during fuel shut-off conditions and the sensor transition time in the intermediate sensor range (e.g., from 0.55 Volts to 0.3 Volts).

(iii) Additionally, for systems where it is not technically feasible to satisfy the criteria in section (f)(8.2.2)(C)(i), prior to certification of 2013 model year engines, the manufacturer must submit a comprehensive plan to the Executive Officer demonstrating the manufacturer's efforts to minimize any gap remaining between the worst performing acceptable sensor and a sufficient sensor. The plan should include quantification of the gap and supporting documentation for efforts to close the gap including sensor monitoring improvements, other system component monitor improvements (e.g., changes to make the catalyst monitor less sensitive to oxygen sensor response), and sensor specification changes, if any. The Executive Officer shall approve the plan upon determining the submitted information supports the necessity of the gap and the plan demonstrates that the manufacturer is taking reasonable efforts to minimize or eliminate the gap in a timely manner.

(D) The OBD system shall detect malfunctions of the oxygen sensor caused by out-of-range values.

(E) The OBD system shall detect a malfunction of the oxygen sensor when a sensor failure or deterioration causes the fuel system (e.g., fuel control) to stop using that sensor as a feedback input (e.g., causes default or open-loop operation).

(8.2.3) Sensor Heaters:

(A) The OBD system shall detect a malfunction of the heater performance when the current or voltage drop in the heater circuit is no longer within the manufacturer's specified limits for normal operation (i.e., within the criteria required to be met by the component vendor for heater circuit performance at high mileage). Subject to Executive Officer approval, other malfunction criteria for heater performance malfunctions may be used upon the Executive Officer determining that the manufacturer has submitted data and/or an engineering evaluation that demonstrate the monitoring reliability and timeliness to be equivalent to the stated criteria in section (f)(8.2.3)(A).

(B) The OBD system shall detect malfunctions of the heater circuit including open or short circuits that conflict with the commanded state of the heater (e.g., shorted to 12 Volts when commanded to 0 Volts (ground)).

(8.3) Monitoring Conditions:

(8.3.1) Primary Sensors

(A) Manufacturers shall define the monitoring conditions for malfunctions identified in sections (f)(8.2.1)(A) and (D) (e.g., proper response rate) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements). For purposes of tracking and reporting as required in section (d)(3.2.1), all monitors used to detect malfunctions identified in sections (f)(8.2.1)(A) and (D) shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

(B) Except as provided in section (f)(8.3.1)(C), monitoring for malfunctions identified in sections (f)(8.2.1)(B) and (C) (i.e., circuit continuity, out-of-range, and open-loop malfunctions) shall be conducted continuously.

(C) A manufacturer may request Executive Officer approval to disable continuous exhaust gas sensor monitoring when an exhaust gas sensor malfunction cannot be distinguished from other effects (e.g., disable out-of-range low monitoring during fuel cut conditions). The Executive Officer shall approve the disablement upon determining that the manufacturer has submitted test data and/or documentation that demonstrate a properly functioning sensor cannot be distinguished from a malfunctioning sensor and that the disablement interval is limited only to that necessary for avoiding false detection.

(8.3.2) Secondary Sensors

(A) Manufacturers shall define monitoring conditions for malfunctions identified in sections (f)(8.2.2)(A) and (C) (e.g., proper sensor activity) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements). For all 2013 and subsequent model year engines meeting the monitoring requirements of section (f)(8.2.2)(C)(i) or (ii), for purposes of tracking and reporting as required in section (d)(3.2.1), all monitors used to detect malfunctions identified in sections (f)(8.2.2)(A) and (C) shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

(B) Except as provided in section (f)(8.3.2)(C), monitoring for malfunctions identified in sections (f)(8.2.2)(B), (D), and (E) (i.e., open circuit, out-of-range malfunctions, open-loop malfunctions) shall be conducted continuously.

(C) A manufacturer may request Executive Officer approval to disable continuous exhaust gas sensor monitoring when an oxygen sensor malfunction cannot be distinguished from other effects (e.g., disable out-of-range low monitoring during fuel cut conditions). The Executive Officer shall approve the disablement upon determining that the manufacturer has submitted test data and/or documentation that demonstrate a properly functioning sensor cannot be distinguished from a malfunctioning sensor and that the disablement interval is limited only to that necessary for avoiding false detection.

(8.3.3) Sensor Heaters

(A) Manufacturers shall define monitoring conditions for malfunctions identified in section (f)(8.2.3)(A) (i.e., sensor heater performance) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements).

(B) Monitoring for malfunctions identified in section (f)(8.2.3)(B) (i.e., circuit malfunctions) shall be conducted continuously.

(8.4) MIL Illumination and Fault Code Storage: General requirements for MIL illumination and fault code storage are set forth in section (d)(2). <u>To the extent feasible, the OBD system shall separately detect lack of circuit continuity and out-of-range faults as required under sections (f)(8.2.1)(B), (f)(8.2.2)(B), and (f)(8.2.2)(D) and store different fault codes for each distinct malfunction (e.g., out-of-range low, out-of-range high, open circuit). Manufacturers are not required to store separate fault codes for lack of circuit continuity faults that cannot be distinguished from other out-of-range circuit faults.</u>

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

(9.1) Requirement: The OBD system shall monitor the VVT system on engines so-equipped for target error and slow response malfunctions. The individual electronic components (e.g., actuators, valves, sensors) that are used in the VVT system shall be monitored in accordance with the comprehensive components requirements in section (g)(3).

(9.2) Malfunction Criteria:

(9.2.1) Target Error: The OBD system shall detect a malfunction prior to any failure or deterioration in the capability of the VVT system to achieve the commanded valve timing and/or control within a crank angle and/or lift tolerance that would cause an engine's emissions to exceed 1.5 times any of the applicable standards.

(9.2.2) Slow Response: The OBD system shall detect a malfunction prior to any failure or deterioration in the capability of the VVT system to achieve the commanded valve timing and/or control within a manufacturer-specified time that would cause an engine's emissions to exceed 1.5 times any of the applicable standards for gasoline engines.

(9.2.3) For engines in which no failure or deterioration of the VVT system could result in an engine's emissions exceeding 1.5 times any of the applicable standards, the OBD system shall detect a malfunction of the VVT system when proper functional response of the system to computer commands does not occur.

(9.3) Monitoring Conditions: Manufacturers shall define the monitoring conditions for VVT system malfunctions identified in section (f)(9.2) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements), with the exception that monitoring shall occur every time the monitoring conditions are met during the driving cycle in lieu of once per driving cycle as required in section (d)(3.1.2). For purposes of tracking and reporting as required in section (d)(3.2.1), all monitors used to detect malfunctions identified in section (f)(9.2) shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

(9.4) MIL Illumination and Fault Code Storage: General requirements for MIL illumination and fault code storage are set forth in section (d)(2).

(g) *Monitoring Requirements For All Engines.*

(1) Engine Cooling System Monitoring

(1.1) Requirement:

(1.1.1) The OBD system shall monitor the thermostat on engines so-equipped for proper operation.

(1.1.2) The OBD system shall monitor the engine coolant temperature (ECT) sensor for circuit continuity, out-of-range values, and rationality faults.

(1.1.3) For engines that use a system other than the cooling system and ECT sensor (e.g., oil temperature, cylinder head temperature) for an indication of engine operating temperature for emission control purposes (e.g., to modify spark or fuel injection timing or quantity), the manufacturer shall submit a monitoring plan to the Executive Officer for approval. The Executive Officer shall approve the request upon determining that the manufacturer has submitted data and an engineering evaluation that demonstrate that the monitoring plan is as reliable and effective as the monitoring required for the engine cooling system under section (g)(1).

(1.2) Malfunction Criteria:

(1.2.1) Thermostat

(A) The OBD system shall detect a thermostat malfunction if, within an Executive Officer-approved time interval after engine start, any of the following conditions occur:

(i) The coolant temperature does not reach the highest temperature required by the OBD system to enable other diagnostics;

(ii) The coolant temperature does not reach a warmed-up temperature within 20 degrees Fahrenheit of the manufacturer's nominal thermostat regulating temperature. Subject to Executive Officer approval, a manufacturer may utilize lower temperatures for this criterion upon the Executive Officer determining that the manufacturer has demonstrated that the fuel, spark timing, and/or other coolant temperature-based modifications to the engine control strategies would not cause an emission increase of 50 or more percent of any of the applicable standards (e.g., 50 degree Fahrenheit emission test).

(B) For 2016 and subsequent model year engines, the OBD system shall detect a thermostat fault if, after the coolant temperature has reached the temperatures indicated in sections (g)(1.2.1)(A)(i) and (ii), the coolant temperature drops below the temperature indicated in section (g)(1.2.1)(A)(i).

(C) Executive Officer approval of the time interval after engine start under section (g)(1.2.1)(A) above shall be granted upon determining that the data and/or engineering evaluation submitted by the manufacturer supports the specified times.

(D) For monitoring of malfunctions under section (g)(1.2.1)(A), with Executive Officer approval, a manufacturer may use alternate malfunction criteria and/or monitoring conditions (see section (g)(1.3)) that are a function of temperature at engine start on engines that do not reach the temperatures specified in the malfunction criteria when the thermostat is functioning properly. Executive Officer approval shall be granted upon determining that the manufacturer has submitted data that demonstrate that a properly operating system does not reach the specified temperatures, that the monitor is capable of meeting the specified malfunction criteria at engine start temperatures greater than 50 degrees Fahrenheit, and that the possibility for cooling system malfunctions to go undetected and disable other OBD monitors is minimized to the extent technically feasible.

(E) A manufacturer may request Executive Officer approval to be exempted from the requirements of thermostat monitoring. Executive Officer approval shall be granted upon determining that the manufacturer has demonstrated that a malfunctioning thermostat cannot cause a measurable increase in emissions during any reasonable driving condition nor cause any disablement of other monitors.

(1.2.2) ECT Sensor

(A) Circuit Continuity. The OBD system shall detect a malfunction when a lack of circuit continuity or out-of-range values occur.

(B) Time to Reach Closed-Loop/Feedback Enable Temperature.

(i) The OBD system shall detect a malfunction if the ECT sensor does not achieve the highest stabilized minimum temperature which is needed for closed-loop/feedback control of all emission control systems (e.g., fuel system, EGR system) within an Executive Officer-approved time interval after engine start.

(ii) The time interval shall be a function of starting ECT and/or a function of intake air temperature. Executive Officer approval of the time interval shall be granted upon determining that the data and/or engineering evaluation submitted by the manufacturer supports the specified times.

(iii) Manufacturers are exempted from the requirements of section (g)(1.2.2)(B) if the manufacturer does not utilize ECT to enable closed-loop/feedback control of any emission control system.

(C) Stuck in Range Below the Highest Minimum Enable Temperature. To the extent feasible when using all available information, the OBD system shall detect a malfunction if the ECT sensor inappropriately indicates a temperature below the highest minimum enable temperature required by the OBD system to enable other diagnostics (e.g., an OBD system that requires ECT to be greater than 140 degrees Fahrenheit to enable a diagnostic must detect malfunctions that cause the ECT sensor to inappropriately indicate a temperature below 140 degrees Fahrenheit). Manufacturers are exempted from this requirement for temperature regions in which the monitors required under sections (g)(1.2.1) or (g)(1.2.2)(B) will detect ECT sensor malfunctions as defined in section (g)(1.2.2)(C).

(D) Stuck in Range Above the Lowest Maximum Enable Temperature.

(i) To the extent feasible when using all available information, the OBD system shall detect a malfunction if the ECT sensor inappropriately indicates a temperature above the lowest maximum enable temperature required by the OBD system to enable other diagnostics (e.g., an OBD system that requires ECT to be less than 90 degrees Fahrenheit at engine start to enable a diagnostic must detect malfunctions that cause the ECT sensor to inappropriately indicate a temperature above 90 degrees Fahrenheit).

(ii) Manufacturers are exempted from this requirement for temperature regions in which the monitors required under sections (g)(1.2.1), (g)(1.2.2)(B), or (g)(1.2.2)(C) (i.e., ECT sensor or thermostat malfunctions) will detect ECT sensor malfunctions as defined in section (g)(1.2.2)(D) or in which the MIL will be illuminated under the requirements of sections (d)(2.2.1)(E) or (d)(2.2.2)(E) for default mode operation (e.g., overtemperature protection strategies).

(iii) Manufacturers are exempted from the requirements of section (g)(1.2.2)(D) for temperature regions where the temperature gauge indicates a temperature in the red zone (engine overheating zone) for vehicles that have a temperature gauge (not a warning light) on the instrument panel and utilize the same ECT sensor for input to the OBD system and the temperature gauge.

(1.3) Monitoring Conditions:

(1.3.1) Thermostat

(A) Manufacturers shall define the monitoring conditions for malfunctions identified in section (g)(1.2.1)(A) in accordance with section (d)(3.1) except as provided for in section (g)(1.3.1)(E). Additionally, except as provided for in sections (g)(1.3.1)(B) ~~and~~ through (~~C~~E), monitoring for malfunctions identified in section (g)(1.2.1)(A) shall be conducted once per driving cycle on every driving cycle in which the ECT sensor indicates, at engine start, a temperature lower than the temperature established as the malfunction criteria in section (g)(1.2.1)(A).

(B) Manufacturers shall define the monitoring conditions for malfunctions identified in section (g)(1.2.1)(B) in accordance with section (d)(3.1) with the exception that monitoring shall occur every time the monitoring conditions are met during the driving cycle in lieu of once per driving cycle.

(C) Manufacturers may disable thermostat monitoring at ambient engine temperatures below 20 degrees Fahrenheit.

(D) Manufacturers may request Executive Officer approval to suspend or disable thermostat monitoring if the vehicle is subjected to conditions which could lead to false diagnosis (e.g., vehicle operation at idle for more than 50 percent of the warm-up time, ~~hot restart conditions~~ engine block heater operation). ~~In general, the Executive Officer shall not approve disablement of the monitor on engine starts where the ECT at engine start is more than 35 degrees Fahrenheit lower than the thermostat malfunction threshold temperature determined under section (g)(1.2.1)(A). The Executive Officer shall approve the request upon determining that the manufacturer has provided data and/or engineering analysis that demonstrate the need for the request.~~ With respect to disablement on driving cycles solely due to warm ECT at engine start conditions, the manufacturer shall disable the monitor during driving cycles where the ECT at engine start is within 35 degrees Fahrenheit of the thermostat malfunction threshold temperature determined under section (g)(1.2.1)(A) (e.g., if the malfunction threshold temperature is 160 degrees Fahrenheit, the monitor shall be disabled if the ECT at engine start is between 125 and 160 degrees Fahrenheit).

(E) Notwithstanding section (g)(1.3.1)(D), manufacturers may request Executive Officer approval to enable thermostat monitoring during a portion of the driving cycles where the ECT at engine start is warmer than 35 degrees Fahrenheit below the thermostat malfunction threshold temperature determined under section (g)(1.2.1)(A) (e.g., if the malfunction threshold temperature is 160 degrees Fahrenheit, the manufacturer may request approval to have the monitor enabled for a portion of the ECT at engine start region between 125 and 160 degrees Fahrenheit). The Executive Officer shall approve the request upon determining that the manufacturer has submitted test data and/or engineering evaluation that demonstrate that the monitor is able to robustly detect thermostat malfunctions (e.g., cannot result in false passes or false indications of malfunctions) on driving cycles where it is enabled.

~~(E)~~(F) With respect to defining enable conditions that are encountered during the FTP cycle as required in (d)(3.1.1) for malfunctions identified in section (g)(1.2.1)(A), the FTP cycle shall refer to on-road driving following the FTP cycle in lieu of testing on an engine dynamometer.

(1.3.2) ECT Sensor

(A) Except as provided below in section (g)(1.3.2)(E), monitoring for malfunctions identified in section (g)(1.2.2)(A) (i.e., circuit continuity and out-of-range) shall be conducted continuously.

(B) Manufacturers shall define the monitoring conditions for malfunctions identified in section (g)(1.2.2)(B) in accordance with section (d)(3.1). Additionally, except as provided for in section (g)(1.3.2)(D), monitoring for malfunctions identified in section (g)(1.2.2)(B) shall be conducted once per driving cycle on every driving cycle in which the ECT sensor indicates a temperature lower than the closed-loop enable temperature at engine start (i.e., all engine start temperatures greater than the ECT sensor out-of-range low temperature and less than the closed-loop enable temperature).

(C) Manufacturers shall define the monitoring conditions for malfunctions identified in sections (g)(1.2.2)(C) and (D) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements).

(D) Manufacturers may suspend or delay the time to reach closed-loop enable temperature diagnostic if the vehicle is subjected to conditions which could lead to false diagnosis (e.g., vehicle operation at idle for more than 50 to 75 percent of the warm-up time).

(E) A manufacturer may request Executive Officer approval to disable continuous ECT sensor monitoring when an ECT sensor malfunction cannot be distinguished from other effects. The Executive Officer shall approve the disablement upon determining that the manufacturer has submitted test data and/or engineering evaluation that demonstrate a properly functioning sensor cannot be distinguished from a malfunctioning sensor and that the disablement interval is limited only to that necessary for avoiding false detection.

(1.4) MIL Illumination and Fault Code Storage: General requirements for MIL illumination and fault code storage are set forth in section (d)(2).

(2) Crankcase Ventilation (CV) System Monitoring

(2.1) Requirement: The OBD system shall monitor the CV system on engines so-equipped for system integrity. Engines not subject to crankcase emission control requirements shall be exempt from monitoring of the CV system.

(2.2) Malfunction Criteria:

(2.2.1) For the purposes of section (g)(2), "CV system" is defined as any form of crankcase ventilation system, regardless of whether it utilizes positive pressure or whether it vents to the atmosphere, the intake, or the exhaust. "CV valve" is defined as any form of valve orifice, and/or filter/separator used to restrict, control, or alter the composition (e.g., remove oil vapor or particulate matter) of the crankcase vapor flow. Further, any additional external CV system tubing or hoses used to equalize crankcase pressure or to provide a ventilation path between various areas of the engine (e.g., crankcase and valve cover) are considered part of the CV system "between the crankcase and the CV valve" and subject to the malfunction criteria in section (g)(2.2.2) below.

(2.2.2) Except as provided below, the OBD system shall detect a malfunction of the CV system when a disconnection of the system occurs between either the crankcase and the CV valve, or between the CV valve and the intake ducting.

(2.2.3) If disconnection in the system results in a rapid loss of oil or other overt indication of a CV system malfunction such that the vehicle operator is certain to respond and have the vehicle repaired, the Executive Officer shall exempt the manufacturer from detection of that disconnection.

(2.2.4) The Executive Officer shall exempt a manufacturer from detecting a disconnection between the crankcase and the CV valve upon determining that the disconnection cannot be made without first disconnecting a monitored portion of the system (e.g., the CV system is designed such that the CV valve is fastened directly to the crankcase in a manner which makes it significantly more difficult to remove the valve from the crankcase rather than disconnect the line between the valve and the intake manifold/ducting (taking aging effects into consideration)) and the line between the valve and the intake ducting is monitored for disconnection. The manufacturer shall file a request and submit data and/or engineering evaluation in support of the exemption.

(2.2.5) Subject to Executive Officer approval, system designs that utilize tubing between the valve and the crankcase shall be exempted from the monitoring requirement for detection of disconnection between the CV valve and the crankcase. The manufacturer shall file a request and submit data and/or engineering evaluation in support of the request. The Executive Officer shall approve the request upon determining that the connections between the valve and the crankcase are: (1) resistant to deterioration or accidental disconnection, (2) significantly more difficult to disconnect than the line between the valve and the intake manifold/ducting, and (3) not subject to disconnection per manufacturer's maintenance, service, and/or repair procedures for non-CV system repair work.

(2.2.6) The Executive Officer shall exempt a manufacturer from detecting a disconnection between the CV valve and the intake manifold upon determining that the disconnection (1) causes the vehicle to stall immediately during idle operation; or (2) 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 manufacturer shall file a request and submit data and/or engineering evaluation in support of the exemption.

(2.2.7) For engines certified on an engine dynamometer having an open CV system (i.e., a system that releases crankcase emissions to the atmosphere without routing them to the intake ducting or to the exhaust upstream of the aftertreatment), the manufacturer shall submit a plan for Executive Officer approval of the monitoring strategy, malfunction criteria, and monitoring conditions prior to OBD certification. Executive Officer approval shall be based on the effectiveness of the monitoring strategy to (i) monitor the performance of the CV system to the extent feasible with respect to the malfunction criteria in section (g)(2.2.1) through (g)(2.2.4) and the monitoring conditions required by the diagnostic, and (ii) monitor the ability of the CV system to control crankcase vapor emitted to the atmosphere relative to the manufacturer's design and performance specifications for a properly functioning system (e.g., if the system is equipped with a filter and/or separator to reduce crankcase emissions to the atmosphere, the OBD system shall monitor the integrity of the filter and/or function of the separator).

(2.3) Monitoring Conditions: Manufacturers shall define the monitoring conditions for malfunctions identified in section (g)(2.2) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements).

(2.4) MIL Illumination and Fault Code Storage: General requirements for MIL illumination and fault code storage are set forth in section (d)(2). The stored fault code need not specifically identify the CV system (e.g., a fault code for idle speed control or fuel system monitoring can be stored) if the manufacturer demonstrates that additional monitoring hardware would be necessary to make this identification, and provided the manufacturer's diagnostic and repair procedures for the detected malfunction include directions to check the integrity of the CV system.

(3) Comprehensive Component Monitoring

(3.1) Requirement:

(3.1.1) Except as provided in sections (g)(3.1.4), (g)(3.1.5), (g)(3.1.6), and (g)(4), the OBD system shall monitor for malfunction any electronic ~~engine~~ powertrain component/system not otherwise described in sections (e)(1) through (g)(2) that either provides input to (directly or indirectly) or receives commands from the on-board computer(s), and: (1) can affect emissions during any reasonable in-use driving condition, or (2) is used as part of the diagnostic strategy for any other monitored system or component.

(A) Input Components: Input components required to be monitored may include the crank angle sensor, knock sensor, throttle position sensor, cam position sensor, intake air temperature sensor, boost pressure sensor, manifold pressure sensor, mass air flow sensor, exhaust temperature sensor, exhaust pressure sensor, fuel pressure sensor, fuel composition sensor (e.g. flexible fuel vehicles), and electronic components used to comply with any applicable engine idling requirements of title 13, CCR section 1956.8.

(B) Output Components/Systems: Output components/systems required to be monitored may include the idle speed control system, fuel injectors, glow plug system, variable length intake manifold runner systems, supercharger or turbocharger electronic components, heated fuel preparation systems, and the wait-to-start lamp on diesel applications.

(3.1.2) For purposes of criteria (1) in section (g)(3.1.1) above, the manufacturer shall determine whether an engine input or output component/system can affect emissions. If the Executive Officer reasonably believes that a manufacturer has incorrectly determined that a component/system cannot affect emissions, the Executive Officer shall require the manufacturer to provide emission data showing that the component/system, when malfunctioning and installed in a suitable test vehicle, does not have an emission effect. The Executive Officer may request emission data for any reasonable driving condition.

(3.1.3) Manufacturers shall monitor for malfunction electronic powertrain input or output components/systems associated with an electronic transfer case, electronic power steering system, transmission (except as provided below in section (g)(3.1.6)), or other components that are driven by the engine and not related to the control of fueling, air handling, or emissions only if the component or system is used as part of the diagnostic strategy for any other monitored system or component.

(3.1.4) Except as specified for hybrid~~s~~ vehicles in section (g)(3.1.5), manufacturers shall monitor for malfunction electronic powertrain input or output components/systems associated with components that only affect emissions by causing additional electrical load to the engine and are not related to the control of fueling, air handling, or emissions only if the component or system is used as part of the diagnostic strategy for any other monitored system or component.

(3.1.5) Except as provided in section (d)(7.6), ~~F~~for hybrid~~s~~ vehicles, manufacturers shall submit a plan to the Executive Officer for approval of the hybrid components determined by the manufacturer to be subject to monitoring in section (g)(3.1.1). In general, the Executive Officer shall approve the plan if it includes monitoring of all components/systems used as part of the diagnostic strategy for any other monitored system or component, monitoring of all energy input devices to the electrical propulsion system, monitoring of battery and charging system performance, monitoring of electric motor performance, and monitoring of regenerative braking performance.

(3.1.6) For OBD systems that receive vehicle speed information from a transmission control unit and use vehicle speed as part of the diagnostic strategy for any other OBD monitored system or component:

(A) The OBD system shall monitor the vehicle speed information to the extent feasible in accordance with the requirements of section (g)(3);

(B) The OBD system shall detect a fault and illuminate the MIL when the OBD system is unable to properly receive the vehicle speed information; and

(C) If the transmission control unit monitors the vehicle speed information and indicates an error of the information to the OBD system (e.g., valid vehicle speed data is no longer available), the OBD system shall handle the error indication as a default mode of operation subject to the MIL illumination requirements under section (d)(2.2).

(3.2) Malfunction Criteria:

(3.2.1) Input Components:

(A) The OBD system shall detect malfunctions of input components caused by a lack of circuit continuity, out-of-range values, and, where feasible, rationality faults. To the extent feasible, the rationality fault diagnostics shall verify that a sensor output is neither inappropriately high nor inappropriately low (i.e., shall be "two-sided" diagnostics).

(B) To the extent feasible, the OBD system shall separately detect and store different fault codes that distinguish rationality faults from lack of circuit continuity and out-of-range faults. For input component lack of circuit continuity and out-of-range faults, the OBD system shall, to the extent feasible, separately detect and store different fault codes for each distinct malfunction (e.g., out-of-range low, out-of-range high, open circuit). The OBD system is not required to store separate fault codes for lack of circuit continuity faults that cannot be distinguished from other out-of-range circuit faults.

(C) For input components that are used to activate alternate strategies that can affect emissions (e.g., AECDs, engine shutdown systems or strategies to meet NOx idling standards required by title 13, CCR section 1956.8), the OBD system shall detect rationality malfunctions that cause the system to erroneously activate or deactivate the alternate strategy. To the extent feasible when using all available information, the rationality fault diagnostics shall detect a malfunction if the input component inappropriately indicates a value that activates or deactivates the alternate strategy. For example, if an alternate strategy requires the intake air temperature to be greater than 120 degrees Fahrenheit to activate, the OBD system shall detect malfunctions that cause the intake air temperature sensor to inappropriately indicate a temperature above 120 degrees Fahrenheit.

(D) For input components that are directly or indirectly used for any emission control strategies that are not covered under sections (e), (f), and (g)(1) (e.g., exhaust temperature sensors used for a control strategy that regulates SCR catalyst inlet temperature within a target window), the OBD system shall detect rationality malfunctions that prevent the component from correctly sensing any condition necessary for the strategy to operate in its intended manner. These malfunctions include faults that inappropriately prevent or delay the activation of the emission control strategy, cause the system to erroneously exit the emission control strategy, or where the control strategy has used up all of the adjustments or authority allowed by the manufacturer and is still unable to achieve the desired condition. The Executive Officer may waive detection of specific malfunctions upon determining that the manufacturer has submitted data and/or an engineering evaluation that demonstrate that reliable detection of the malfunction is technically infeasible or would require additional hardware.

(E) For engines that require precise alignment between the camshaft and the crankshaft, the OBD system shall monitor the crankshaft position sensor(s) and camshaft position sensor(s) to verify proper alignment between the camshaft and crankshaft in addition to monitoring the sensors for circuit continuity and rationality malfunctions. Proper alignment monitoring between a camshaft and a crankshaft shall only be required in cases where both are equipped with position sensors. For engines equipped with VVT systems and a timing belt or chain, the OBD system shall detect a malfunction if the alignment between the camshaft and crankshaft is off by one or more cam/crank sprocket cogs (e.g., the timing belt/chain has slipped by one or more teeth/cogs). If a manufacturer demonstrates that a single tooth/cog misalignment cannot cause a measurable increase in emissions during any reasonable driving condition, the OBD system shall detect a malfunction when the minimum number of teeth/cogs misalignment needed to cause a measurable emission increase has occurred.

(3.2.2) Output Components/Systems:

(A) The OBD system shall detect a malfunction of an output component/system when proper functional response of the component and system to computer commands does not occur. If a functional check is not feasible, the OBD system shall detect malfunctions of output components/systems caused by a lack of circuit continuity or circuit fault (e.g., short to ground or high voltage). For output component lack of circuit continuity faults and circuit faults, the OBD system is not required to store different fault codes for each distinct malfunction (e.g., open circuit, shorted low). Manufacturers are not required to activate an output component/system when it would not normally be active for the purposes of performing functional monitoring of output components/systems as required in section (g)(3).

(B) The idle control system shall be monitored for proper functional response to computer commands.

(i) For gasoline engines using monitoring strategies based on deviation from target idle speed, a malfunction shall be detected when either of the following conditions occur:

a. The idle speed control system cannot achieve the target idle speed within 200 revolutions per minute (rpm) above the target speed or 100 rpm below the target speed. The Executive Officer shall allow larger engine speed tolerances upon determining that a manufacturer has submitted data and/or an engineering evaluation which demonstrate that the tolerances can be exceeded without a malfunction being present.

b. The idle speed control system cannot achieve the target idle speed within the smallest engine speed tolerance range required by the OBD system to enable any other monitors.

(ii) For diesel engines, a malfunction shall be detected when any of the following conditions occur:

a. The idle control system cannot achieve or maintain the idle speed within +/-50 percent of the manufacturer-specified target or desired engine speed.

b. The idle control system cannot achieve the target or desired idle speed within the smallest engine speed tolerance range required by the OBD system to enable any other monitors.

c. For 2013 and subsequent model year engines, the idle control system cannot achieve the fueling quantity within the smallest fueling quantity tolerance range required by the OBD system to enable any other monitors.

d. For 2013 and subsequent model year engines, the idle control system cannot achieve the target idle speed with a fuel injection quantity within +/-50 percent of the fuel quantity necessary to achieve the target idle speed for a properly functioning engine and the ~~given~~ known operating conditions.

(C) Glow plugs/intake air heater systems shall be monitored for proper functional response to computer commands and for circuit continuity faults. The glow plug/intake air heater circuit(s) shall be monitored for proper current and voltage drop. The Executive Officer shall approve other monitoring strategies based on manufacturer's data and/or engineering analysis demonstrating equally reliable and timely detection of malfunctions. Except as provided below, the OBD system shall detect a malfunction when a single glow plug no longer operates within the manufacturer's specified limits for normal operation. If a manufacturer demonstrates that a single glow plug failure cannot cause a measurable increase in emissions during any reasonable driving condition, the OBD system shall detect a malfunction for the minimum number of glow plugs needed to cause an emission increase. Further, to the extent feasible on existing engine designs (without adding additional hardware for this purpose) and on all 2013 and subsequent model year engines, the stored fault code shall identify the specific malfunctioning glow plug(s).

(D) The wait-to-start lamp circuit shall be monitored for malfunctions that cause the lamp to fail to illuminate when commanded on (e.g., burned out bulb).

(E) For output components/systems that are directly or indirectly used for any emission control strategies that are not covered under sections (e), (f), and (g)(1) (e.g., an intake throttle used for a control strategy that adjusts intake throttle position to regulate SCR catalyst inlet temperature within a target window), the OBD system shall detect functional malfunctions that prevent the component/system from achieving the desired functional response necessary for the strategy to operate in its intended manner. These malfunctions include faults that inappropriately prevent or delay the activation of the emission control strategy, cause the system to erroneously exit the emission control strategy, or where the control strategy has used up all of the adjustments or authority allowed by the manufacturer and is still unable to achieve the desired condition. The Executive Officer may waive detection of specific malfunctions upon determining that the manufacturer has submitted data and/or an engineering evaluation that demonstrate that reliable detection of the malfunction is technically infeasible or would require additional hardware.

(F) For ~~2013~~ 2015 and subsequent model year engines that utilize fuel control system components (e.g., injectors, fuel pump) that have tolerance compensation features implemented in hardware or software during production or repair procedures (e.g., individually coded injectors for flow characteristics that are programmed into an electronic control unit to compensate for injector to injector tolerances, fuel pumps that use in-line resistors to correct for differences in fuel pump volume output), the components shall be monitored to ensure the proper compensation is being used.

(i) Except as provided in section (g)(3.2.2)(F)(ii) below, ~~T~~the system shall detect a fault if the compensation being used by the control system does not match the compensation designated for the installed component (e.g., the flow characteristic coding designated on a specific injector does not match the compensation being used by the fuel control system for that injector). If a manufacturer demonstrates that a single component (e.g., injector) using the wrong compensation cannot cause a measurable increase in emissions during any reasonable driving condition, the manufacturer shall detect a malfunction for the minimum number of components using the wrong compensation needed to cause an emission increase. Further, the stored fault code shall identify the specific component that does not match the compensation.

(ii) Monitoring of the fuel control system components under section (g)(3.2.2)(F)(i) is not required if the manufacturer demonstrates that no fault of the components' tolerance compensation features (e.g., wrong compensation being used) could cause emissions to (1) increase by 15 percent or more of the applicable full useful life standard as measured from an applicable emission test cycle; or (2) exceed the applicable full useful life standard as measured from an applicable emission test cycle. For purposes of determining if the emission criteria above are met, the manufacturers shall request Executive Officer approval of the test plan for which the emission impact will be determined. The test plan shall include the combination of failed components and the degree of mismatch (e.g., wrong compensation) used as well as the test procedure and emission test cycles used to demonstrate the emission impact, including the necessary preconditioning cycles used by the system to correct or adapt for any mismatch and mitigate the emission impact. Executive Officer approval shall be granted upon determining that the manufacturer has submitted data and/or engineering analysis that demonstrate that the conditions necessary for the system to correct or adapt will readily occur in a timely manner during in-use operation and that the test conditions represent worst case emissions from typical in-use service actions when considering the distribution and variance of the compensation values and parts (e.g., replacement of one or more plus-one-sigma injectors with minus-one-sigma injectors without updating of the compensation value).

(3.3) Monitoring Conditions:

(3.3.1) Input Components:

(A) Except as provided in section (g)(3.3.1)(C), input components shall be monitored continuously for proper range of values and circuit continuity.

(B) For rationality monitoring (where applicable) manufacturers shall define the monitoring conditions for detecting malfunctions in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements), with the exception that rationality monitoring shall occur every time the monitoring conditions are met during the driving cycle in lieu of once per driving cycle as required in section (d)(3.1.2).

(C) A manufacturer may request Executive Officer approval to disable continuous input component proper range of values or circuit continuity monitoring when a malfunction cannot be distinguished from other effects. The Executive Officer shall approve the disablement upon determining that the manufacturer has submitted test data and/or documentation that demonstrate a properly functioning input component cannot be distinguished from a malfunctioning input component and that the disablement interval is limited only to that necessary for avoiding false detection.

(3.3.2) Output Components/Systems:

(A) Except as provided in section (g)(3.3.2)(D), monitoring for circuit continuity and circuit faults shall be conducted continuously.

(B) Except as provided in section (g)(3.3.2)(C), for functional monitoring, manufacturers shall define the monitoring conditions for detecting malfunctions in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements).

(C) For the idle control system, manufacturers shall define the monitoring conditions for functional monitoring in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements), with the exception that functional monitoring shall occur every time the monitoring conditions are met during the driving cycle in lieu of once per driving cycle as required in section (d)(3.1.2).

(D) A manufacturer may request Executive Officer approval to disable continuous output component circuit continuity or circuit fault monitoring when a malfunction cannot be distinguished from other effects. The Executive Officer shall approve the disablement upon determining that the manufacturer has submitted test data and/or documentation that demonstrate a properly functioning output component cannot be distinguished from a malfunctioning output component and that the disablement interval is limited only to that necessary for avoiding false detection.

(3.4) MIL Illumination and Fault Code Storage:

(3.4.1) Except as provided in sections (g)(3.4.2) and (3.4.4) below, general requirements for MIL illumination and fault code storage are set forth in section (d)(2).

(3.4.2) Exceptions to general requirements for MIL illumination. MIL illumination is not required in conjunction with storing a confirmed or MIL-on fault code for any comprehensive component if:

(A) the component or system, when malfunctioning, could not cause engine emissions to increase by 15 percent or more of the FTP standard during any reasonable driving condition; and

(B) the component or system is not used as part of the diagnostic strategy for any other monitored system or component.

(3.4.3) For purposes of determining the emission increase in section (g)(3.4.2)(A), the manufacturer shall request Executive Officer approval of the test cycle/vehicle operating conditions for which the emission increase will be determined. Executive Officer approval shall be granted upon determining that the manufacturer has submitted data and/or engineering evaluation that demonstrate that the testing conditions represent in-use driving conditions where emissions are likely to be most affected by the malfunctioning component. For purposes of determining whether the specified percentages in section (g)(3.4.2)(A) are exceeded, if the approved testing conditions are comprised of an emission test cycle with an exhaust emission standard, the measured increase shall be compared to a percentage of the exhaust emission standard (e.g., if the increase is equal to or more than 15 percent of the exhaust emission standard for that test cycle). If the approved testing conditions are comprised of a test cycle or vehicle operating condition that does not have an exhaust emission standard, the measured increase shall be calculated as a percentage of the baseline test (e.g., if the increase from a back-to-back test sequence between normal and malfunctioning condition is equal to or more than 15 percent of the baseline test results from the normal condition).

(3.4.4) For malfunctions required to be detected by section (g)(3.2.2)(B)(ii)d. (idle control fuel injection quantity faults), the stored fault code is not required to specifically identify the idle control system (e.g., a fault code for cylinder fuel injection quantity imbalance or combustion quality monitoring can be stored).

(4) Other Emission Control System Monitoring

(4.1) Requirement: For other emission control systems that are: (1) not identified or addressed in sections (e)(1) through (g)(3) (e.g., hydrocarbon traps, homogeneous charge compression ignition (HCCI) control systems), or (2) identified or addressed in section (g)(3) but not corrected or compensated for by an adaptive control system (e.g., swirl control valves), manufacturers shall submit a plan for Executive Officer approval of the monitoring strategy, malfunction criteria, and monitoring conditions prior to introduction on a production engine. Executive Officer approval shall be based on the effectiveness of the monitoring strategy, the malfunction criteria utilized, the monitoring conditions required by the diagnostic, and, if applicable, the determination that the requirements of section (g)(4.2) and (g)(4.3) below are satisfied.

(4.2) For engines that utilize emission control systems that alter intake air flow or cylinder charge characteristics by actuating valve(s), flap(s), etc. in the intake air delivery system (e.g., swirl control valve systems), the manufacturers, in addition to meeting the requirements of section (g)(4.1) above, may elect to have the OBD system monitor the shaft to which all valves in one intake bank are physically attached in lieu of monitoring the intake air flow, cylinder charge, or individual valve(s)/flap(s) for proper functional response. For non-metal shafts or segmented shafts, the monitor shall verify all shaft segments for proper functional response (e.g., by verifying the segment or portion of the shaft furthest from the actuator properly functions). For systems that have more than one shaft to operate valves in multiple intake banks, manufacturers are not required to add more than one set of detection hardware (e.g., sensor, switch) per intake bank to meet this requirement.

(4.3) For emission control strategies that are not covered under sections (e), (f), and (g)(1) (e.g., a control strategy that regulates SCR catalyst inlet temperatures within a target window), Executive Officer approval shall be based on the effectiveness of the plan in detecting malfunctions that prevent the strategy from operating in its intended manner. These malfunctions include faults that inappropriately prevent or delay the activation of the emission control strategy, faults that cause the system to erroneously exit the emission control strategy, and faults where the control strategy has used up all of the adjustments or authority allowed by the manufacturer and is still unable to achieve the desired condition. The Executive Officer may waive detection of specific malfunctions upon determining that the manufacturer has submitted data and/or an engineering evaluation that demonstrate that reliable detection of the malfunction is technically infeasible or would require additional hardware.

(5) Exceptions to Monitoring Requirements

(5.1) Upon request of a manufacturer or upon the best engineering judgment of ARB, the Executive Officer may revise the emission threshold for any monitor in sections (e) through (g) ~~or~~ if the most reliable monitoring method developed requires a higher threshold to prevent false indications of a malfunction. Additionally, except as specified in section (e)(8.2.1)(C), for 2010 through 2015 model year engines, the Executive Officer may revise the PM filter malfunction criteria of section (e)(8.2.1) to exclude detection of specific failure modes (e.g., partially melted substrates) if the most reliable monitoring method developed requires ~~a higher threshold (or, in the case of section (e)(8.2.1),~~ the exclusion of specific failure modes~~)~~ to prevent ~~significant errors of commission in detecting~~ false indications of a malfunction.

(5.2) For 2010 through 2012 model year diesel engines, in determining the malfunction criteria for diesel engine monitors in sections (e)(1), (3), (4), (5), (8.2.2), (9.2.1)(A), and (e)(10), the manufacturer shall use a threshold of 2.5 times any of the applicable NMHC, CO, or NOx standards in lieu of 2.0 times any of the applicable standards.

(5.3) Manufacturers may request Executive Officer approval to disable an OBD system monitor at ambient temperatures below 20 degrees Fahrenheit (low ambient temperature conditions may be determined based on intake air or engine coolant temperature at engine start) or at elevations above 8000 feet above sea level. The Executive Officer shall approve the request upon determining that the manufacturer has provided data and/or an engineering evaluation that demonstrate that monitoring during the conditions would be unreliable. A manufacturer may further request, and the Executive Officer shall approve, that an OBD system monitor be disabled at other ambient temperatures upon determining that the manufacturer has demonstrated with data and/or an engineering evaluation that misdiagnosis would occur at the ambient temperatures because of its effect on the component itself (e.g., component freezing).

(5.4) Manufacturers may request Executive Officer approval to disable monitoring systems that can be affected by low fuel level or running out of fuel (e.g., misfire detection) when the fuel level is 15 percent or less of the nominal capacity of the fuel tank. The Executive Officer shall approve the request upon determining that the manufacturer has submitted data and/or an engineering evaluation that demonstrate that monitoring at the fuel levels would be unreliable and the OBD system is able to detect a malfunction if the component(s) used to determine fuel level erroneously indicates a fuel level that causes the disablement.

(5.5) Manufacturers may disable monitoring systems that can be affected by vehicle battery or system voltage levels.

(5.5.1) For monitoring systems affected by low vehicle battery or system voltages, manufacturers may disable monitoring systems when the battery or system voltage is below 11.0 Volts. Manufacturers may request Executive Officer approval to utilize a voltage threshold higher than 11.0 Volts to disable system monitoring. The Executive Officer shall approve the request upon determining that the manufacturer has submitted data and/or an engineering evaluation that demonstrate that monitoring at the voltages would be unreliable and that either operation of a vehicle below the disablement criteria for extended periods of time is unlikely or the OBD system monitors the battery or system voltage and will detect a malfunction at the voltage used to disable other monitors.

(5.5.2) For monitoring systems affected by high vehicle battery or system voltages, manufacturers may request Executive Officer approval to disable monitoring systems when the battery or system voltage exceeds a manufacturer-defined voltage. The Executive Officer shall approve the request upon determining that the manufacturer has submitted data and/or an engineering evaluation that demonstrate that monitoring above the manufacturer-defined voltage would be unreliable and that either the electrical charging system/alternator warning light is illuminated (or voltage gauge is in the "red zone") or the OBD system monitors the battery or system voltage and will detect a malfunction at the voltage used to disable other monitors.

(5.6) A manufacturer may request Executive Officer approval to disable monitors that can be affected by PTO activation on engines or vehicles designed to accommodate the installation of PTO units (as defined in section (c)).

(5.6.1) Except as allowed in section (g)(5.6.2) below, a manufacturer may request Executive Officer approval to disable an affected monitor provided disablement occurs only while the PTO unit is active and the OBD readiness status (specified under section (h)(4.1)) and PTO activation time are appropriately tracked and erased as described in this section. The Executive Officer shall approve the request for disablement based on the manufacturer's demonstration that the affected monitor cannot robustly detect malfunctions (e.g., cannot avoid false passes or false indications of malfunctions) while the PTO unit is active. The OBD system shall track the cumulative engine runtime with PTO active and clear OBD readiness status (i.e., set all monitors to indicate "not complete") no later than the start of the next ignition cycle if 750 minutes of cumulative engine runtime with PTO active has occurred since the last time the affected monitor has determined the component or system monitored by the affected monitor is or is not malfunctioning (i.e., has completed). The PTO timer shall pause whenever PTO changes from active to not active and resume counting when PTO is re-activated. The timer shall be reset to zero after the affected monitor has completed and no later than the start of the next ignition cycle. Once the PTO timer has reached 750 minutes and the OBD readiness status has been cleared, the PTO timer may not cause the OBD system to clear the readiness status again until after the PTO timer has reset to zero (after the monitor has completed) and again reached 750 minutes.

(5.6.2) For 2010 through 2012 model year engines, in lieu of requesting Executive Officer approval for disabling an affected monitor according to section (g)(5.6.1) above, a manufacturer may disable affected monitors, provided disablement occurs only while the PTO unit is active, and the OBD readiness status is cleared by the on-board computer (i.e., all monitors set to indicate "not complete") while the PTO unit is activated. If the disablement occurs, the readiness status may be restored to its state prior to PTO activation when the disablement ends.

(5.7) A manufacturer may request Executive Officer approval to be exempt from monitoring a component if both of the following criteria are met when the ambient temperature is above 20 degrees Fahrenheit: (1) a malfunction of the component does not affect emissions during any reasonable driving condition, and (2) a malfunction of the component does not affect the diagnostic strategy for any other monitored component or system. The ambient temperature shall be determined based on a temperature sensor monitored by the OBD system (e.g., IAT sensor). The Executive Officer shall approve the request upon determining that the manufacturer has submitted data and/or engineering evaluation that support these criteria.

(5.8) Whenever the requirements in section (e) or (f) of this regulation require a manufacturer to meet a specific phase-in schedule, manufacturers may use an alternate phase-in schedule in lieu of the required phase-in schedule if the alternate phase-in schedule provides for equivalent compliance volume as defined in section (c) except as specifically noted for the phase-in for the PM filter monitor in section (e)(8.2.1)

(5.8.1) Manufacturers may use an alternate phase-in schedule in lieu of the required phase-in schedule if the alternate phase-in schedule provides for equivalent compliance volume as defined in section (c) except as specifically noted for the phase-in for the PM filter monitor in section (e)(8.2.1).

(5.8.2) Small volume manufacturers may use an alternate phase-in schedule in accordance with section (g)(5.8.1) in lieu of the required phase-in schedule or may use a different schedule as follows:

(A) For the diesel misfire monitor phase-in schedule in section (e)(2.2.2), the manufacturer may meet the requirement on all engines by the 2018 model year in lieu of meeting the specific phase-in requirements for the 2016 and 2017 model years.

(B) For the diesel misfire monitor phase-in schedule in section (e)(2.3.3), the manufacturer may meet the monitoring conditions requirements of section (e)(2.3.3)(A)(i) on all engines subject to (e)(2.2.2) through the 2020 model year and the monitoring conditions requirements of section (e)(2.3.3)(A)(ii) on all 2021 and subsequent model year engines in lieu of the specific phase-in requirements in section (e)(2.3.3)(A) for the 2019 and 2020 model years.

(C) For the diesel NOx converting catalyst monitor phase-in schedules in section (e)(6), the manufacturer may use the malfunction criteria in sections (e)(6.2.1)(B) and (e)(6.2.2)(A)(ii) for all 2014 and 2015 model year engines in lieu of the malfunction criteria and required phase-in schedule in sections (e)(6.2.1)(C) and (e)(6.2.2)(A)(iii).

(D) For the diesel PM filter monitor phase-in schedule in section (e)(8), the manufacturer may use the malfunction criteria in section (e)(8.2.1)(B) for all 2014 and 2015 model year engines in lieu of the malfunction criteria and required phase-in schedule in section (e)(8.2.1)(C).

(E) For the diesel NOx sensor phase-in schedules in section (e)(9), the manufacturer may use the malfunction criteria in section (e)(9.2.2)(A)(ii) for all 2014 and 2015 model year engines in lieu of the malfunction criteria and required phase-in schedule in section (e)(9.2.2)(A)(iii).

~~(5.7)~~(5.9) Whenever the requirements in sections (e) through (g) of this regulation require monitoring "to the extent feasible", the manufacturer shall submit its proposed monitor(s) for Executive Officer approval. The Executive Officer shall approve the proposal upon determining that the proposed monitor(s) meets the criteria of "to the extent feasible" by considering the best available monitoring technology to the extent that it is known or should have been known to the manufacturer and given the limitations of the manufacturer's existing hardware, the extent and degree to which the monitoring requirements are met in full, the limitations of monitoring necessary to prevent significant errors of commission and omission, and the extent to which the manufacturer has considered and pursued alternative monitoring concepts to meet the requirements in full. The manufacturer's consideration and pursuit of alternative monitoring concepts shall include evaluation of other modifications to the proposed monitor(s), the monitored components themselves, and other monitors that use the monitored components (e.g., altering other monitors to lessen the sensitivity and reliance on the component or characteristic of the component subject to the proposed monitor(s)).

(h) *Standardization Requirements.*

(1) Reference Documents:
The following Society of Automotive Engineers (SAE) and International Organization of Standards (ISO) documents are incorporated by reference into this regulation:

(1.1) SAE J1930 "Electrical/Electronic Systems Diagnostic Terms, Definitions, Abbreviations, and Acronyms – Equivalent to ISO/TR 15031-2", October 2008 (SAE J1930).

(1.1.1) SAE J1930-DA "Electrical/Electronic Systems Diagnostic Terms, Definitions, Abbreviations, and Acronyms Web Tool Spreadsheet", March

2012.

(1.2) SAE J1962 "Diagnostic Connector – Equivalent to ISO/DIS 15031-3: December 14, 2001", April 2002 (SAE J1962).

(1.3) SAE J1978 "OBD II Scan Tool – Equivalent to ISO/DIS 15031-4: December 14, 2001", April 2002 (SAE J1978).

(1.4) SAE J1979 "E/E Diagnostic Test Modes", ~~May 2007~~ February 2012 (SAE J1979).

(1.4.1) SAE J1979-DA "Digital Annex of E/E Diagnostic Test Modes", October 2011.

(1.5) SAE J2012 "Diagnostic Trouble Code Definitions", December 2007 (SAE J2012).

(1.5.1) SAE J2012-DA "Digital Annex of Diagnostic Trouble Code Definitions and Failure Type Byte Definitions", July 2010.

(1.6) ISO 15765-4~~:2005~~ "Road Vehicles-Diagnostics Communication ~~on~~ over Controller Area Network (CAN) - Part 4: Requirements for emission-related systems", ~~January 2005~~ February 2011 (ISO 15765-4).

(1.7) SAE J1939 consisting of:

(1.7.1) J1939 Recommended Practice for a Serial Control and Communications Vehicle Network, ~~March 2009~~April 2011;

(1.7.2) J1939/1 ~~Recommended Practice for~~ On-Highway Equipment Control and Communications Network ~~for On-Highway Equipment~~, ~~September 2000~~May 2011;

(1.7.3) J1939/11 Physical Layer, 250K bits/s, Twisted Shielded Pair, September 2006;

(1.7.4) J1939/13 Off-Board Diagnostic Connector, ~~March 2004~~October 2011;

(1.7.5) J1939/15 Reduced Physical Layer, 250K bits/sec, UN-Shielded Twisted Pair (UTP), August 2008;

(1.7.6) J1939/21 Data Link Layer, December ~~2006~~2010;

(1.7.7) J1939/31 Network Layer, ~~April 2004~~May 2010;

(1.7.8) J1939/71 Vehicle Application Layer (Through ~~February 2008~~May 2010), ~~January 2009~~March 2011;

(1.7.9) J1939/73 Application Layer—Diagnostics, ~~September 2006~~February 2010;

(1.7.10) J1939/81 Network Management, ~~May 2003~~June 2011; and

(1.7.11) J1939/84 OBD Communications Compliance Test Cases For Heavy Duty Components and Vehicles, December ~~2008~~2010.

(1.8) SAE J2403 "Medium/Heavy-Duty E/E Systems Diagnosis Nomenclature," ~~August 2007~~ February 2011 (SAE J2403).

(1.9) SAE J1699-3 —"Vehicle OBD II Compliance Test Cases", ~~May 2006~~ December 2009 (SAE J1699-3).

(1.10) SAE J2534-1 —"Recommended Practice for Pass-Thru Vehicle Programming", December 2004 (SAE J2534-1).

(2) Diagnostic Connector:
A standard data link connector conforming to SAE J1962 or SAE J1939-13 specifications (except as specified in section (h)(2.3)) shall be incorporated in each vehicle.

(2.1) For the 2010 through 2012 model year engines:

(2.1.1) The connector shall be located in the driver's side foot-well region of the vehicle interior in the area bound by the driver's side of the vehicle and the driver's side edge of the center console (or the vehicle centerline if the vehicle does not have a center console) and at a location no higher than the bottom of the steering wheel when in the lowest adjustable position. The connector may not be located on or in the center console (i.e., neither on the horizontal faces near the floor-mounted gear selector, parking brake lever, or cup-holders nor on the vertical faces near the car stereo, climate system, or navigation system controls).

(2.1.2) If the connector is covered, the cover must be removable by hand without the use of any tools and be labeled "OBD" to aid technicians in identifying the location of the connector. Access to the diagnostic connector may not require opening or the removal of any storage accessory (e.g., ashtray, coinbox). The label shall be submitted to the Executive Officer for review and approval, at or before the time the manufacturer submits its certification application. The Executive Officer shall approve the label upon determining that it clearly identifies that the connector is located behind the cover and is consistent with language and/or symbols commonly used in the automotive industry.

(2.2) For 2013 and subsequent model year engines:

(2.2.1) The connector shall be located in the driver's side foot-well region of the vehicle interior in the area bound by the driver's side of the vehicle and the foot pedal closest to the driver's side of the vehicle (left most pedal in a left hand drive vehicle) excluding a foot-activated emergency brake if equipped (e.g., typically the brake pedal for an automatic transmission equipped vehicle or the clutch pedal for a manual transmission equipped vehicle) and at a location no higher than the bottom of the steering wheel when in the lowest adjustable position.

(2.2.2) The connector shall be mounted in an uncovered location and may not be covered with or located behind any form of panel, access door, or storage device (e.g., fuse panel cover, hinged door, ashtray, coinbox) that requires opening or removal to access the connector. The connector may be equipped with a dust cap in the shape and size of the diagnostic connector for environmental protection purposes but the dust cap must be removable by hand without the use of any tools and be labeled "OBD" to aid technicians in identifying the connector.

(2.2.3) The connector shall be mounted in a manner that allows vehicle operation and driving (e.g., does not interfere with use of driver controls such as the clutch, brake, and accelerator pedal) while a scan tool is connected to the vehicle.

(2.3) The location of the connector shall be capable of being easily identified and accessed (e.g., to connect an off-board tool). For vehicles equipped with a driver's side door, the connector shall be capable of being easily identified and accessed by a technician standing (or "crouched") on the ground outside the driver's side of the vehicle with the driver's side door open.

(2.4) If the ISO 15765-4 protocol (see section (h)(3)) is used for the required OBD standardized functions, the connector shall meet the "Type A" specifications of SAE J1962. Any pins in the connector that provide electrical power shall be properly fused to protect the integrity and usefulness of the connector for diagnostic purposes and may not exceed 20.0 Volts DC regardless of the nominal vehicle system or battery voltage (e.g., 12V, 24V, 42V).

(2.5) If the SAE J1939 protocol (see section (h)(3)) is used for the required OBD standardized functions, the connector shall meet the "Type 1" or "Type 2" specifications of SAE J1939-13 if the 250 kbps baud rate of J1939 is used and the "Type 2" specifications of J1939-13 if the 500 kbps baud rate of J1939 is used. Any pins in the connector that provide electrical power shall be properly fused to protect the integrity and usefulness of the connector for diagnostic purposes.

(2.6) Manufacturers may equip vehicles with additional diagnostic connectors for manufacturer-specific purposes (i.e., purposes other than the required OBD functions). However, if the additional connector conforms to the "Type A" specifications of SAE J1962 or the specifications of SAE J1939-13:

(2.6.1) ~~and~~ For 2010 through 2015 model year engines, if the additional connector is located in the vehicle interior near the required connector of section (h)(2), the connector(s) must be clearly labeled to identify which connector is used to access the standardized OBD information required in section (h).

(2.6.2) For 2016 and subsequent model year engines, the additional connector may not be in the location specified in section (h)(2.2.1).

(3) Communications to a Scan Tool:
All OBD control modules (e.g., engine, auxiliary emission control module) on a single vehicle shall use the same protocol for communication of required emission-related messages from on-board to off-board network communications to a scan tool meeting SAE J1978 specifications or designed to communicate with an SAE J1939 network. Engine manufacturers shall not alter normal operation of the engine emission control system due to the presence of off-board test equipment accessing information required by section (h). The OBD system shall use one of the following standardized protocols:

(3.1) ISO 15765-4. All required emission-related messages using this protocol shall use a 500 kbps baud rate.

(3.2) SAE J1939. This protocol may only be used on vehicles with diesel engines (including diesel engines converted to alternate-fueled engines). For 2010 through 2015 model year engines, all required emission-related messages using this protocol on an individual vehicle shall use either the 250 kbps or the 500 kbps baud rate. The 250 kbps baud rate may not be used on 2016 or subsequent model year engines.

(4) Required Emission Related Functions:
The following standardized functions shall be implemented in accordance with the specifications in SAE J1979 or SAE J1939 to allow for access to the required information by a scan tool meeting SAE J1978 specifications or designed to communicate with an SAE J1939 network:

(4.1) Readiness Status: In accordance with SAE J1979/J1939-73 specifications, the OBD system shall indicate "complete" or "not complete" since the fault memory was last cleared for each of the installed monitored components and systems identified in sections (e)(1) through (f)(9), and (g)(3) except (e)(11) and (f)(4). ~~The readiness status for all components or systems identified in (f)(2) and (g)(3) shall always indicate "complete". The readiness status for all other components or systems shall immediately indicate "complete" upon the respective monitor(s) (except those monitors specified under section (h)(4.1.4) below) determining that the component or system is not malfunctioning. The readiness status for a component or system shall also indicate "complete" if after the requisite number of decisions necessary for determining MIL status has been fully executed, the monitor indicates a malfunction for the component or system. The readiness status for each of the monitored components or systems shall indicate "not complete" whenever fault memory has been cleared or erased by a means other than that allowed in section (d)(2). Normal vehicle shut down (i.e., key off, engine off) may not cause the readiness status to indicate "not complete".~~

(4.1.1) ~~Subject to Executive Officer approval, a manufacturer may request that the readiness status for a monitor be set to indicate "complete" without monitoring having been completed if monitoring is disabled for a multiple number of driving cycles due to the continued presence of extreme operating conditions (e.g., cold ambient temperatures, high altitudes). Executive Officer approval shall be based on the conditions for monitoring system disablement and the number of driving cycles specified without completion of monitoring before readiness is indicated as "complete".~~ The readiness status for the following component/system readiness bits shall always indicate "complete":

(A) Gasoline misfire (section (f)(2))

(B) Diesel and gasoline comprehensive component (section (g)(3))

(4.1.2) ~~For the evaporative system monitor, the readiness status shall be set in accordance with section (h)(4.1) when both the functional check of the purge valve and, if applicable, the leak detection monitor of the orifice size specified in section (f)(7.2.2)(B) (e.g., 0.150 inch) indicate that they are complete.~~ For 2010 through 2015 model year engines, for components and systems not listed in section (h)(4.1.1) above, the readiness status shall immediately indicate "complete" upon the respective monitor(s) (except those monitors specified under section (h)(4.1.7) below) determining that the component or system is not malfunctioning. The readiness status for a component or system shall also indicate "complete" if after the requisite number of decisions necessary for determining MIL status has been fully executed, the monitor indicates a malfunction for the component or system.

(4.1.3) For 2016 and subsequent model year engines, for components and systems not listed in section (h)(4.1.1) above, the readiness status for each component/system readiness bit listed below shall immediately indicate "complete" if any of the following conditions occur: (1) all the respective supported monitors listed below for each component/system have fully executed and determined that the component or system is not malfunctioning, or (2) at least one of the monitors listed below for each component/system has determined that the component or system is malfunctioning after the requisite number of decisions necessary for determining the MIL status have been fully executed, regardless of whether or not the other monitors listed have been fully executed:

(A) Diesel Fuel System: sections (e)(1.2.1), (e)(1.2.2), and (e)(1.2.3)
(B) Diesel Misfire: section (e)(2.2.1)
(C) Diesel EGR/VVT: sections (e)(3.2.1), (e)(3.2.2), (e)(3.2.3), (e)(3.2.5), (e)(3.2.6), and (e)(10.2)
(D) Diesel Boost Pressure Control System: sections (e)(4.2.1), (e)(4.2.2), (e)(4.2.3), and (e)(4.2.4)
(E) Diesel NMHC Converting Catalyst: sections (e)(5.2.2) and (e)(5.2.3)(A)
(F) Diesel NOx Converting Catalyst: section (e)(6.2.1)
(G) Diesel NOx Aftertreatment: sections (e)(7.2.1) and (e)(7.2.2)
(H) Diesel PM Filter: sections (e)(8.2.1), (e)(8.2.2), (e)(8.2.5), and (e)(8.2.6)
(I) Diesel Exhaust Gas Sensor: sections (e)(9.2.1)(A)(i), (e)(9.2.1)(A)(iv), (e)(9.2.1)(B)(i), (e)(9.2.1)(B)(iv), (e)(9.2.2)(A), (e)(9.2.2)(D), and (e)(9.2.3)(A)
(J) Gasoline Fuel System: section (f)(1.2.1)(C)
(K) Gasoline EGR/VVT: sections (f)(3.2.1), (f)(3.2.2), (f)(9.2.1), (f)(9.2.2), and (f)(9.2.3)
(L) Gasoline Secondary Air System: sections (f)(5.2.1), (f)(5.2.2), (f)(5.2.3), and (f)(5.2.4)
(M) Gasoline Catalyst: section (f)(6.2.1)
(N) Gasoline Evaporative System: sections (f)(7.2.2)(A) and (f)(7.2.2)(B)
(O) Gasoline Oxygen Sensor: sections (f)(8.2.1)(A), (f)(8.2.1)(D), (f)(8.2.2)(A), and (f)(8.2.2)(C)

(4.1.4) For 2016 and subsequent model year engines, for monitors that detect faults of more than one major emission-related component (e.g., a single monitor that is used to detect both oxygen sensor faults that are tied to the oxygen sensor readiness bit and air-fuel ratio cylinder imbalance faults that are tied to the fuel system readiness bit), the manufacturer shall include the monitor only in the readiness status for the component/system that the monitor is primarily calibrated, intended, or expected in-use to detect faults of.

(4.1.5) Except for the readiness bits listed under section (h)(4.1.1) above, the readiness status for each of the monitored components or systems shall indicate "not complete" whenever fault memory has been cleared or erased by a means other than that allowed in section (d)(2). Normal vehicle shut down (i.e., key off, engine off) may not cause the readiness status to indicate "not complete".

~~(4.1.3)~~(4.1.6) If the manufacturer elects to additionally indicate readiness status through the MIL in the key on, engine off position as provided for in section (d)(2.1.3), the readiness status shall be indicated in the following manner: If the readiness status for all monitored components or systems is "complete", the MIL shall ~~remain~~ continuously illuminate~~d~~ in the key on, engine off position for at least 15~~-20~~ seconds as required by section (d)(2.1.2). If the readiness status for one or more of the monitored components or systems is "not complete", after 15-20 seconds of operation in the key on, engine off position with the MIL illuminated continuously as required by section (d)(2.1.2), the MIL shall blink once per second for 5-10 seconds. The data stream value for MIL status (section (h)(4.2)) shall indicate "commanded off" during this sequence unless the MIL has also been "commanded on" for a detected fault.

~~(4.1.4)~~(4.1.7) Manufacturers are not required to use the following monitors in determining the readiness status for the specific component or system:

(A) Circuit and out-of-range monitors that are required to be continuous;

(B) Gasoline and diesel exhaust gas sensor feedback monitors specified in sections (e)(9.2.1)(A)(iii), (e)(9.2.1)(B)(iii), (e)(9.2.2)(C), (f)(8.2.1)(C), and (f)(8.2.2)(E);

(C) Diesel feedback control monitors specified in sections (e)(1.2.4), (e)(3.2.4), (e)(4.2.5), (e)(6.2.2)(D), (e)(7.2.3), and (e)(8.2.7);

(D) Gasoline fuel system monitors specified in sections (f)(1.2.1)(A), (f)(1.2.1)(B), (f)(1.2.2), (f)(1.2.4), and (f)(1.2.5).

(4.2) Data Stream: The following signals shall be made available on demand through the standardized data link connector in accordance with SAE J1979/J1939 specifications. The actual signal value shall always be used instead of a default or limp home value.

(4.2.1) For all gasoline engines:

(A) Calculated load value, engine coolant temperature, engine speed, vehicle speed, time elapsed since engine start; and

(B) Absolute load, fuel level (if used to enable or disable any other diagnostics), barometric pressure (directly measured or estimated), engine control module system voltage, commanded equivalence ratio; and

(C) Number of stored confirmed fault codes, catalyst temperature (if directly measured or estimated for purposes of enabling the catalyst monitor(s)), monitor status (i.e., disabled for the rest of this driving cycle, complete this driving cycle, or not complete this driving cycle) since last engine shut-off for each monitor used for readiness status, distance traveled (or engine run time for engines not utilizing vehicle speed information) while MIL activated, distance traveled (or engine run time for engines not utilizing vehicle speed information) since fault memory last cleared, and number of warm-up cycles since fault memory last cleared, OBD requirements to which the engine is certified (e.g., California OBD, EPA OBD, European OBD, non-OBD) and MIL status (i.e., commanded-on or commanded-off).

(4.2.2) For all diesel engines:

(A) Calculated load (engine torque as a percentage of maximum torque available at the current engine speed), driver's demand engine torque (as a percentage of maximum engine torque), actual engine torque (as a percentage of maximum engine torque), reference engine maximum torque, reference maximum engine torque as a function of engine speed (suspect parameter numbers (SPN) 539 through 543 defined by SAE J1939 within parameter group number (PGN) 65251 for engine configuration), engine coolant temperature, engine oil temperature (if used for emission control or any OBD diagnostics), engine speed, time elapsed since engine start;

(B) Fuel level (if used to enable or disable any other diagnostics), vehicle speed (if used for emission control or any OBD diagnostics), barometric pressure (directly measured or estimated), engine control module system voltage;

(C) Number of stored confirmed/MIL-on fault codes, monitor status (i.e., disabled for the rest of this driving cycle, complete this driving cycle, or not complete this driving cycle) since last engine shut-off for each monitor used for readiness status, distance traveled (or engine run time for engines not utilizing vehicle speed information) while MIL activated, distance traveled (or engine run time for engines not utilizing vehicle speed information) since fault memory last cleared, number of warm-up cycles since fault memory last cleared, OBD requirements to which the engine is certified (e.g., California OBD, California OBD-child rating (i.e., for engines subject to (d)(7.1.2) or (d)(7.2.3)) EPA OBD, European OBD, non-OBD), MIL status (i.e., commanded-on or commanded-off);

(D) NOx NTE control area status (i.e., inside control area, outside control area, inside manufacturer-specific NOx NTE carve-out area, or deficiency active area), PM NTE control area status (i.e., inside control area, outside control area, inside manufacturer-specific PM NTE carve-out area, or deficiency active area);

(E) For 2013 and subsequent model year engines, normalized trigger for PM filter regeneration (SPN 5456 defined by SAE J1939 for 2016 and subsequent model year engines), PM filter regeneration status (SPN 3700 defined by SAE J1939 for 2016 and subsequent model year engines); and

(F) For 2013 and subsequent model year engines, average distance (or engine run time for engines not utilizing vehicle speed information) between PM filter regenerations.

(G) For 2016 and subsequent model year engines, fuel rate (mg/stroke), engine torque (including fan or accessory torque), and modeled exhaust flow (mass/time).

(~~G~~H) For purposes of the calculated load and torque parameters in section (h)(4.2.2)(A) and the torque, fuel rate, and modeled exhaust flow parameters in section (h)(4.2.2)(G), manufacturers shall report the most accurate values that are calculated within the applicable electronic control unit (e.g., the engine control module). "Most accurate values", in this context, shall be of sufficient accuracy, resolution, and filtering to be used for the purposes of in-use emission testing with the engine still in a vehicle (e.g., using portable emission measurement equipment).

(4.2.3) For all engines so equipped:

(A) Absolute throttle position, relative throttle position, fuel control system status (e.g., open loop, closed loop), fuel trim, fuel pressure, ignition timing advance, fuel injection timing, intake air/manifold temperature, engine intercooler temperature, manifold absolute pressure, air flow rate from mass air flow sensor, secondary air status (upstream, downstream, or atmosphere), ambient air temperature, commanded purge valve duty cycle/position, commanded EGR valve duty cycle/position, actual EGR valve duty cycle/position, EGR error between actual and commanded, PTO status (active or not active), redundant absolute throttle position (for electronic throttle or other systems that utilize two or more sensors), absolute pedal position, redundant absolute pedal position, commanded throttle motor position, fuel rate, boost pressure, commanded/target boost pressure, turbo inlet air temperature, fuel rail pressure, commanded fuel rail pressure, PM filter inlet pressure, PM filter inlet temperature, PM filter outlet pressure, PM filter outlet temperature, PM filter delta pressure, exhaust pressure sensor output, exhaust gas temperature sensor output, injection control pressure, commanded injection control pressure, turbocharger/turbine speed, variable geometry turbo position, commanded variable geometry turbo position, turbocharger compressor inlet temperature, turbocharger compressor inlet pressure, turbocharger turbine inlet temperature, turbocharger turbine outlet temperature, wastegate valve position, glow plug lamp status;

(B) For 2013 and subsequent model year engines, EGR temperature, variable geometry turbo control status (e.g., open loop, closed loop), reductant level (e.g., urea tank fill level), alcohol fuel percentage, type of fuel currently being used, NOx adsorber regeneration status, NOx adsorber deSOx status, hybrid battery pack remaining charge;

(C) Oxygen sensor output, air/fuel ratio sensor output, NOx sensor output, evaporative system vapor pressure; ~~and~~

(D) For 2013 and subsequent model year engines, PM sensor output and distance traveled while low/empty SCR reductant driver warning/inducement active.

<u>(E) For 2016 and subsequent model year engines, reductant quality sensor output and corrected NOx sensor output (e.g., raw sensor signal corrected for estimated ammonia concentrations or auto-zero calculations and used by the applicable electronic control unit).</u>

(4.3) Freeze Frame:

(4.3.1) "Freeze frame" information required to be stored pursuant to sections (d)(2.2.1)(D), (d)(2.2.2)(D), (e)(1.4.2)(D), (e)(2.4.2)(B), (f)(1.4.4), and (f)(2.4.3) shall be made available on demand through the standardized data link connector in accordance with SAE J1979/J1939-73 specifications.

(4.3.2) "Freeze frame" conditions must include the fault code which caused the data to be stored and all of the signals required in sections (h)(4.2.1)(A) and (4.2.2)(A). Freeze frame conditions shall also include all of the signals required on the engine in sections (h)(4.2.1)(B), (4.2.2)(B), (4.2.2)(E), (4.2.3)(A), and (4.2.3)(B) that are used for diagnostic or control purposes in the specific diagnostic or emission-critical powertrain control unit that stored the fault code.

(4.3.3) Only one frame of data is required to be recorded. Manufacturers may choose to store additional frames provided that at least the required frame can be read by a scan tool meeting SAE J1978 specifications or designed to communicate with an SAE J1939 network.

(4.4) Fault Codes:

(4.4.1) For vehicles using the ISO 15765-4 protocol for the standardized functions required in section (h):

(A) For all monitored components and systems, stored pending, confirmed, and permanent fault codes shall be made available through the diagnostic connector in a standardized format in accordance with SAE J1979 specifications. Standardized fault codes conforming to SAE J2012 shall be employed.

(B) The stored fault code shall, to the fullest extent possible, pinpoint the likely cause of the malfunction. To the extent feasible, manufacturers shall use separate fault codes for every diagnostic where the diagnostic and repair procedure or likely cause of the failure is different. In general, rationality and functional diagnostics shall use different fault codes than the respective circuit continuity diagnostics. Additionally, input component circuit continuity diagnostics shall use different fault codes for distinct malfunctions (e.g., out-of-range low, out-of-range high, open circuit).

(C) Manufacturers shall use appropriate SAE-defined fault codes of SAE J2012 (e.g., P0xxx, P2xxx) whenever possible. With Executive Officer approval, manufacturers may use manufacturer-defined fault codes in accordance with SAE J2012 specifications (e.g., P1xxx). Factors to be considered by the Executive Officer for approval shall include the lack of available SAE-defined fault codes, uniqueness of the diagnostic or monitored component, expected future usage of the diagnostic or component, and estimated usefulness in providing additional diagnostic and repair information to service technicians. Manufacturer-defined fault codes shall be used consistently (i.e., the same fault code may not be used to represent two different failure modes) across a manufacturer's entire product line.

(D) A pending or confirmed fault code (as required in sections (d) and (e) through (g)) shall be stored and available to an SAE J1978 scan tool within 10 seconds after a diagnostic has determined that a malfunction has occurred. A permanent fault code shall be stored and available to an SAE J1978 scan tool no later than the end of an ignition cycle (including electronic control unit shutdown) in which the corresponding confirmed fault code causing the MIL to be illuminated has been stored.

(E) Pending fault codes:

(i) Pending fault codes for all components and systems (including continuously and non-continuously monitored components) shall be made available through the diagnostic connector in accordance with SAE J1979 specifications (e.g., Mode/Service $07).

(ii) A pending fault code(s) shall be stored and available through the diagnostic connector for all currently malfunctioning monitored component(s) or system(s), regardless of the MIL illumination status or confirmed fault code status (e.g., even after a pending fault has matured to a confirmed fault code and the MIL is illuminated, a pending fault code shall be stored and available if the most recent monitoring event indicates the component is malfunctioning).

(iii) Manufacturers using alternate statistical protocols for MIL illumination as allowed in section (d)(2.2.1)(C) shall submit to the Executive Officer a protocol for setting pending fault codes. The Executive Officer shall approve the proposed protocol upon determining that, overall, it is equivalent to the requirements in sections (h)(4.4.1)(E)(i) and (ii) and that it effectively provides service technicians with a quick and accurate indication of a pending failure.

(F) Permanent fault codes:

(i) Permanent fault codes for all components and systems shall be made available through the diagnostic connector in a standardized format that distinguishes permanent fault codes from both pending fault codes and confirmed fault codes.

(ii) A confirmed fault code shall be stored as a permanent fault code no later than the end of the ignition cycle and subsequently at all times that the confirmed fault code is commanding the MIL on (e.g., for currently failing systems but not during the 40 warm-up cycle self-healing process described in section (d)(2.3.1)(B)).

(iii) Permanent fault codes shall be stored in NVRAM and may not be erasable by any scan tool command (generic or enhanced) or by disconnecting power to the on-board computer.

(iv) Permanent fault codes may not be erased when the control module containing the permanent fault code is reprogrammed unless the readiness ~~status~~ bits (refer to section (h)(4.1)) for all monitored components and systems in all modules that reported supported readiness for a readiness bit other than the comprehensive components readiness bit are set to "not complete" in conjunction with the reprogramming event.

(v) The OBD system shall have the ability to store a minimum of four current confirmed fault codes as permanent fault codes in NVRAM. If the number of confirmed fault codes currently commanding the MIL on exceeds the maximum number of permanent fault codes that can be stored, the OBD system shall store the earliest detected confirmed fault codes as permanent fault codes. If additional confirmed fault codes are stored when the maximum number of permanent fault codes is already stored in NVRAM, the OBD system may not replace any existing permanent fault code with the additional confirmed fault codes.

(4.4.2) For vehicles using the SAE J1939 protocol for the standardized functions required in section (h):

(A) For all monitored components and systems, stored pending, MIL-on, and previously MIL-on fault codes shall be made available through the diagnostic connector in a standardized format in accordance with SAE J1939 specifications (i.e., Diagnostic Message (DM) 6, DM12, and DM23). Standardized fault codes conforming to SAE J1939 shall be employed.

(B) The stored fault code shall, to the fullest extent possible, pinpoint the likely cause of the malfunction. To the extent feasible, manufacturers shall use separate fault codes for every diagnostic where the diagnostic and repair procedure or likely cause of the failure is different. In general, rationality and functional diagnostics shall use different fault codes than the respective circuit continuity diagnostics. Additionally, input component circuit continuity diagnostics shall use different fault codes for distinct malfunctions (e.g., out-of-range low, out-of-range high, open circuit).

(C) Manufacturers shall use appropriate SAE-defined fault codes of SAE J939 whenever possible. With Executive Officer approval, manufacturers may use manufacturer-defined fault codes in accordance with SAE J1939 specifications. Factors to be considered by the Executive Officer for approval shall include the lack of available SAE-defined fault codes, uniqueness of the diagnostic or monitored component, expected future usage of the diagnostic or component, and estimated usefulness in providing additional diagnostic and repair information to service technicians. Manufacturer-defined fault codes shall be used consistently (i.e., the same fault code may not be used to represent two different failure modes) across a manufacturer's entire product line.

(D) A pending or MIL-on fault code (as required in sections (d), (e), and (g)) shall be stored and available to an SAE J1939 scan tool within 10 seconds after a diagnostic has determined that a malfunction has occurred. A permanent fault code shall be stored and available to an SAE J1939 scan tool no later than the end of an ignition cycle (including electronic control unit shutdown) in which the corresponding MIL-on fault code causing the MIL to be illuminated has been stored.

(E) Pending fault codes:

(i) Pending fault codes for all components and systems (including continuously and non-continuously monitored components) shall be made available through the diagnostic connector in accordance with SAE J1939 specifications (i.e., DM6).

(ii) Manufacturers using alternate statistical protocols for MIL illumination as allowed in section (d)(2.2.2)(C) shall submit to the Executive Officer a protocol for setting pending fault codes. The Executive Officer shall approve the proposed protocol upon determining that, overall, it is equivalent to the requirements in sections (h)(4.4.2)(E)(i) and that it effectively provides service technicians with a quick and accurate indication of a pending failure.

(F) Permanent fault codes:

(i) Permanent fault codes for all components and systems shall be made available through the diagnostic connector in a standardized format that distinguishes permanent fault codes from pending fault codes, MIL-on fault codes, and previously MIL-on fault codes.

(ii) A MIL-on fault code shall be stored as a permanent fault code no later than the end of the ignition cycle and subsequently at all times that the MIL-on fault code is commanding the MIL on (e.g., for currently failing systems).

(iii) Permanent fault codes shall be stored in NVRAM and may not be erasable by any scan tool command (generic or enhanced) or by disconnecting power to the on-board computer.

(iv) Permanent fault codes may not be erased when the control module containing the permanent fault codes is reprogrammed unless the readiness ~~status~~ bits (refer to section (h)(4.1)) for all monitored components and systems in all modules that reported supported readiness for a readiness bit other than the comprehensive components readiness bit are set to "not complete" in conjunction with the reprogramming event.

(v) The OBD system shall have the ability to store a minimum of four current MIL-on fault codes as permanent fault codes in NVRAM. If the number of MIL-on fault codes currently commanding the MIL on exceeds the maximum number of permanent fault codes that can be stored, the OBD system shall store the earliest detected MIL-on fault codes as permanent fault codes. If additional MIL-on fault codes are stored when the maximum number of permanent fault codes is already stored in NVRAM, the OBD system may not replace any existing permanent fault code with the additional MIL-on fault codes.

(4.5) Test Results:

(4.5.1) Except as provided in section (h)(4.5.7), for all monitored components and systems identified in sections (e)(1) through (f)(9), results of the most recent monitoring of the components and systems and the test limits established for monitoring the respective components and systems shall be stored and available through the data link in accordance with the standardized format specified in SAE J1979 for the ISO 15765-4 protocol or SAE J1939.

(4.5.2) The test results shall be reported such that properly functioning components and systems (e.g., "passing" systems) do not store test values outside of the established test limits. Test limits shall include both minimum and maximum acceptable values and shall be defined so that a test result equal to either test limit is a "passing" value, not a "failing" value.

(4.5.3) The test results shall be standardized such that the name of the monitored component (e.g., catalyst bank 1) can be identified by a generic scan tool and the test results and limits can be scaled and reported with the appropriate engineering units by a generic scan tool.

(4.5.4) The test results shall be stored until updated by a more recent valid test result or the fault memory of the OBD system computer is cleared.

(4.5.5) If the OBD system fault memory is cleared, all test results shall report values of zero for the test result and test limits. The test results shall be updated once the applicable monitor has run and has valid test results and limits to report.

(4.5.6) All test results and test limits shall always be reported. The OBD system shall store and report unique test results for each separate diagnostic.

(4.5.7) The requirements of section (h)(4.5) do not apply to gasoline fuel system monitors specified under sections (f)(1.2.1)(A), (f)(1.2.1)(B), (f)(1.2.2), (f)(1.2.4), and (f)(1.2.5), exhaust gas sensor monitors specified under sections (e)(9.2.1)(A)(iii), (e)(9.2.1)(B)(iii), (e)(9.2.2)(C), (f)(8.2.1)(C), and (f)(8.2.2)(E), cold start emission reduction strategy monitors, circuit and out-of-range monitors that are required to be continuous, and diesel feedback control monitors specified under sections (e)(1.2.4), (e)(3.2.4), (e)(4.2.5), (e)(6.2.2)(D), (e)(7.2.3), and (e)(8.2.7).

(4.6) Software Calibration Identification:

(4.6.1) Except as provided for in section (h)(4.6.3), on all vehicles, a single software calibration identification number (CAL ID) for each diagnostic or emission critical control unit(s) shall be made available through the standardized data link connector in accordance with the SAE J1979/J1939 specifications.

(4.6.2) A unique CAL ID shall be used for every emission-related calibration and/or software set having at least one bit of different data from any other emission-related calibration and/or software set. Control units coded with multiple emission or diagnostic calibrations and/or software sets shall indicate a unique CAL ID for each variant in a manner that enables an off-board device to determine which variant is being used by the vehicle. Control units that utilize a strategy that will result in MIL illumination if the incorrect variant is used (e.g., control units that contain variants for manual and automatic transmissions but will illuminate the MIL if the variant selected does not match the type of transmission on the vehicle) are not required to use unique CAL IDs.

(4.6.3) Manufacturers may request Executive Officer approval to respond with more than one CAL ID per diagnostic or emission critical powertrain control unit. Executive Officer approval of the request shall be based on the method used by the manufacturer to ensure each control unit will respond to a generic scan tool with the CAL IDs in order of highest to lowest priority with regards to areas of the software most critical to emission and OBD system performance.

(4.7) Software Calibration Verification Number:

(4.7.1) All vehicles shall use an algorithm to calculate a single calibration verification number (CVN) that verifies the on-board computer software integrity for each diagnostic or emission critical electronic control unit. The CVN shall be made available through the standardized data link connector in accordance with the SAE J1979/J1939 specifications. The CVN shall be capable of being used to determine if the emission-related software and/or calibration data are valid and applicable for that vehicle and CAL ID.

(4.7.2) One CVN shall be made available for each CAL ID made available. For diagnostic or emission critical powertrain control units with more than one CAL ID, each CVN shall be output to a generic scan tool in the same order as the CAL IDs are output to the generic scan tool to allow the scan tool to match each CVN to the corresponding CAL ID.

(4.7.3) Manufacturers shall submit information for Executive Officer approval of the algorithm used to calculate the CVN. Executive Officer approval of the algorithm shall be based on the complexity of the algorithm and the determination that the same CVN is difficult to achieve with modified calibration values.

(4.7.4) The CVN shall be calculated at least once per ignition cycle and stored until the CVN is subsequently updated. ~~Except for immediately after a reprogramming event or a non-volatile memory clear or for the first 30 seconds of engine operation after a volatile memory clear or battery disconnect, the stored value shall be made available through the data link~~

~~connector to a generic scan tool in accordance with SAE J1979/J1939 specifications.~~ The stored CVN value may not be erased when fault memory is erased by a generic scan tool in accordance with SAE J1979/J1939 specifications or during normal vehicle shut down (i.e., key off, engine off).

(4.7.5) When a CVN request message is received by the on-board computer, the stored CVN value shall be made available through the data link connector to a generic scan tool. Except as provided for below, the on-board computer may not use delayed timing in sending the CVN and may not respond with a message indicating that the CVN value is not currently available. If the CVN request message is received immediately following erasure of the stored CVN value (i.e., within the first 120 seconds of engine operation after a reprogramming event or a non-volatile memory clear or within the first 120 seconds of engine operation after a volatile memory clear or battery disconnect), the on-board computer may respond with one or more messages directing the scan tool to wait or resend the request message after the delay. Such messages and delays shall conform to the specifications for transmitting CVN data contained in SAE J1979 or J1939, whichever applies.

~~(4.7.5)~~(4.7.6) For purposes of Inspection and Maintenance (I/M) testing, manufacturers shall make the CVN and CAL ID combination information available for all vehicles in a standardized electronic format that allows for off-board verification that the CVN is valid and appropriate for a specific vehicle and CAL ID. The standardized electronic format is detailed in Attachment F of ARB Mail-Out #MSC 09-22, July 7, 2009, incorporated by reference. Manufacturers shall submit the CVN and CAL ID information to the Executive Officer not more than 25 days after the close of a calendar quarter.

(4.8) Vehicle and Engine Identification Numbers:

(4.8.1) All vehicles shall have the vehicle identification number (VIN) available in a standardized format through the standardized data link connector in accordance with SAE J1979/J1939 specifications. Only one electronic control unit per vehicle shall report the VIN to an SAE J1978/J1939 scan tool.

(4.8.2) All 2013 and subsequent model year engines shall have the engine serial number (ESN) available in a standardized format through the standardized data link connector. Only one electronic control unit per vehicle shall report the ESN to an SAE J1978/J1939 scan tool.

(4.8.3) If the VIN or ESN is reprogrammable, in conjunction with reprogramming of the VIN or the ESN, the OBD system shall erase all emission-related diagnostic information identified in section (h)(4.10.1) in all control modules that reported supported readiness for a readiness bit other than the comprehensive components readiness bit ~~shall be erased in conjunction with reprogramming of the VIN or the ESN.~~

(4.9) ECU Name: For 2013 and subsequent model year engines, the name of each electronic control unit that responds to an SAE J1978/J1939 scan tool with a unique address or identifier shall be communicated in a standardized format in accordance with SAE J1979/J1939 (e.g., ECUNAME in Service/Mode $09, InfoType $0A in SAE J1979).

(4.10) Erasure of Emission-Related Diagnostic Information:

(4.10.1) For purposes of section (h)(4.10), "emission-related diagnostic information" includes all the following:

(A) Readiness status (section (h)(4.1))

(B) Data stream information (section (h)(4.2)) including number of stored confirmed/MIL-on fault codes, distance traveled while MIL activated, number of warm-up cycles since fault memory last cleared, and distance traveled since fault memory last cleared.

(C) Freeze frame information (section (h)(4.3))

(D) Pending, confirmed, MIL-on, and previously MIL-on fault codes (section (h)(4.4.))

(E) Test results (section (h)(4.5))

(4.10.2) For all vehicles, the emission-related diagnostic information shall be erased if commanded by a scan tool (generic or enhanced) and may be erased if the power to the on-board computer is disconnected. Except as provided for in sections (h)(4.4.1)(F)(iv), (h)(4.4.2)(F)(iv), and (h)(4.8.3), ~~I~~if any of the emission-related diagnostic information is commanded to be erased by a scan tool (generic or enhanced), all emission-related diagnostic information from all diagnostic or emission critical control units shall be erased. The OBD system may not allow a scan tool to erase a subset of the emission-related diagnostic information (e.g., the OBD system may not allow a scan tool to erase only one of three stored fault codes or only information from one control unit without erasing information from the other control unit(s)).

(5) Tracking Requirements:

(5.1) In-use Performance Ratio Tracking Requirements:

(5.1.1) For each monitor required in sections (e) through (g) to separately report an in-use performance ratio, manufacturers shall implement software algorithms to report a numerator and denominator in the standardized format specified below and in accordance with the SAE J1979/J1939 specifications.

(5.1.2) Numerical Value Specifications:

(A) For the numerator, denominator, general denominator, and ignition cycle counter:

(i) Each number shall have a minimum value of zero and a maximum value of 65,535 with a resolution of one.

(ii) Each number shall be reset to zero only when a non-volatile random access memory (NVRAM) reset occurs (e.g., reprogramming event) or, if the numbers are stored in keep-alive memory (KAM), when KAM is lost due to an interruption in electrical power to the control module (e.g., battery disconnect). Numbers may not be reset to zero under any other circumstances, including when a scan tool command to clear fault codes or reset KAM is received.

(iii) If either the numerator or denominator for a specific component reaches the maximum value of 65,535 ±2, both numbers shall be divided by two before either is incremented again to avoid overflow problems.

(iv) If the ignition cycle counter reaches the maximum value of 65,535 ±2, the ignition cycle counter shall rollover and increment to zero on the next ignition cycle to avoid overflow problems.

(v) If the general denominator reaches the maximum value of 65,535 ±2, the general denominator shall rollover and increment to zero on the next driving cycle that meets the general denominator definition to avoid overflow problems.

(vi) If a vehicle is not equipped with a component (e.g., oxygen sensor bank 2, secondary air system), the corresponding numerator and denominator for that specific component shall always be reported as zero.

(B) For the ratio:

(i) The ratio shall have a minimum value of zero and a maximum value of 7.99527 with a resolution of 0.000122.

(ii) A ratio for a specific component shall be considered to be zero whenever the corresponding numerator is equal to zero and the corresponding denominator is not zero.

(iii) A ratio for a specific component shall be considered to be the maximum value of 7.99527 if the corresponding denominator is zero or if the actual value of the numerator divided by the denominator exceeds the maximum value of 7.99527.

(5.2) Engine Run Time Tracking Requirements:

(5.2.1) For all gasoline and diesel engines, manufacturers shall implement software algorithms to individually track and report in a standardized format the engine run time while being operated in the following conditions:

(A) Total engine run time;

(B) Total idle run time (with "idle" defined as accelerator pedal released by driver, engine speed greater than or equal to 50 to 150 rpm below the normal warmed-up idle speed (as determined in the drive position for vehicles equipped with an automatic transmission), PTO not active, and either vehicle speed less than or equal to one mile per hour or engine speed less than or equal to 200 rpm above normal warmed-up idle), and;

(C) Total run time with PTO active;

(D) For 2013 and subsequent model year diesel engines only:

(i) total run time with EI-AECD #1active;

(ii) total run time with EI-AECD #2 active; and so on up to

(iii) total run time with EI-AECD #n active.

(5.2.2) Numerical Value Specifications: For each counter specified in section (h)(5.2.1):

(A) Each number shall conform to the standardized format specified in SAE J1979/J1939.

(B) Each number shall be reset to zero only when a non-volatile memory reset occurs (e.g., reprogramming event). Numbers may not be reset to zero under any other circumstances including when a scan tool (generic or enhanced) command to clear fault codes or reset KAM is received.

(C) If any of the individual counters reach the maximum value, all counters shall be divided by two before any are incremented again to avoid overflow problems.

~~(D) The counters shall be made available to a generic scan tool in accordance with the SAE J1979/J1939 specifications and may be rescaled when transmitted, if required by the SAE specifications, from a resolution of one second per bit to no more than three minutes per bit.~~

(5.2.3) Specifications of EI-AECDs

(A) For purposes of section (h)(5.2.3), the following terms shall be defined as follows:

(i) "Purpose" is defined as the objective of the EI-AECD when it is activated (e.g., EGR valve protection);

(ii) "Action" is defined as a specific component/element act that is commanded when the EI-AECD is activated (e.g., EGR system is derated);

(iii) "Parameter" is defined as a component/element (e.g., ECT, oil temperature) used to determine when to activate the EI-AECD; and

(iv) "Condition" is defined as the specific characteristic/state exhibited by the parameter (e.g., ECT above 100 degrees Celsius) that triggers activation of the EI-AECD.

(B) Each unique combination of action, parameter, and condition within a purpose shall be tracked as a separate EI-AECD and increment the timer(s) at all times the condition necessary to activate the EI-AECD is present.

(i) For EI-AECDs that implement an action of variable degree based on the varying characteristics of a parameter (e.g., derate EGR more aggressively as engine oil temperature continues to increase), the EI-AECD shall be tracked by incrementing two separate timers within a single EI-AECD (e.g., EI-AECD #1 timer 1 and EI-AECD #1 timer 2) as follows:

a. The first of the two timers shall be incremented whenever the EI-AECD is commanding some amount of reduced emission control effectiveness up to but not including 75 percent of the maximum reduced emission control effectiveness that the EI-AECD is capable of commanding during in-use vehicle or engine operation. For example, an overheat protection strategy that progressively derates EGR and eventually shuts off EGR as oil temperature increases would accumulate time for the first timer from the time derating of EGR begins up to the time that EGR is derated 75 percent. As a second example, an overheat protection strategy that advances fuel injection timing progressively up to a maximum advance of 15 degrees crank angle as the engine coolant temperature increases would accumulate time for the first timer from the time advance is applied up to the time that advance reaches 11.25 degrees (75 percent of the maximum 15 degrees).

b. The second of the two timers shall be incremented whenever the EI-AECD is commanding 75 percent or more of the maximum reduced emission control effectiveness that the EI-AECD is capable of commanding during in-use vehicle or engine operation. For example, the second timer for the first example EI-AECD identified in section (h)(5.2.3)(B)(i) would accumulate time from the time that EGR is derated 75 percent up to and including when EGR is completely shut off. For the second example EI-AECD identified in section (h)(5.2.3)(B)(i), the second timer would accumulate time from the time fuel injection timing advance is at 11.25 degrees up to and including the maximum advance of 15 degrees.

(C) A manufacturer may request Executive Officer approval to combine multiple unique actions, parameters, and/or conditions to be tracked within a single EI-AECD. The manufacturer shall submit a plan for combining, tracking, and incrementing the EI-AECD to the Executive Officer for approval. Executive Officer approval of the plan shall be based on the effectiveness and the equivalence of the incrementing plan to determine the amount of EI-AECD activity per condition relative to the measure of EI-AECD activity under section (h)(5.2.3)(B).

(D) For EI-AECDs that are activated solely due to elevation, the timer shall be incremented only for the portion of EI-AECD activation when the elevation is below 8000 feet (e.g., the timer for an EI-AECD that is activated when the elevation is above 5000 feet shall be incremented only when the EI-AECD is active and the elevation is below 8000 feet).

(E) For EI-AECDs that are initially activated due to engine warm-up and are subsequently reactivated after the engine has warmed up, the timer shall be incremented only when the EI-AECD is active after the initial engine warm-up (e.g., an EI-AECD that turns off an emission control at low engine coolant temperature would not increment the timer during initial warm-up but would increment the timer if coolant temperature subsequently dropped below the low temperature and reactivated the EI-AECD later in the drive cycle).

(F) If more than one EI-AECD is currently active, the timers for both EI-AECDs shall accumulate time, regardless if there is overlap or redundancy in the commanded action (e.g., two different EI-AECDs independently but simultaneously commanding EGR off shall both accumulate time in their respective timers).

(6) Service Information:

(6.1) Engine manufacturers shall provide the aftermarket service and repair industry emission-related service information as set forth in sections (h)(6.3) through (6.5).

(6.2) The Executive Officer shall waive the requirements of sections (h)(6.3) through (6.5) upon determining that ARB or U.S. EPA has adopted a service information regulation or rule that is in effect and operative and requires engine manufacturers to provide emission-related service information:

(A) of comparable or greater scope than required under these provisions;

(B) in an easily accessible format and in a timeframe that is equivalent to or exceeds the timeframes set forth below; and

(C) at fair and reasonable cost.

(6.3) Manufacturers shall make readily available, at a fair and reasonable price to the automotive repair industry, vehicle repair procedures which allow effective emission-related diagnosis and repairs to be performed using only the SAE J1978/J1939 generic scan tool and commonly available, non-microprocessor based tools.

(6.4) As an alternative to publishing repair procedures required under section (h)(6.3), a manufacturer may publish repair procedures referencing the use of manufacturer-specific or enhanced equipment provided the manufacturer meets one of the following conditions:

(6.4.1) makes available to the aftermarket scan tool industry the information needed to manufacture scan tools to perform the same emission-related diagnosis and repair procedures (excluding any reprogramming) in a comparable manner as the manufacturer-specific diagnostic scan tool, or

(6.4.2) makes available for purchase, at a fair and reasonable price to the automotive repair industry, a manufacturer-specific or enhanced tool to perform the emission-related diagnosis and repair procedures (excluding any reprogramming).

(6.5) Manufacturers shall make available:

(6.5.1) Information to utilize the test results reported as required in section (h)(4.5). The information must include a description of the test and test result, typical passing and failing values, associated fault codes with the test result, and scaling, units, and conversion factors necessary to convert the results to engineering units.

(6.5.2) A generic description of each of the diagnostics used to meet the requirements of this regulation. The generic description must include a text description of how the diagnostic is performed, typical enable conditions, typical malfunction thresholds, typical monitoring time, fault codes associated with the diagnostic, and test results (section (h)(4.5)) associated with the diagnostic. Vehicles that have diagnostics not adequately represented by the typical values identified above shall be specifically identified along with the appropriate typical values.

(6.5.3) Information necessary to execute each of the diagnostics used to meet the requirements of sections (e)(1) through (f)(9). The information must include either a description of sample driving patterns designed to be operated in-use or a written description of the conditions the vehicle needs to operate in to execute each of the diagnostics necessary to change the readiness status from "not complete" to "complete" for all monitors. The information shall be able to be used to exercise all necessary monitors in a single driving cycle as well as be able to be used to exercise the monitors to individually change the readiness status for each specific monitor from "not complete" to "complete".

~~(7) Exceptions to Standardization Requirements.~~

~~(7.1) For 2020 and subsequent model year alternate-fueled engines derived from a diesel-cycle engine, a manufacturer may meet the standardized requirements of section (h) that are applicable to diesel engines in lieu of the requirements applicable to gasoline engines.~~

(i) *Monitoring System Demonstration Requirements for Certification.*

(1) General.

(1.1) Certification requires that manufacturers submit emission test data from one or more durability demonstration test engines (test engines).

(1.2) The Executive Officer may approve other demonstration protocols if the manufacturer can provide comparable assurance that the malfunction criteria are chosen based on meeting the malfunction criteria requirements and that the timeliness of malfunction detection is within the constraints of the applicable monitoring requirements.

(1.3) For flexible fuel engines capable of operating on more than one fuel or fuel combinations, the manufacturer shall submit a plan for providing emission test data to the Executive Officer for approval. The Executive Officer shall approve the plan if it is determined to be representative of expected in-use fuel or fuel combinations and provides accurate and timely evaluation of the monitored systems.

(2) Selection of Test Engines:

(2.1) Prior to submitting any applications for certification for a model year, a manufacturer shall notify the Executive Officer of the engine families and engine ratings within each family planned for that model year. The Executive Officer will then select the engine family(ies) and the specific engine rating within the engine family(ies) that the manufacturer shall use as demonstration test engines to provide emission test data. The selection of test vehicles for production vehicle evaluation, as specified in section (l)(2), may take place during this selection process.

(2.2) Number of test engines:

(2.2.1) For the 2010 model year, a manufacturer shall provide emission test data of a test engine from the OBD parent rating.

(2.2.2) For the 2011 and 2012 model years, a manufacturer certifying one to seven engine families in a model year shall provide emission test data of a test engine from one OBD child rating. A manufacturer certifying eight or more engine families in a model year shall provide emission test data of test engines from two OBD child ratings. The Executive Officer may waive the requirement for submittal of data of one or more of the test engines if data have been previously submitted for all of the OBD parent and OBD child ratings.

(2.2.3) For the 2013 and subsequent model years, a manufacturer certifying one to five engine families in a model year shall provide emission test data of a test engine from one engine rating. A manufacturer certifying six to ten engine families in a model year shall provide emission test data from test engines from two engine ratings. A manufacturer certifying eleven or more engine families in a model year shall provide emission test data of test engines from three engine ratings. The Executive Officer may waive the requirement for submittal of data of one or more of the test engines if data have been previously submitted for all of the engine ratings.

(2.2.4) For a given model year, a manufacturer may elect to provide emission data of test engines from more engine ratings than required by section (i)(2.2.1) through (2.2.3). For each additional engine rating tested in that given model year, the Executive Officer shall reduce the number of engine ratings required for testing in one future model year under sections (i)(2.2.2) through (2.2.3) by one.

(2.3) Aging and data collection of diesel test engines:

(2.3.1) For 2010 through 2012 model year test engines, a manufacturer shall use an engine aged for a minimum of 125 hours plus exhaust aftertreatment emission controls aged by an accelerated aging process to be representative of full useful life. Manufacturers are required to submit for Executive Officer approval a description of the accelerated aging process and/or supporting data. The Executive Officer shall approve the process upon determining that the submitted description and/or data demonstrate that the process ensures that deterioration of the exhaust aftertreatment emission controls is stabilized sufficiently such that it is representative of the manufacturer's best estimates for the performance of the emission control at the end of the useful life. The Executive Officer may not require manufacturers to provide actual in-use or high mileage data to verify or validate that the aging is equivalent to full useful life for purposes of section (i)(2.3.1).

(2.3.2) For 2013 through 2015 model year test engines:

(A) A manufacturer shall collect emission and deterioration data from an actual high mileage system(s) (consisting of the engine, engine emission controls, and aftertreatment) to validate its accelerated aging process. The manufacturer shall collect the data from a 2010 or newer model year system that is the most representative of system designs planned for the 2013 model year and has a minimum actual mileage of full useful life or 185,000 miles, whichever is lower. The manufacturer shall collect and report the data to ARB prior to the end of 2011. The manufacturer shall submit a plan for system selection, procurement, and data collection to the Executive Officer for approval prior to proceeding with the data collection. The Executive Officer shall approve the plan upon determining that the submitted description will result in the manufacturer gathering data necessary to quantify emission performance and deterioration of the system elements in a manner that will allow comparison to deterioration and performance levels achieved with the manufacturer's accelerated aging process.

(B) For testing of 2013 through 2015 model year engines, a manufacturer shall use a system (engine, engine emission controls, and aftertreatment) aged by an accelerated aging process to be representative of full useful life. Manufacturers are required to submit for Executive Officer approval a description of the accelerated aging process and supporting data. The Executive Officer shall approve the process upon determining that the submitted description and data demonstrate that the aging process will result in a system representative of the manufacturer's best estimates of the system performance at full useful life and that the manufacturer has utilized the data collected under section (i)(2.3.2)(A) to validate the correlation of the aging process to actual high mileage systems up to a minimum of full useful life or 185,000 miles.

(2.3.3) For 2016 and subsequent model year test engines:

(A) A manufacturer shall collect emission and deterioration data from an actual high mileage system(s) (consisting of the engine, engine emission controls, and aftertreatment) to validate its accelerated aging process. The manufacturer shall collect the data from a 2010 or newer model year system that is the most representative of system designs planned for the 2016 model year and has a minimum actual mileage of full useful life. The manufacturer shall collect and report the data to ARB prior to the end of 2014. The manufacturer shall submit a plan for system selection, procurement, and data collection to the Executive Officer for approval prior to proceeding with the data collection. The Executive Officer shall approve the plan upon determining that the submitted description will result in the manufacturer gathering data necessary to quantify emission performance and deterioration of the system elements in a manner that will allow comparison to deterioration and performance levels achieved with the manufacturer's accelerated aging process.

(B) For testing of 2016 and subsequent model year engines, a manufacturer shall use a system (engine, engine emission controls, and aftertreatment) aged by an accelerated aging process to be representative of full useful life. Manufacturers are required to submit for Executive Officer approval a description of the accelerated aging process and supporting data. The Executive Officer shall approve the process upon determining that the submitted description and data demonstrate that the aging process will result in a system representative of the manufacturer's best estimates of the system performance at full useful life and that the manufacturer has utilized the data collected under section (i)(2.3.3)(A) to validate the correlation of the aging process to actual high mileage systems up to a minimum of full useful life.

(2.4) Aging of gasoline engines: For the test engine(s), a manufacturer shall use a certification emission durability test engine(s) system (i.e., consisting of the engine, engine emission controls, and aftertreatment), a representative high mileage engine(s) system, or an engine(s) system aged to the end of the full useful life using an ARB-approved alternative durability procedure (ADP).

(3) Required Testing:
Except as provided below, the manufacturer shall perform single-fault testing based on the applicable test with the following components/systems set at their malfunction criteria limits as determined by the manufacturer for meeting the requirements of sections (e), (f), and (g) or sections (d)(7.1.2) and (d)(7.2.3) for extrapolated OBD systems.

(3.1) Required testing for Diesel/Compression Ignition Engines:

(3.1.1) Fuel System: The manufacturer shall perform a separate test for each malfunction limit established by the manufacturer for the fuel system parameters (e.g., fuel pressure, injection timing) <u>and calibrated to the emission threshold malfunction criteria (e.g., 2.0 times the standard)</u> ~~specified~~ in sections (e)(1.2.1) through (e)(1.2.3). When performing a test for a specific parameter, the fuel system shall be operating at the malfunction criteria limit for the applicable parameter only. All other parameters shall be with normal characteristics. In conducting the fuel system demonstration tests, the manufacturer may use computer modifications to cause the fuel system to operate at the malfunction limit if the manufacturer can demonstrate to the Executive Officer that the computer modifications produce test results equivalent to an induced hardware malfunction.

(3.1.2) Misfire Monitoring: ~~For 2010 through 2012 model year engines, a~~A misfire demonstration test is not required for diesel engines. ~~For 2013 and subsequent model year engines, the manufacturer shall perform a test at the malfunction criteria limit specified in section (e)(2.2.2).~~

(3.1.3) EGR System: The manufacturer shall perform a test at each flow, slow response, and cooling limit calibrated to the emission threshold malfunction criteria (e.g., 2.0 times the standard) in sections (e)(3.2.1) through (3.2.3) and (e)(3.2.5). In conducting the EGR cooler performance demonstration test, the EGR cooler(s) being evaluated shall be deteriorated to the applicable malfunction criteria using methods established by the manufacturer in accordance with section (e)(3.2.9). In conducting the EGR system slow response demonstration tests, the manufacturer may use computer modifications to cause the EGR system to operate at the malfunction limit if the manufacturer can demonstrate to the Executive Officer that the computer modifications produce test results equivalent to an induced hardware malfunction or that there is no reasonably feasible method to induce a hardware malfunction.

(3.1.4) Boost Pressure Control System: The manufacturer shall perform a test at each boost, response, and cooling limit calibrated to the emission threshold malfunction criteria (e.g., 2.0 times the ~~FTP~~ standard) in sections (e)(4.2.1) through (4.2.3) and (e)(4.2.4). In conducting the charge air undercooling demonstration test, the charge air cooler(s) being evaluated shall be deteriorated to the applicable malfunction ~~criteria~~ limit established by the manufacturer in section (e)(4.2.4) using methods established by the manufacturer in accordance with section (e)(4.2.8).

(3.1.5) NMHC Catalyst: The manufacturer shall perform a separate test for each monitored NMHC catalyst(s) that is used for a different purpose (e.g., oxidation catalyst upstream of a PM filter, NMHC catalyst used downstream of an SCR catalyst). The catalyst(s) being evaluated shall be deteriorated to the applicable malfunction ~~criteria~~ limit(s) established by the manufacturer and calibrated to the emission threshold malfunction criteria (e.g., 2.0 times the standard) in section (e)(5.2.2)(A) and (e)(5.2.2)(B) using methods established by the manufacturer in accordance with section (e)(5.2.4). For each monitored NMHC catalyst(s), the manufacturer shall also demonstrate that the OBD system will detect a catalyst malfunction with the catalyst at its maximum level of deterioration (i.e., the substrate(s) completely removed from the catalyst container or "empty" can). Emission data are not required for the empty can demonstration.

(3.1.6) NOx Catalyst: The manufacturer shall perform a separate test for each monitored NOx catalyst(s) that is used for a different purpose (e.g., passive lean NOx catalyst, SCR catalyst). The catalyst(s) being evaluated shall be deteriorated to the applicable malfunction ~~criteria~~ limit(s) established by the manufacturer and calibrated to the emission threshold malfunction criteria (e.g., 2.0 times the standard) in sections (e)(6.2.1)~~(A)(i), (e)(6.2.1)(B)(i),~~ and (e)(6.2.2)(A) using methods established by the manufacturer in accordance with section (e)(6.2.3). For each monitored NOx catalyst(s), the manufacturer shall also demonstrate that the OBD system will detect a catalyst malfunction with the catalyst at its maximum level of deterioration (i.e., the substrate(s) completely removed from the catalyst container or "empty" can). Emission data are not required for the empty can demonstration.

(3.1.7) NOx Adsorber: The manufacturer shall perform a test using a NOx adsorber(s) deteriorated to the malfunction limit calibrated to the emission threshold malfunction criteria (e.g., 2.0 times the standard) in section (e)(7.2.1). The manufacturer shall also demonstrate that the OBD system will detect a NOx adsorber malfunction with the NOx adsorber at its maximum level of deterioration (i.e., the substrate(s) completely removed from the container or "empty" can). Emission data are not required for the empty can demonstration.

(3.1.8) PM Filter: The manufacturer shall perform a test using a PM filter(s) deteriorated to each applicable malfunction limit calibrated to the emission threshold malfunction criteria (e.g., 2.0 times the standard) in sections (e)(8.2.1), (e)(8.2.2), and (e)(8.2.4)(A). The manufacturer shall also demonstrate that the OBD system will detect a PM filter malfunction with the filter at its maximum level of deterioration (i.e., the filter(s) completely removed from the filter container or "empty" can). Emission data are not required for the empty can demonstration.

(3.1.9) Exhaust Gas Sensor: The manufacturer shall perform a test for each exhaust gas sensor parameter at ~~the~~ each malfunction limit calibrated to the emission threshold malfunction criteria (e.g., 2.0 times the ~~FTP~~ standard) in sections (e)(9.2.1)(A)(i), (e)(9.2.1)(B)(i)a. through b., and (e)(9.2.2)(A)(i) through (ii). When performing a test, all exhaust gas sensors used for the same purpose (e.g., for the same feedback control loop, for the same control feature on parallel exhaust banks) shall be operating at the malfunction criteria limit for the applicable parameter only. All other exhaust gas sensor parameters shall be with normal characteristics.

(3.1.10) VVT System: The manufacturer shall perform a test at each target error limit and slow response limit calibrated to the emission threshold malfunction criteria (e.g., 2.0 times the ~~FTP~~ standard) in sections (e)(10.2.1) and (e)(10.2.2). In conducting the VVT system demonstration tests, the manufacturer may use computer modifications to cause the VVT system to operate at the malfunction limit if the manufacturer can demonstrate to the Executive Officer that the computer modifications produce test results equivalent to an induced hardware malfunction.

(3.1.11) Cold Start Emission Reduction Strategy: The manufacturer shall perform a test at the malfunction limit calibrated to the emission threshold malfunction criteria (e.g., 2.0 times the standard) for the system or for each component monitored according to section (e)(11.2.2).

(3.1.12) For each of the testing requirements of section (i)(3.1), if the manufacturer has established that only a functional check is required because no failure or deterioration of the specific tested system could result in an engine's emissions exceeding the emission threshold malfunction criteria (e.g., 2.0 times any of the applicable standards), the manufacturer is not required to perform a demonstration test; however the manufacturer is required to provide the data and/or engineering analysis used to determine that only a functional test of the system(s) is required.

(3.2) Required testing for Gasoline/Spark-Ignited Engines:

(3.2.1) Fuel System:

(A) For engines with adaptive feedback based on the primary fuel control sensor(s), the manufacturer shall perform a test with the adaptive feedback based on the primary fuel control sensor(s) at the rich limit(s) and a test at the lean limit(s) established by the manufacturer and calibrated to the emission threshold malfunction criteria (e.g., 1.5 times the standard) in section (f)(1.2.1)(A) ~~to detect a malfunction before emissions exceed 1.5 times the applicable standards~~. For purposes of fuel system testing, the fault(s) induced may result in a uniform distribution of fuel and air among the cylinders. Non-uniform distribution of fuel and air used to induce a fault may not cause misfire.

(B) For engines with feedback based on a secondary fuel control sensor(s) and subject to the malfunction criteria in section (f)(1.2.1)(B), the manufacturer shall perform a test with the feedback based on the secondary fuel control sensor(s) at the rich limit(s) and a test at the lean limit(s) established by the manufacturer and calibrated to the emission threshold malfunction criteria (e.g., 1.5 times the standard) in section (f)(1.2.1)(B) ~~to detect a malfunction before emissions exceed 1.5 times the applicable standards~~.

(C) For engines subject to the malfunction criteria in section (f)(1.2.1)(C) (monitoring of air-fuel ratio cylinder imbalance faults), the manufacturer shall perform a test at the malfunction limit(s) calibrated to the emission threshold malfunction criteria (e.g., 1.5 times the standard) in section (f)(1.2.1)(C). The manufacturer shall perform the test at the rich limit and another test at the lean limit with a fault induced on the worst case cylinder for each limit. The manufacturer shall submit data and/or analysis demonstrating that a fault of the cylinder(s) will result in the worst case emissions for each malfunction limit.

~~(C)~~(D) For other fuel metering or control systems, the manufacturer shall perform a test at the criteria limit(s).

~~(D)~~(E) ~~For purposes of fuel system testing, the fault(s) induced may result in a uniform distribution of fuel and air among the cylinders. Non-uniform distribution of fuel and air used to induce a fault may not cause misfire.~~ In conducting the fuel system demonstration tests, the manufacturer may use computer modifications to cause the fuel system to operate at the malfunction limit if the manufacturer can demonstrate to the Executive Officer that the computer modifications produce test results equivalent to an induced hardware malfunction.

(3.2.2) Misfire: The manufacturer shall perform a test at the malfunction ~~criteria~~ limit calibrated to the emission threshold malfunction criteria (e.g., 1.5 times the standard) ~~specified~~ in section (f)(2.2.2).

(3.2.3) EGR System: The manufacturer shall perform a test at each flow limit calibrated to the emission threshold malfunction criteria (e.g., 1.5 times the standard) in sections (f)(3.2.1) and (f)(3.2.2).

(3.2.4) Cold Start Emission Reduction Strategy: The manufacturer shall perform a test at the malfunction limit calibrated to the emission threshold malfunction criteria (e.g., 1.5 times the standard) for each component monitored according to section (f)(4.2.1)(A) or (f)(4.2.2)(B).

(3.2.5) Secondary Air System: The manufacturer shall perform a test at each flow limit calibrated to the emission threshold malfunction criteria in sections (f)(5.2.1) and (f)(5.2.2).

(3.2.6) Catalyst: The manufacturer shall perform a test using a catalyst system deteriorated to the emission threshold malfunction criteria (e.g., 1.5 times the standard) in section (f)(6.2.1) using methods established by the manufacturer in accordance with section (f)(6.2.2). The manufacturer shall also demonstrate that the OBD system will detect a catalyst system malfunction with the catalyst system at its maximum level of deterioration (i.e., the substrate(s) completely removed from the catalyst container or "empty" can). Emission data are not required for the empty can demonstration.

(3.2.7) Exhaust Gas Sensor:

(A) The manufacturer shall perform a test with all primary oxygen sensors (conventional switching sensors and wide range or universal sensors) used for fuel control simultaneously possessing a response rate deteriorated to the malfunction ~~criteria~~ limit calibrated to the emission threshold malfunction criteria (e.g., 1.5 times the standard) in section (f)(8.2.1)(A). For conventional switching sensors, the manufacturer shall perform a test for each of the following malfunctions (1) the single worst case response rate malfunction among all symmetric and asymmetric patterns required by section (f)(8.2.1)(A), and (2) the worst case asymmetric response rate malfunction that results in delays during transitions from rich-to-lean or lean-to-rich sensor output. For wide range or universal sensors, the manufacturer shall perform a test for each of the following malfunctions: (1) the single worst case response rate malfunction among all symmetric and asymmetric patterns required by section (f)(8.2.1)(A), and (2) the symmetric response rate malfunction that results in delays during transitions from rich-to-lean and lean-to-rich sensor output. For systems where the same response rate pattern meets the criteria of (1) and (2) above, only one demonstration test is required. For the response rate patterns not tested, the manufacturer is required to provide the data and/or engineering analysis used to determine that the tested response pattern for criterion (1) will result in the worst case emissions compared to all the other response rate malfunctions. Manufacturers shall also perform a test for any other oxygen sensor parameter under sections (f)(8.2.1)(A) and (f)(8.2.2)(A) that can cause engine emissions to exceed the emission threshold malfunction ~~threshold~~ criteria (e.g., 1.5 times the applicable standards due to a shift in air/fuel ratio at which oxygen sensor switches, decreased amplitude). When performing additional test(s), all primary and secondary (if applicable) oxygen sensors used for fuel control shall be operating at the malfunction criteria limit for the applicable parameter only. All other primary and secondary oxygen sensor parameters shall be with normal characteristics.

(B) For engines utilizing sensors other than oxygen sensors for primary fuel control (e.g., hydrocarbon sensors), the manufacturer shall submit, for Executive Officer approval, a demonstration test plan for performing testing of all of the sensor parameters that can cause engine emissions to exceed the emission threshold malfunction ~~threshold~~ criteria (e.g., 1.5 times the applicable standards). The Executive Officer shall approve the plan if it is determined that it will provide data that will assure proper performance of the diagnostics of the sensors, consistent with the intent of section (i).

(3.2.8) VVT System: The manufacturer shall perform a test at each target error limit and slow response limit calibrated to the emission threshold malfunction criteria (e.g., 1.5 times the ~~FTP~~ standard) in sections (f)(9.2.1) and (f)(9.2.2). In conducting the VVT system demonstration tests, the manufacturer may use computer modifications to cause the VVT system to operate at the malfunction limit if the manufacturer can demonstrate to the Executive Officer that the computer modifications produce test results equivalent to an induced hardware malfunction.

(3.2.9) For each of the testing requirements of section (i)(3.2), if the manufacturer has established that only a functional check is required because no failure or deterioration of the specific tested system could result in an engine's emissions exceeding the emission threshold malfunction criteria (e.g., 1.5 times any of the applicable standards), the manufacturer is not required to perform a demonstration test; however the manufacturer is required to provide the data and/or engineering analysis used to determine that only a functional test of the system(s) is required.

(3.3) Required Testing for All Engines:

(3.3.1) Other Emission Control Systems: The manufacturer shall conduct demonstration tests for all other emission control components (e.g., hydrocarbon traps, adsorbers) designed and calibrated to an emission threshold malfunction criteria (e.g., 1.5 times the applicable ~~emission~~ standards) under the provisions of section (g)(4).

(3.3.2) For each of the testing requirements of section (i)(3.3), if the manufacturer has established that only a functional check is required because no failure or deterioration of the specific tested system could result in an engine's emissions exceeding the emission threshold malfunction criteria (e.g., 1.5 times any of the applicable standards), the manufacturer is not required to perform a demonstration test; however the manufacturer is required to provide the data and/or engineering analysis used to determine that only a functional test of the system(s) is required.

(3.4) The manufacturer may electronically simulate deteriorated components if the manufacturer can demonstrate to the Executive Officer that the computer modifications produce test results equivalent to an induced hardware malfunction but may not make any engine control unit modifications (unless otherwise provided above or exempted pursuant to this section) when performing demonstration tests. All equipment necessary to duplicate the demonstration test must be made available to ARB upon request. A manufacturer may request Executive Officer approval to electronically simulate a deteriorated component with engine control unit modifications. The Executive Officer shall approve the request upon determining the manufacturer has submitted data and/or engineering analysis demonstrating that is technically infeasible, very difficult, and/or resource intensive to implant the fault with modifications external to the engine control unit.

(3.5) For each of the testing requirements of (i)(3), when performing a test, all components or systems used in parallel for the same purpose (e.g., separate VVT actuators on the intake valves for Bank 1 and Bank 2, separate NOx converting catalysts on parallel exhaust banks) shall be simultaneously deteriorated to the malfunction criteria limit. Components or systems in series or used for different purposes (e.g., upstream and downstream exhaust gas sensors in a single exhaust bank, separate high pressure and low pressure EGR systems) may not be simultaneously deteriorated to the malfunction criteria limit.

<u>(3.6) For each of the testing requirements under section (i)(3), if the manufacturer has established that only a functional check is required because no failure or deterioration of the specific tested system could result in an engine's emissions exceeding the emission threshold malfunction criteria (e.g., 1.5 times the standards), the manufacturer is not required to perform a demonstration test; however the manufacturer is required to provide the data and/or engineering analysis used to determine that only a functional test of the system(s) is required.</u>

(4) Testing Protocol:

(4.1) Preconditioning:.The manufacturer may request Executive Officer approval to use a preconditioning cycle prior to conducting each of the above emission tests. The Executive Officer shall approve the request upon determining that a manufacturer has provided data and/or engineering evaluation that demonstrate that the preconditioning is necessary to stabilize the emission control system. The manufacturer may also request Executive Officer approval to use an additional identical preconditioning cycle following a 20 minute hot soak after the initial preconditioning cycle. The Executive Officer shall approve the request upon determining that a manufacturer has provided data and/or engineering evaluation that demonstrate that the additional preconditioning is necessary to stabilize the emission control system. The manufacturer may not require the test engine to be cold soaked prior to conducting preconditioning cycles in order for the monitoring system testing to be successful. If a second preconditioning cycle is permitted, the manufacturer may adjust the system or component to be tested before conducting the second preconditioning cycle. The manufacturer may not replace, modify, or adjust the system or component after the last preconditioning cycle has taken place.

(4.2) Test Sequence:

(4.2.1) The manufacturer shall set the system or component on the test engine for which detection is to be tested at the <u>malfunction</u> criteria limit(s) prior to conducting the applicable emission test (or preconditioning, if approved).

(4.2.2) The test engine shall be operated over the first engine start of the FTP emission test (i.e., the cold start) or a SET cycle to allow for the initial detection of the tested system or component malfunction. If required by the designated monitoring strategy, an additional cold soak and first engine start of the FTP cycle (i.e., the cold start) may be performed prior to conducting this test cycle (e.g., for two-trip monitors that only run during cold starts).

(4.2.3) The test engine shall then be operated over the second engine start of the FTP emission test (i.e., the hot start) or an SET emission test. The second SET cycle may be omitted from the testing protocol if it is unnecessary (e.g., one-trip fault detection strategies that run on the SET).

(4.3) Test Data Collection:

(4.3.1) During the test sequence of section (i)(4.2), the manufacturer shall collect data immediately prior to each engine shut-down (e.g., the end of each preconditioning cycle in section (i)(4.2.1), the end of the cold start FTP cycle in section (i)(4.2.3), the end of the warm start FTP cycle in section (i)(4.2.3)). If the data cannot be collected immediately prior to engine shut-down, the data shall be collected immediately after engine shut-down.

(4.3.2) The manufacturer shall ~~be required to~~ collect the following data:

(A) Approximate time on the test cycle (in seconds after engine start) when the MIL illuminates (e.g., MIL illuminated at 402 seconds into the cold start FTP cycle);

(B) All data required by sections (h)(4.1) through (h)(4.9) and (h)(5) including readiness status, current data stream values, fault code(s), freeze frame data, test results, CAL ID, CVN, VIN, ESN, ECU Name, in-use performance ratios, and engine run time tracking data.

(4.4) A manufacturer required to test more than one test engine (section (i)(2.2)) may utilize internal calibration sign-off test procedures (e.g., forced cool downs, less frequently calibrated emission analyzers) instead of official test procedures to obtain the emission test data required in section (i) for all but one of the required test engines. The manufacturer may elect this option if the data from the alternative test procedure are representative of official emission test results. Manufacturers using this option are still responsible for meeting the malfunction criteria specified in sections (e) through (g) when emission tests are performed in accordance with official test procedures.

(4.5) A manufacturer may request Executive Officer approval to utilize an alternate testing protocol for demonstration of MIL illumination if the engine dynamometer emission test cycle does not allow all of a monitor's enable conditions to be satisfied. A manufacturer may request the use of an alternate engine dynamometer test cycle or the use of chassis testing to demonstrate proper MIL illumination. In evaluating the manufacturer's request, the Executive Officer shall consider the technical necessity for using an alternate test cycle and the degree to which the alternate test cycle demonstrates that in-use operation with the malfunctioning component will properly result in MIL illumination.

(5) Evaluation Protocol:

(5.1) Full OBD engine ratings subject to sections (d)(7.1.1), (d)(7.2.2), or (d)(7.3) shall be evaluated according to the following protocol.

(5.1.1) For all tests conducted under section (i), the MIL shall be illuminated upon detection of the tested system or component malfunction before the end of the emission test specified in (i)(4.2.3) in accordance with the requirements of sections (e) through (g).

(5.1.2) If the MIL illuminates prior to emissions exceeding the applicable emission threshold malfunction criteria specified in sections (e) through (g), no further demonstration is required. With respect to the misfire monitor demonstration test, if a manufacturer has elected to use the minimum misfire malfunction criteria of one percent as allowed in sections (e)(2.2.2)(A) and (f)(2.2.2)(A), no further demonstration is required if the MIL illuminates with misfire implanted at the malfunction criteria limit.

(5.1.3) If the MIL does not illuminate when the system or component is set at its limit(s), the criteria limit or the OBD system is not acceptable.

(A) ~~Except for testing of the catalyst (i.e., components monitored under sections (e)(5.2.2), (e)(6.2.1), (e)(7.2.1), and (f)(6.2.1)) or PM filter system (i.e., (e)(8.2.1) and (e)(8.2.4)), i~~If the MIL first illuminates after emissions exceed the applicable emission threshold malfunction criteria specified in sections (e) through (g), the test engine shall be retested with the tested system or component adjusted so that the MIL will illuminate ~~before~~ without emissions exceeding the applicable emission threshold malfunction criteria specified in sections (e) through (g). If the system or component cannot be adjusted to meet this criterion because a default fuel or emission control strategy is used when a malfunction is detected (e.g., open loop fuel control used after an oxygen sensor malfunction is determined), the test engine shall be retested with the system or component adjusted to the worst acceptable limit (i.e., the applicable monitor indicates the system or component's ~~is~~ performance~~ing~~ is passing but at the closest possible value relative to the monitor threshold value at which a fault would be detected that would invoke the default strategy and illuminate the MIL~~or slightly better than the malfunction criteria~~). The manufacturer may request the Executive Officer to accept test data when the system or component's performance is at the worst acceptable limit within a margin of error necessary to accommodate testing variability and/or other practical limitations in setting the performance at the absolute worst acceptable limit. The Executive Officer shall accept the test data upon determining that the test data adequately demonstrate that emissions do not exceed the applicable malfunction criteria at the tested worst acceptable limit and that emissions will not exceed the applicable emission threshold malfunction criteria before performance exceeds the monitor threshold for fault detection. ~~When tested with the component adjusted to the worst acceptable limit, the MIL must not illuminate during the test and the engine emissions must be below the applicable malfunction criteria specified in sections (e) through (g).~~ These provisions shall only apply to testing of the catalyst (i.e., components monitored under sections (e)(5.2.2), (e)(6.2.1), (e)(7.2.1), and (f)(6.2.1)) or PM filter system (i.e., (e)(8.2.1) and (e)(8.2.4)) if the on-board computer invokes a default fuel or emission control strategy upon detection of the relevant catalyst malfunction. Otherwise, the provisions of section (i)(5.1.3)(B) shall apply to testing of the catalyst or PM filter system.

(B) Except as provided for in section (i)(5.1.3)(A), i~~I~~n testing the catalyst (i.e., components monitored under sections (e)(5.2.2), (e)(6.2.1), (e)(7.2.1), and (f)(6.2.1)) or PM filter system (i.e., (e)(8.2.1) and (e)(8.2.4)), if the MIL first illuminates after emissions exceed the applicable emission threshold~~(s)~~ malfunction criteria specified in sections (e) and (f), the tested engine shall be retested with a less deteriorated catalyst/PM filter system (i.e., more of the applicable engine out pollutants are converted or trapped). Adjustment and testing of the catalyst or PM filter system's performance may be repeated until successful results are obtained. For the OBD system to be approved, ~~testing shall be continued until~~ either of the following conditions ~~are~~ must be satisfied by the test results:

(i) The MIL is illuminated and emissions do not exceed the emission threshold~~s~~ malfunction criteria specified in sections (e) or (f); or

(ii) The manufacturer demonstrates that the MIL illuminates within the upper and lower limits of the ~~threshold~~ malfunction criteria identified below. ~~The manufacturer shall demonstrate acceptable limits by continuing testing until~~ The demonstration shall be deemed appropriate when the test results show:

a. The MIL is illuminated and emissions exceed the emission threshold~~s~~ malfunction criteria specified in sections (e) or (f) by ~~10~~ 20 percent or less of the applicable standard (e.g., emissions are less than ~~1.85~~ 2.2 times the applicable standard for an emission threshold malfunction criterion of ~~1.75~~ 2.0 times the standard); and

b. The MIL is not illuminated and emissions are below the emission threshold~~s~~ malfunction criteria specified in sections (e) or (f) by no more than 20 percent of the standard (e.g., emissions are between ~~1.55~~ 1.8 and ~~1.75~~ 2.0 times the applicable standard for an emission threshold malfunction criterion of ~~1.75~~ 2.0 times the standard).

(5.1.4) If an OBD system is determined unacceptable by the above criteria, the manufacturer may recalibrate and retest the system on the same test engine. In such a case, the manufacturer must confirm, by retesting, that all systems and components that were tested prior to recalibration and are affected by the recalibration function properly under the OBD system as recalibrated.

(5.2) OBD child ratings subject to sections (d)(7.1.2) or (d)(7.2.3) (i.e., extrapolated OBD) shall be evaluated according to the following protocol.

(5.2.1) For all tests conducted under section (i), the MIL shall be illuminated upon detection of the tested system or component malfunction before the end of the emission test specified in (i)(4.2.3) in accordance with the malfunction criteria established by the manufacturer under sections (d)(7.1.2) and (d)(7.2.3).

(5.2.2) Except for testing of the catalyst or PM filter system, if the MIL first illuminates after the tested component or system significantly exceeds the applicable malfunction criteria established by the manufacturer, the test engine shall be retested with the tested system or component adjusted so that the MIL will illuminate at the applicable malfunction criteria established by the manufacturer.

(5.2.3) In testing the catalyst or PM filter system, if the MIL first illuminates after the tested component or system significantly exceeds the applicable malfunction criteria established by the manufacturer, the tested engine shall be retested with a less deteriorated catalyst/PM filter system (i.e., more of the applicable engine out pollutants are converted or trapped). For the OBD system to be approved, testing shall be continued until either of the following conditions are satisfied:

(A) The MIL is illuminated and the tested component or system is at the applicable malfunction criteria established by the manufacturer; or

(B) The manufacturer demonstrates that the MIL illuminates within the upper and lower limits of the threshold identified below. The manufacturer shall demonstrate acceptable limits by continuing testing until the test results show:

(i) The MIL is illuminated and monitoring results indicate the tested component or system exceeds the malfunction criteria established by the manufacturer by 10 percent or less of the monitored parameter; and

(ii) The MIL is not illuminated and monitoring results indicate the tested component or system is below the malfunction criteria established by the manufacturer by 10 percent or less of the monitored parameter.

(6) Confirmatory Testing:

(6.1) ARB may perform confirmatory testing to verify the emission test data submitted by the manufacturer under the requirements of section (i) comply with the requirements of section (i) and the malfunction criteria identified in sections (e) through (g). This confirmatory testing is limited to the engine rating represented by the demonstration engine(s).

(6.2) ARB or its designee may install appropriately deteriorated or malfunctioning components (or simulate a deteriorated or malfunctioning component) in an otherwise properly functioning test engine of an engine rating represented by the demonstration test engine(s) in order to test any of the components or systems required to be tested in section (i). Upon request by the Executive Officer, the manufacturer shall make available an engine and all test equipment (e.g., malfunction simulators, deteriorated components) necessary to duplicate the manufacturer's testing. The Executive Officer shall make the request within six months of reviewing and approving the demonstration test engine data submitted by the manufacturer for the specific engine rating.

(j) *Certification Documentation.*

(1) When submitting an application for certification of an engine, the manufacturer shall submit the following documentation. If any of the items listed below are standardized for all of a manufacturer's engines, the manufacturer may, for each model year, submit one set of documents covering the standardized items for all of its engines.

(1.1) For the required documentation not standardized across all engines, the manufacturer may propose to the Executive Officer that it be allowed to submit documentation for certification from one engine that is representative of other engines. The Executive Officer shall approve the engine as representative if the engine possesses the most stringent <u>exhaust</u> emission standards and OBD monitoring requirements and covers all of the emission control devices for the engines covered by the submitted documentation. Upon approval, this grouping shall be known as an "OBD certification documentation group".

(1.2) With Executive Officer approval, one or more of the documentation requirements of section (j) may be waived or modified if the information required would be redundant or unnecessarily burdensome to generate.

(1.3) To the extent possible, the certification documentation shall use SAE J1930 or J2403 terms, abbreviations, and acronyms.

(2) The following information shall be submitted as part of the certification application. Except as provided below for demonstration data, the Executive Officer will not issue an Executive Order certifying the covered engines without the information having been provided. The information must include:

(2.1) A description of the functional operation of the OBD system including a complete written description for each monitoring strategy that outlines every step in the decision-making process of the monitor. Algorithms, diagrams, samples of data, and/or other graphical representations of the monitoring strategy shall be included where necessary to adequately describe the information.

(2.2) A table, in the standardized format detailed in Attachment C of ARB Mail-Out #MSC 09-22~~ July 7, 2009, incorporated by reference~~.

(2.2.1) The table must include the following information for each monitored component or system (either computer-sensed or -controlled) of the emission control system:

(A) Corresponding fault code

(B) Monitoring method or procedure for malfunction detection

(C) Primary malfunction detection parameter and its type of output signal

(D) Fault criteria limits used to evaluate output signal of primary parameter

(E) Other monitored secondary parameters and conditions (in engineering units) necessary for malfunction detection

(F) Monitoring time length and frequency of checks

(G) Criteria for storing fault code

(H) Criteria for illuminating malfunction indicator light

(I) Criteria used for determining out-of-range values and input component rationality checks

(2.2.2) Wherever possible, the table shall use the following engineering units:

(A) Degrees Celsius (°C) for all temperature criteria

(B) KiloPascals (KPa) for all pressure criteria related to manifold or atmospheric pressure

(C) Grams (g) for all intake air mass criteria

(D) Pascals (Pa) for all pressure criteria related to evaporative system vapor pressure

(E) Miles per hour (mph) for all vehicle speed criteria

(F) Relative percent (%) for all relative throttle position criteria (as defined in SAE J1979/J1939)

(G) Voltage (V) for all absolute throttle position criteria (as defined in SAE J1979/J1939)

(H) <u>Milligrams per stroke (mg/stroke) for all fuel quantity-based per ignition event criteria for diesel engines, and </u>~~P~~<u>p</u>er crankshaft revolution (/rev) for all <u>other</u> changes per ignition event based criteria (e.g., <u>airflow in</u> g/rev instead of g/stroke or g/firing)<u> for gasoline and diesel engines</u>

(I) Per second (/sec) for all changes per time based criteria (e.g., g/sec)

(J) Percent of nominal tank volume (%) for all fuel tank level criteria

(2.3) A logic flowchart describing the step-by-step evaluation of the enable criteria and malfunction criteria for each monitored emission-related component or system.

(2.4) Emission test data, a description of the testing sequence (e.g., the number and types of preconditioning cycles), the data required to be collected in section (i)(4.3), and a description of the modified or deteriorated components used for fault simulation with respect to the demonstration tests specified in section (i). The Executive Officer may approve conditional certification of an engine prior to the submittal of this data for ARB review and approval. Factors to be considered by the Executive Officer in approving the late submission of information identified in section (j)(2.4) shall include the reason for the delay in the data collection, the length of time until data will be available, and the demonstrated previous success of the manufacturer in submitting the data prior to certification.

(2.5) For gasoline engines, data supporting the misfire monitor, including:

(2.5.1) The established percentage of misfire that can be tolerated without damaging the catalyst over the full range of engine speed and load conditions.

(2.5.2) Data demonstrating the probability of detection of misfire events of the misfire monitoring system over the full engine speed and load operating range <u>as detailed in ARB Mail-Out #MSC 09-22</u> for the following misfire patterns: random cylinders misfiring at the malfunction criteria established in section (f)(2.2.2), one cylinder continuously misfiring, and paired cylinders continuously misfiring.

(2.5.3) Data identifying all disablement of misfire monitoring that occurs during the FTP. For every disablement that occurs during the cycles, the data ~~should~~<u>shall</u> identify: when the disablement occurred relative to the driver's trace, the number of engine revolutions that each disablement was present for, and which disable condition documented in the certification application caused the disablement. <u>The number of 1000-revolution intervals completed and the number of 1000-revoluation intervals in which the FTP misfire threshold was exceeded shall also be identified. The data shall be submitted in the standardized format detailed in Attachment A: Misfire Disablement and Detection Chart of ARB Mail-Out #MSC 09-22.</u>

(2.5.4) Manufacturers are not required to use the durability demonstration engine to collect the misfire data for sections (j)(2.5.1) through (2.5.3).

(2.6) ~~Data supporting the limit for the time between engine starting and attaining the designated heating temperature for after-start heated catalyst systems.~~<u>For diesel engines subject to the monitoring requirements of section (e)(2.2.2), data supporting the misfire monitor, including:</u>

<u>(2.6.1) Data demonstrating the probability of detection of misfire events of the misfire monitoring system as detailed in ARB Mail-Out #MSC 09-22 over the required engine speed and load operating range for the following misfire patterns: random cylinders misfiring at the malfunction criteria specified in</u>

section (e)(2.2.2), one cylinder continuously misfiring, and paired cylinders continuously misfiring.

(2.6.2) Data identifying all disablement of misfire monitoring that occurs during the EPA Urban Dynamometer Driving Schedule for Heavy-Duty Vehicles specified in 40 CFR Part 86, Appendix I (d). For every disablement that occurs during the cycle, the data shall identify: when the disablement occurred relative to the driver's trace, the number of engine revolutions that each disablement was present for, and which disable condition documented in the certification application caused the disablement. The number of 1000-revolution intervals completed and the number of 1000-revoluation intervals in which the misfire threshold was exceeded shall also be identified. The data shall be submitted in the standardized format detailed in Attachment A: Misfire Disablement and Detection Chart of ARB Mail-Out #MSC 09-22.

(2.7) Data supporting the criteria used to detect a malfunction of the fuel system, EGR system, boost pressure control system, catalyst, NOx adsorber, PM filter, cold start emission reduction strategy, secondary air, evaporative system, VVT system, exhaust gas sensors, and other emission controls which causes emissions to exceed the applicable malfunction criteria specified in sections (e), (f), and (g). For diesel engine monitors in sections (e) and (g) that are required to indicate a malfunction before emissions exceed an emission threshold based on any applicable standard (e.g., 1.5 times any of the applicable standards), the test cycle and standard determined by the manufacturer to be the most stringent for each applicable monitor in accordance with section (d)(6.1) and the adjustment factors determined by the manufacturer for each applicable monitor in accordance with section (d)(6.2).

(2.8) 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. For input and output signals that are monitored as comprehensive components, the listing shall also identify the specific fault code for each malfunction criteria (e.g., out of range low, out of range high, open circuit, rationality low, rationality high).

(2.9) A written description of all parameters and conditions necessary to begin closed-loop/feedback control of emission control systems (e.g., fuel system, boost pressure, EGR flow, SCR reductant delivery, PM filter regeneration, fuel system pressure).

(2.10) A written identification of the communication protocol utilized by each engine for communication with an SAE J1978/J1939 scan tool.

(2.11) A pictorial representation or written description of the diagnostic connector and its location including any covers or labels.

(2.12) A written description of the method used by the manufacturer to meet the requirements of section (g)(2) for CV system monitoring including diagrams or pictures of valve and/or hose connections.

(2.13) A written description of each AECD utilized by the manufacturer including the sensor signals and/or calculated values used to invoke each AECD, the engineering data and/or analysis demonstrating the need for such an AECD, the actions taken when each AECD is activated, the expected in-use frequency of operation of each AECD, the expected emission impact from each AECD activation, and , for diesel engines, the identification of each AECD that has been determined by the manufacturer to be an EI-AECD and the assignment by the manufacturer to the data required to be tracked and reported in the standardized format specified in section (h)(6) (e.g., the AECD of "engine overheat protection as determined by coolant temperature greater than..." is an EI-AECD and is reported as EI-AECD #1 to a generic scan tool).

(2.14) A written description of each NOx and PM NTE deficiency and emission carve-out utilized by the manufacturer including the sensor signals and/or calculated values used to invoke each NTE deficiency or carve-out, the engineering data and/or analysis demonstrating the need for such an NTE deficiency or carve-out, the actions taken when each NTE deficiency or carve-out is activated, the expected in-use frequency of operation of each NTE deficiency or carve-out, and the expected emission impact from each NTE deficiency or carve-out activation.

(2.15) Build specifications provided to engine purchasers or chassis manufacturers detailing all specifications or limitations imposed on the engine purchaser relevant to OBD requirements or emission compliance (e.g., allowable MIL locations, connector location specifications, cooling system heat rejection rates). A description of the method or copies of agreements used to ensure engine purchasers or chassis manufacturers will comply with the OBD and emission relevant build specifications (e.g., signed agreements, required audit/evaluation procedures).

(2.16) A cover letter identifying all concerns and deficiencies applicable to the equivalent previous model year engine, ~~and~~ the changes and/or resolution of each concern or deficiency for the current model year engine, and all other known issues that apply to the current model year engine (e.g., concerns or deficiencies of another engine that also apply to this engine).

(2.17) A checklist of all the malfunction criteria in sections (e), (f), and (g) and the corresponding diagnostic noted by fault code for each malfunction criterion. The formats of the checklists are detailed in Attachments G and H of ARB Mail-Out #MSC 09-22, July 7, 2009, incorporated by reference.

(2.18) ~~Any other information determined by the Executive Officer to be necessary to demonstrate compliance with the requirements of this regulation.~~ A list of all components/systems required to track and report in-use performance under section (d)(3.2.1), the corresponding diagnostic(s) noted by fault code used to increment the numerator for each component/system, and a description of the incrementing specifications for the in-use monitor performance numerator and denominator for each diagnostic.

(2.19) A list of the test results required to be made available under section (g)(4.5) and the corresponding diagnostic(s) noted by fault code for each test result.

(2.20) A timeline showing the start of engine production and the start of vehicle production for the engine family, and the required deadlines for production vehicle evaluation testing of the standardized requirements (according to section (l)(1.2)) and the monitoring requirements (according to section (l)(2.1)).

~~(2.18)~~(2.2~~0~~1) Any other information determined by the Executive Officer to be necessary to demonstrate compliance with the requirements of this regulation.

(k) *Deficiencies.*

(1) The Executive Officer, upon receipt of an application from the manufacturer, may certify OBD systems installed on engines even though the systems do not comply with one or more of the requirements of title 13, CCR section 1971.1. In granting the certification, the Executive Officer shall consider the following factors: the extent to which the requirements of section 1971.1 are satisfied overall based on a review of the engine applications in question, the relative performance of the resultant OBD system compared to systems fully compliant with the requirements of section 1971.1, and a demonstrated good-faith effort on the part of the manufacturer to: (1) meet the requirements in full by evaluating and considering the best available monitoring technology; and (2) come into compliance as expeditiously as possible. The Executive Officer may not grant certification to an engine in which the reported noncompliance for which a deficiency is sought would be subject to ordered recall pursuant to section 1971.5(d)(3)(A).

(2) For 2013 and subsequent model year engines, manufacturers of OBD systems for which deficiencies have been granted are subject to fines pursuant to section 43016 of the California Health and Safety Code. The specified fines apply to: (1) the third and subsequently identified deficiency(ies), ordered according to section (k)(3), and (2) a monitoring system deficiency where a required monitoring strategy is completely absent from the OBD system.

(3) The fines for engines specified in section (k)(2) above are in the amount of $50 per deficiency per engine for non-compliance with any of the monitoring requirements specified in sections (e), (f), and (g)(4), and $25 per deficiency per engine for non-compliance with any other requirement of section 1971,1. In determining the identified order of deficiencies, deficiencies subject to a $50 fine are identified first. Total fines per engine under section (k) may not exceed $500 per engine and are payable to the State Treasurer for deposit in the Air Pollution Control Fund.

(4) Manufacturers must re-apply for Executive Officer approval of a deficiency each model year. In considering the request to carry-over a deficiency, the Executive Officer shall consider the factors identified in section (k)(1) including the manufacturer's progress towards correcting the deficiency. The Executive Officer may not allow manufacturers to carry over monitoring system deficiencies for more than two model years unless it can be demonstrated that substantial engine hardware modifications and additional lead time beyond two years would be necessary to correct the deficiency, in which case the Executive Officer shall allow the deficiency to be carried over for three model years.

(5) Except as allowed in section (k)(6), deficiencies may not be retroactively granted after certification.

(6) Request for retroactive deficiencies

(6.1) During either the first 6 months after commencement of the start of engine production or the first ~~3~~6 months after commencement of the start of vehicle production, whichever is later, 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. If the Executive Officer grants the deficiency(ies) and amends the certification, the approval would be retroactive to all affected engines within the engine family.

(6.2) Executive Officer approval of the request for a retroactive deficiency shall be granted provided that the conditions necessary for a pre-certification deficiency determination are satisfied (see section (k)(1)) and the manufacturer could not have reasonably anticipated the identified problem before commencement of production.

(6.3) In granting the amended certification, the Executive Officer shall include any approved post-production deficiencies together with all previously approved deficiencies in computing fines in accordance with section (k)(2).

(7) For 2013 through 2015 model year engines that utilize PM sensors for PM filter filtering performance monitoring (section (e)(8.2.1)), in cases where the deficiency is for a monitor required to detect malfunctions of the PM filter filtering performance (section (e)(8.2.1)), the PM sensor (section (e)(9.2.2)), or the PM sensor heater (section (e)(9.2.4)), the deficiency shall be exempt from the specified fines of section (k)(3) and the deficiency shall not be included in the count of deficiencies used in (k)(2) to determine the number of deficiencies subject to fines.

(8) For hybrid vehicles:

(8.1) For 2014 model year hybrid vehicles previously certified with deficiencies for the 2013 model year, the 2014 model year shall be considered the first model year for the deficiency with regards to the carry-over provisions in section (k)(4).

(8.2) For deficiencies related to issues with the implementation of the hybrid system or of the hybrid system itself on 2013 through 2015 model year engines, two additional deficiencies shall be exempt from the specified fines of section (k)(3) and the deficiencies shall not be included in the count of deficiencies used in (k)(2) to determine the number of deficiencies subject to fines.

~~(7)~~(9) Any OBD system installed on a production engine/vehicle that fails to conform with the certified OBD system for that engine/vehicle or otherwise fails to meet the requirements of section 1971.1 and has not been granted a deficiency pursuant to the provisions of section (k)(1) through (k)(6) are considered non-compliant. The engines/vehicles are subject to enforcement pursuant to applicable provisions of the Health and Safety Code and title 13, CCR section 1971.5.

(l) *Production Engine/Vehicle Evaluation Testing.*

(1) Verification of Standardized Requirements.

(1.1) Requirement: Manufacturers shall perform testing to verify that 2013 and subsequent model year production engines installed in vehicles meet the requirements of section (h)(3) and (h)(4) relevant to proper communication of required emission-related messages to an SAE J1978/J1939 scan tool.

(1.2) Selection of Test Vehicles:

(1.2.1) Engine manufacturers shall perform this testing every model year on ten unique production vehicles (i.e., engine rating and chassis application combination) per engine family. If there are less than ten unique production vehicles for a certain engine family, the manufacturer shall test each unique production vehicle in that engine family. Manufacturers shall perform this testing no later than either three months after the start of engine production or one month after the start of vehicle production, whichever is later. Manufacturers may request Executive Officer approval to group multiple production vehicles together and test one representative vehicle per group. The Executive Officer shall approve the request upon finding that the software and hardware designed to comply with the standardization requirements of section (h) (e.g., communication protocol message timing, number of supported data stream parameters, engine and vehicle communication network architecture) in the representative vehicle are identical to all others in the group and that any differences in the production vehicles are not relevant with respect to meeting the criteria in section (l)(1.4).

(1.2.2) For 2016 and subsequent model year engines, the Executive Officer shall reduce the maximum required number of vehicles to be tested from ten per engine family to five per engine family for a manufacturer based on the demonstrated previous success of the manufacturer to meet the requirements of section (l)(1). For purposes of this requirement, a manufacturer shall be determined to be successful in meeting the requirements of section (l)(1) if zero vehicles fail the testing required by section (l)(1) for two consecutive years.

(1.2.3) For 2019 and subsequent model year engines, the Executive Officer shall further reduce the maximum required number of vehicles to be tested to three per engine family for a manufacturer based on the demonstrated previous success of the manufacturer to meet the requirements of section (l)(1). For purposes of this requirement, a manufacturer shall be determined to be successful in meeting the requirements of section (l)(1) if zero vehicles fail the testing required by section (l)(1) for three consecutive years.

(1.2.4) The Executive Officer may waive the requirement for submittal of data from one or more of the production vehicles if data have been previously submitted for all of the production vehicles. Manufacturers may request Executive Officer approval to carry over data collected in previous model years. The Executive Officer shall approve the request upon finding that the software and hardware designed to comply with the standardization requirements of section (h) are identical to the previous model year and no other hardware or software changes that affect compliance with the standardization requirements have been made.

(1.3) Test Equipment: For the testing required in section (l)(1), manufacturers shall utilize an off-board device to conduct the testing. Prior to conducting testing, manufacturers are required to request and receive Executive Officer approval of the off-board device that the manufacturer will use to perform the testing.

(1.3.1) For vehicles using the ISO 15765-4 protocol for the standardized functions required in section (h), the Executive Officer shall approve the request upon determining that the manufacturer has submitted data, specifications, and/or engineering analysis that demonstrate that the off-board device meets the minimum requirements to conduct testing according to SAE J1699-3 using the software developed and maintained for the SAE J1699-3 committee and available through www.sourceforge.net and SAE J2534 compliant hardware configured specifically for SAE J1699-3 testing.

(1.3.2) For vehicles using the SAE J1939 protocol for the standardized functions required in section (h), the Executive Officer shall approve the request upon determining that the manufacturer has submitted data, specifications, and/or engineering analysis that demonstrate that the off-board device is able to verify that vehicles tested are able to perform all of the required functions in section (l)(1.4) with any other off-board device designed and built in accordance with the SAE J1978/J1939 generic scan tool specifications.

(1.4) Required Testing:

(1.4.1) The testing shall verify that communication can be properly established between all emission-related on-board computers and any SAE J1978/J1939 scan tool designed to adhere strictly to the communication protocols allowed in section (h)(3);

(1.4.2) The testing shall verify that all emission-related information is properly communicated between all emission-related on-board computers and any SAE J1978/J1939 scan tool in accordance with the requirements of section (h) and the applicable ISO and SAE specifications including specifications for physical layer, network layer, message structure, and message content.

(1.4.3) The testing shall further verify that the following information can be properly communicated to any SAE J1978/J1939 scan tool:

(A) The current readiness status from all on-board computers required to support readiness status in accordance with SAE J1979/J1939-73 and section (h)(4.1) in the key on, engine off position and while the engine is running;

(B) The MIL command status while the MIL is commanded off and while the MIL is commanded on in accordance with SAE J1979/J1939 and section (h)(4.2) in the key on, engine off position and while the engine is running, and in accordance with SAE J1979/J1939 and sections (d)(2.1.2) during the MIL functional check and, if applicable, (h)(4.1.~~3~~6) during the MIL readiness status check while the engine is off;

(C) All data stream parameters required in section (h)(4.2) in accordance with SAE J1979/J1939 including, if applicable, the proper identification of each data stream parameter as supported in SAE J1979 (e.g., Mode/Service $01, PID $00);

(D) The CAL ID, CVN, ESN, and VIN in accordance with SAE J1979/J1939 and sections (h)(4.6) through (4.8);

(E) An emission-related fault code (permanent, confirmed, pending, MIL-on, and previously MIL-on) in accordance with SAE J1979/J1939-73 (including correctly indicating the number of stored fault codes and MIL command status (e.g., Mode/Service $01, PID $01, Data A for SAE J1979)) and section (h)(4.4) for each diagnostic and emission critical electronic powertrain control unit;

(1.4.4) The testing shall also verify that the on-board computer(s) can properly respond to any SAE J1978/J1939 scan tool request to clear emission-related fault codes and reset readiness status in accordance with section (h)(4.10).

(1.5) Reporting of Results:

(1.5.1) The manufacturer shall submit to the Executive Officer the following, based on the results of testing:

(A) If a variant meets all the requirements of section (l)(1.4), the test results (i.e., the test log file) and a statement specifying that the variant passed all the tests, or

(B) If any variant does not meet the requirements of section (l)(1.4), a written report to the Executive Officer for approval within one month of testing the specific variant. The written report shall include the problem(s) identified and the manufacturer's proposed corrective action (if any) to remedy the problem(s). Factors to be considered by the Executive Officer in approving the proposed corrective action shall include the severity of the problem(s), the ability of the vehicle to be tested in a California inspection program (e.g., roadside inspection, fleet self-inspection program), the ability of service technicians to access the required diagnostic information, the impact on equipment and tool manufacturers, and the amount of time prior to implementation of the proposed corrective action.

(1.5.2) Upon request of the Executive Officer, a manufacturer shall submit a report of the results of any testing conducted pursuant to section (l)(1) to the Executive Officer for review.

(1.5.3) In accordance with section (k)(6), manufacturers may request Executive Officer approval for a retroactive deficiency to be granted for items identified during this testing.

(1.6) Alternative Testing Protocols. Manufacturers may request Executive Officer approval to use other testing protocols. The Executive Officer shall approve the protocol if the manufacturer can demonstrate that the alternate testing methods and equipment provide an equivalent level of verification of compliance with the standardized requirements to the requirements of section (l)(1).

(2) Verification of Monitoring Requirements.

(2.1) No later than either six months after the start of engine production or ~~three~~ six months after the start of vehicle production, whichever is later, manufacturers shall conduct a complete evaluation of the OBD system of one or more production vehicles (test vehicles) and submit the results of the evaluation to the Executive Officer.

(2.2) Selection of test vehicles:

(2.2.1) For each engine selected for monitoring system demonstration in section (j), the manufacturer shall evaluate one production vehicle equipped with an engine from the same engine family and rating as the demonstration engine. The Executive Officer shall select the specific production vehicle(s) to be tested.

(2.2.2) A manufacturer required to test more than one test vehicle may test an engine in lieu of a vehicle for all but one of the required test vehicles.

(2.2.3) The Executive Officer may waive the requirements for submittal of evaluation results from one or more of the test vehicles if data have been previously submitted for all of the engine ratings and variants.

(2.3) Evaluation requirements:

(2.3.1) The evaluation shall demonstrate the ability of the OBD system on the selected production vehicle to detect a malfunction, illuminate the MIL, and, where applicable, store an appropriate fault code readable by a scan tool conforming to SAE J1978/J1939 when a malfunction is present and the monitoring conditions have been satisfied for each individual diagnostic required by title 13, CCR section 1971.1.

(2.3.2) The evaluation shall verify that malfunctions detected by non-MIL illuminating diagnostics of components used to enable any other OBD system diagnostic (e.g., fuel level sensor) will not inhibit the ability of other OBD system diagnostics to properly detect malfunctions.

(2.3.3) The evaluation shall verify that the software used to track the numerator and denominator for purposes of determining in-use monitoring frequency correctly increments as required in section (d)(4).

(2.3.4) Malfunctions may be mechanically implanted or electronically simulated but internal on-board computer hardware or software changes may not be used to simulate malfunctions. For monitors that are required to indicate a malfunction before emissions exceed an emission threshold based on any applicable standard (e.g., 2.0 times any of the applicable standards), manufacturers are not required to use malfunctioning components/systems set exactly at their malfunction criteria limits. Emission testing to confirm that the malfunction is detected before the appropriate ~~emission standards~~ emission threshold malfunction criteria (e.g., 2.0 times the standard) are exceeded is not required.

(2.3.5) Manufacturers shall submit a proposed test plan for Executive Officer approval prior to evaluation testing being performed. The test plan shall identify the method used to induce a malfunction for each diagnostic. If the Executive Officer determines that the requirements of section (l)(2) are satisfied, the proposed test plan shall be approved.

(2.3.6) Subject to Executive Officer approval, manufacturers may omit demonstration of specific diagnostics. The Executive Officer shall approve a manufacturer's request if the demonstration cannot be reasonably performed without causing physical damage to the vehicle (e.g., on-board computer internal circuit faults) or jeopardizing the safety of personnel performing the demonstration.

(2.3.7) For evaluation of test vehicles selected in accordance with section (l)(2.2), manufacturers are not required to demonstrate diagnostics that were previously demonstrated prior to certification as required in section (i).

(2.4) Manufacturers shall submit a report of the results of all testing conducted pursuant to section (l)(2) to the Executive Officer for review. This report shall identify the method used to induce a malfunction in each diagnostic, the MIL illumination status, and the fault code(s) stored.

(2.5) In accordance with section (k)(6), manufacturers may request Executive Officer approval for a retroactive deficiency to be granted for items identified during this testing.

(3) Verification and Reporting of In-use Monitoring Performance.

(3.1) Manufacturers are required to collect and report in-use monitoring performance data representative of production vehicles (i.e., engine rating and chassis application combination). Manufacturers shall collect and report the data to ARB within twelve months after the production vehicles were first introduced into commerce.

(3.2) Manufacturers shall separate production vehicles into monitoring performance groups, as defined by sections (l)(3.2.1) and (3.2.2) below, and submit data representative of each group:

(3.2.1) Emission architecture. Engines shall be separated by emission architecture. All engines that use the same or similar emission control architecture and monitoring system shall be in the same emission architecture category.

(3.2.2) Monitoring performance group. Within an emission architecture category, engines shall be separated by vehicle application. The separate monitoring performance groups shall 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.

(3.3) Manufacturers may request Executive Officer approval to use an alternate grouping method to collect representative data. Executive Officer approval shall be granted upon determining that the proposed groupings include production vehicles using similar emission controls, OBD strategies, monitoring condition calibrations, and vehicle application driving/usage patterns such that they are expected to have similar in-use monitoring performance. If approved by the Executive Officer, the manufacturer may submit one set of data for each of the approved groupings.

(3.4) For each group, the data must include all of the in-use performance tracking data reported through SAE J1979/J1939 (i.e., all numerators, denominators, the general denominator, and the ignition cycle counter), the engine model year, the engine manufacturer, the engine family, the engine serial number, the engine HP rating (for diesels), the engine torque rating (for diesels), the date the data were collected, the odometer reading, the vehicle/chassis VIN, the monitoring performance group, and the ECM software calibration identification number and be in the standardized format detailed in Attachments D and E of ARB Mail-Out #MSC 09-22.

(3.5) Manufacturers shall submit a plan to the Executive Officer for review and approval that details the types of production vehicles in each group, the number of vehicles per group to be sampled, the sampling method, the time line to collect the data, and the reporting format. The Executive Officer shall approve the plan upon determining that it provides for effective collection of data from a sample of vehicles that, at a minimum, is fifteen vehicles per group, will likely result in the collection and submittal of data within the required time frame, will generate data that are representative of California drivers and temperatures, and does not, by design, exclude or include specific vehicles in an attempt to collect data only from vehicles with the highest in-use performance ratios.

(3.6) Upon request of the manufacturer, the Executive Officer may for good cause extend the twelve month time requirement set forth in section (l)(3.1) up to a maximum of eighteen months. In granting additional time, the Executive Officer shall consider, among other things, information submitted by the manufacturer to justify the delay, sales volume of the group(s), and the sampling mechanism utilized by the manufacturer to procure vehicles for data collection. If an extension beyond twelve months is granted, the manufacturer shall additionally be required to submit an interim report within twelve months for data collected up to the time of the interim report.

(4) Verification of In-Use Compliance

(4.1) As a condition for certification, manufacturers are required to perform compliance testing on in-use engines as specified in California Code of Regulations, title 13, section 1971.5(c).

NOTE: Authority cited: Sections 39010, 39600, 39601, 43000.5, 43013, 43016, 43018, 43100, 43101, 43104, 43105, 43105.5, ~~and~~ 43106, 43154, 43211, and 43212, Health and Safety Code. Reference: Sections 39002, 39003, 39010, 39018, 39021.5, 39024, 39024.5, 39027, 39027.3, 39028, 39029, 39031, 39032, 39032.5, 39033, 39035, 39037.05, 39037.5, 39038, 39039, 39040, 39042, 39042.5, 39046, 39047, 39053, 39054, 39058, 39059,-39060, 39515, 39600,-39601, 43000, 43000.5, 43004, 43006, 43013, 43016, 43018, 43100, 43101, 43102, 43104, 43105, 43105.5, 43106, 43150, 43151, 43152, 43153, 43154, 43155, -43156, 43204, 43211, and 43212, Health and Safety Code.

Appendix B

PROPOSED REGULATION ORDER

Amend section 1968.2, title 13, California Code of Regulations, to read as follows:

Note: The amendments that were approved by the Board at the January 23, 2012 board hearing are shown in single underline to indicate additions and ~~single strikeout~~ to indicate deletions from the existing regulatory text, while the amendments proposed during this rulemaking are shown in double underline to indicate additions and ~~double strikeout~~ to indicate deletions from the existing regulatory text. Various portions of the regulations that are not modified by the proposed amendments are omitted from the text shown and indicated by " * * * * ".

§1968.2. Malfunction and Diagnostic System Requirements -- 2004 and Subsequent Model-Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines

(a) *Purpose.*

The purpose of this regulation is to reduce motor vehicle and motor vehicle engine emissions by establishing emission standards and other requirements for onboard diagnostic systems (OBD II systems) that are installed on 2004 and subsequent model-year passenger cars, light-duty trucks, and medium-duty vehicles and engines certified for sale in California. The OBD II systems, through the use of an onboard computer(s), shall monitor emission systems in-use for the actual life of the vehicle and shall be capable of detecting malfunctions of the monitored emission systems, illuminating a malfunction indicator light (MIL) to notify the vehicle operator of detected malfunctions, and storing fault codes identifying the detected malfunctions. The use and operation of OBD systems will ensure reductions in in-use motor vehicle and motor vehicle engine emissions through improvements of emission system durability and performance.

* * * *

(c) *Definitions.*

* * * *

"Alternate phase-in" is a phase-in schedule that achieves equivalent compliance volume by the end of the last year of a scheduled phase-in provided in this regulation. The compliance volume is the number calculated by multiplying the percent of vehicles (based on the manufacturer's projected sales volume of all vehicles unless specifically stated otherwise in section (e) or (f)) meeting the new requirements per year by the number of years implemented prior to and including the last year of the scheduled phase-in and then summing these yearly results to determine a cumulative total (e.g., a three year, 30/60/100 percent scheduled phase-

in would be calculated as (30*3 years) + (60*2 years) + (100*1 year) = 310). On phase-ins scheduled to begin prior to the 2004 model year, manufacturers are allowed to include vehicles introduced before the first year of the scheduled phase-in (e.g., in the previous example, 10 percent introduced one year before the scheduled phase-in begins would be calculated as (10*4 years) and added to the cumulative total). However, on phase-ins scheduled to begin in 2004 or subsequent model years, manufacturers are only allowed to include vehicles introduced up to one model year before the first year of the scheduled phase-in. The Executive Officer shall consider acceptable any alternate phase-in that results in an equal or larger cumulative total by the end of the last year of the scheduled phase-in and ensures that all vehicles subject to the phase-in will comply with the respective requirements no later than two model years following the last year of the scheduled phase-in.

* * * *

"*Emission standard*," as it applies to OBD compliance, relates to the emission characteristics of a motor vehicle and engine and means:

(1) a numerical limit on the amount of a given pollutant that a motor vehicle or motor vehicle engine may emit into the atmosphere; or

(2) a requirement that a motor vehicle or motor vehicle engine be equipped with a certain type of pollution-control device or some other design feature related to the control of emissions.

* * * *

"*Evaporative emission standards*" are a subset of emission standards that refer to the specific motor vehicle fuel evaporative emission standards and test procedures incorporated by reference in title 13, CCR section 1976 to which a vehicle is certified.

"*Exhaust emission standards*" or "*tailpipe emission standards*" are a subset of emission standards that collectively refer to the specific FTP standards and SET standards to which a vehicle is certified.

* * * *

(d) *General Requirements.*

Section (d) sets forth the general requirements of the OBD II system. Specific performance requirements for components and systems that shall be monitored are set forth in sections (e) and (f) below.

* * * *

(3) *Monitoring Conditions.*

Section (d)(3) sets forth the general monitoring requirements while sections (e) and (f) set forth the specific monitoring requirements as well as identify which of the following general monitoring requirements in section (d)(3) are applicable for each monitored component or system identified in sections (e) and (f).

* * * *

(3.2) As specifically provided for in sections (e) and (f), manufacturers shall define monitoring conditions in accordance with the criteria in sections (d)(3.2.1) through (3.2.3). The requirements of section (d)(3.2) shall be phased in as follows: 30 percent of all 2005 model year vehicles, 60 percent of all 2006 model year vehicles, and 100 percent of all 2007 and subsequent model year vehicles. Manufacturers may use an alternate phase-in schedule in lieu of the required phase-in schedule if the alternate phase-in schedule provides for equivalent compliance volume as defined in section (c) with the exception that 100 percent of 2007 and subsequent model year vehicles shall comply with the requirements. Small volume manufacturers shall meet the requirements on 100 percent of 2007 and subsequent model year vehicles but shall not be required to meet the specific phase-in requirements for the 2005 and 2006 model years.

(3.2.1) Manufacturers shall define monitoring conditions that, in addition to meeting the criteria in section (d)(3.1), ensure that the monitor yields an in-use performance ratio (as defined in section (d)(4)) that meets or exceeds the minimum acceptable in-use monitor performance ratio on in-use vehicles. For purposes of this regulation, except as provided below in section (d)(3.2.1)(D), the minimum acceptable in-use monitor performance ratio is:

(A) 0.260 for secondary air system monitors and other cold start related monitors utilizing a denominator incremented in accordance with section (d)(4.3.2)(E);

(B) For evaporative system monitors:

(i) 0.260 for monitors designed to detect malfunctions identified in section (e)(4.2.2)(C) (i.e., 0.020 inch leak detection); and

(ii) 0.520 for monitors designed to detect malfunctions identified in section (e)(4.2.2)(A) and (B) (i.e., purge flow and 0.040 inch leak detection);

(C) 0.336 for catalyst, oxygen sensor, EGR, VVT system, and all other monitors specifically required in sections (e) and (f) to meet the monitoring condition requirements of section (d)(3.2);

(D) For ~~introductory~~ interim years:

(i) through the 2007 model year, for the first three years a vehicle is certified to the in-use performance ratio monitoring requirements of section (d)(3.2), 0.100 for all monitors specified in section (d)(3.2.1)(A) through (C) above. For example, the 0.100 ratio shall apply to the 2004, 2005, and 2006 model years for vehicles first certified in the 2004 model year and to the 2007, 2008, and 2009 model years for vehicles first certified in the 2007 model year~~.~~;

(ii) through the 2014 model year, for fuel system air-fuel ratio cylinder imbalance monitors, 0.100;

(iii) through the 2011 model year, for secondary exhaust gas sensor monitors specified in (e)(7.2.2)(C), 0.100;

(iv) through the 2012 model year, for vehicles subject to the monitoring requirements of section (f), 0.100 for all monitors specified in section (d)(3.2.1)(C) above~~.~~;

(v) through the 2016 model year for plug-in hybrid electric vehicles, 0.100

for all monitors specifically required in sections (e) and (f) to meet the monitoring condition requirements of section (d)(3.2) and that are for systems or components that require engine operation~~.~~;

(vi) for 2016 through 2018 model year medium-duty vehicles certified to an engine dynamometer tailpipe emission standard, 0.100 for diesel PM filter filtering performance monitors (section (f)(9.2.1)) and missing substrate monitors (section (f)(9.2.5)) not using the denominator criteria in section(d)(4.3.2)(G).

* * * *

(4) *In-Use Monitor Performance Ratio Definition.*

* * * *

(4.3) Denominator Specifications

* * * *

(4.3.2) Specifications for incrementing:

* * * *

(F) In addition to the requirements of section (d)(4.3.2)(B) above, the denominator(s) for the following monitors of ~~output~~ components (except those operated only at engine start-up and subject to the requirements of the previous section (d)(4.3.2)(E)) shall be incremented if and only if the component is commanded to function (e.g., commanded "on", "open", "closed", "locked", etc.) on two or more occasions for greater than two seconds during the driving cycle or for a cumulative time greater than or equal to ten seconds, whichever occurs first:

(i) Air conditioning system (section (e)(12))

(ii) Variable valve timing and/or control system (sections (e)(13) and (f)(13))

(iii) "Other emission control or source device" (sections (e)(16) and (f)(16))

(iv) Comprehensive component output component (sections (e)(15) and (f)(15)) (e.g., turbocharger waste-gates, variable length manifold runners, torque converter clutch lock-up solenoids, etc.)

(v) PM sensor heater (section (f)(5.2.4)(A))

(vi) PM filter active/intrusive injection (section (f)(9.2.6))

For the PM sensor heater monitor, as an alternative for 2013 through 2015 model year vehicles, the manufacturer may use the criteria in section (d)(4.3.2)(B) in lieu of the criteria specified in section (d)(4.3.2)(F) above. For the PM filter active/intrusive injection monitor, as an alternative for 2013 through 2015 model year vehicles, the manufacturer may use the criteria in section (d)(4.3.2)(I) in lieu of the criteria specified in section (d)(4.3.2)(F) above.

(G) For the following monitors, the denominator(s) shall be incremented by one during a driving cycle in which the following two criteria are met: (1) the requirements of section (d)(4.3.2)(B) have been met on at least one driving cycle since the denominator was last incremented, and (2) the number of cumulative miles of vehicle operation since the denominator was last incremented is greater than or equal to 500 miles:

(i) Diesel NMHC converting catalyst (section (f)(1.2.2))

(ii) Diesel NMHC converting catalyst other aftertreatment assistance functions (sections (f)(1.2.3)(B) and (f)(1.2.3)(D))

(iii) Diesel PM filter NMHC conversion (sections ~~(f)(9.2.1),~~ (f)(9.2.4)~~, and (f)(9.2.5)~~)

(iv) Diesel PM filter filtering performance and missing substrate (sections (f)(9.2.1) and (f)(9.2.5)) for passenger cars, light-duty trucks, and MDPVs certified to a chassis dynamometer tailpipe emission standard

(v) Diesel PM filter filtering performance and missing substrate (sections (f)(9.2.1) and (f)(9.2.5)) for 2004 through 2015 model year medium-duty vehicles certified to an engine dynamometer tailpipe emission standard

* * * *

(I) For 2013 and subsequent model year vehicles, in addition to the requirements of section (d)(4.3.2)(B) above, the denominator(s) for the following monitors shall be incremented if and only if a regeneration event is commanded for a time greater than or equal to ten seconds:

(i) Diesel NMHC converting catalyst other aftertreatment assistance functions (sections (f)(1.2.3)(A) and (f)(1.2.3)(C))

(ii) PM filter incomplete regeneration (section (f)(9.2.3))

~~(iii) PM filter active/intrusive injection (section (f)(9.2.6))~~

* * * *

(e) *Monitoring Requirements for Gasoline/Spark-Ignited Engines.*

* * * *

(6) Fuel System Monitoring

(6.1) Requirement:

(6.1.1) The OBD II system shall monitor the fuel delivery system to determine its ability to provide compliance with ~~emission~~ applicable standards.

* * * *

(f) *Monitoring Requirements for Diesel/Compression-Ignition Engines.*

(1) Non-Methane Hydrocarbon (NMHC) Converting Catalyst Monitoring

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(1.2) Malfunction Criteria:

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(1.2.3) Other Aftertreatment Assistance Functions. Additionally, for 2010 and subsequent model year vehicles, the catalyst(s) shall be monitored for other aftertreatment assistance functions:

* * * *

(B) For 201~~0~~5 and subsequent model year passenger cars, light-duty trucks, and MDPVs certified to a chassis dynamometer tailpipe emission standard and 201~~3~~5 and subsequent model year medium-duty vehicles (including MDPVs) certified to an engine dynamometer tailpipe emission standard, for catalysts used to generate a feedgas constituency to assist SCR systems (e.g., to increase NO_2 concentration upstream of an SCR system), the OBD II system shall detect a malfunction when the catalyst is unable to generate the necessary feedgas constituents for proper SCR system operation. Catalysts are exempt from feedgas generation monitoring if no malfunction of the catalyst's feedgas generation ability can cause emissions to (1) increase by 15 percent or more of the applicable full useful life standard as measured from an applicable emission test cycle; or (2) exceed the applicable full useful life standard as measured from an applicable emission test cycle.

* * * *

(2) *Oxides of Nitrogen (NOx) Converting Catalyst Monitoring*

* * * *

(2.2) Malfunction Criteria:

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(2.2.2) Conversion Efficiency:

(A) The OBD II system shall detect a NOx catalyst malfunction when the catalyst conversion capability decreases to the point that NOx or NMHC emissions exceed:

* * * *

(ii) For medium-duty vehicles (including MDPVs) certified to an engine dynamometer tailpipe emission standard:

a. the applicable NOx standard by more than 0.5 g/bhp-hr (e.g., cause NOx emissions to exceed 0.7 g/bhp-hr if the emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test or 3.5 times the applicable NMHC standard for 2007 through 2009 model year vehicles;

b. the applicable NOx standard by more than 0.4 g/bhp-hr (e.g., cause NOx emissions to exceed 0.6 g/bhp-hr if the emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test or 2.5 times the applicable NMHC standard for 2010 through 2012 model year vehicles; ~~and~~

c. the applicable NOx standard by more than 0.3 g/bhp-hr (e.g., cause NOx emissions to exceed 0.5 g/bhp-hr if the emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test or 2.0 times the applicable NMHC standard for 2013 through 2015 model year vehicles; and

~~c~~d. the applicable NOx standard by more than 0.2 g/bhp-hr (e.g., cause NOx emissions to exceed 0.4 g/bhp-hr if the emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test or 2.0 times the applicable NMHC standard for ~~2013~~ 2016 and subsequent model year vehicles.

* * * *

(3) *Misfire Monitoring*

* * * *

(3.1) Requirement:

(3.1.1) The OBD II system shall monitor the engine for misfire ~~causing excess emissions~~. The OBD II system shall be capable of detecting misfire occurring in one or more cylinders. To the extent possible without adding hardware for this specific purpose, the OBD II system shall also identify the specific misfiring cylinder.

* * * *

(3.2) Malfunction Criteria:

(3.2.1) The OBD II system shall detect a misfire malfunction when one or more cylinders are continuously misfiring.

(3.2.2) Additionally, for 2010 and subsequent model year ~~vehicles~~ passenger cars, light-duty trucks, and MDPVs certified to a chassis dynamometer tailpipe emission standard and 2010 through 2015 model year medium-duty vehicles equipped with sensors that can detect combustion or combustion quality (e.g., for use in homogeneous charge compression ignition (HCCI) control systems), and for 20 percent of 2016 model year, 50 percent of 2017 model year, and 100 percent of 2018 model year medium-duty vehicles (percentage based on the manufacturer's projected California sales volume for all medium-duty diesel vehicles):

(A) The OBD II system shall detect a misfire malfunction ~~that would cause a vehicle's NMHC, CO, NOx, or PM emissions to exceed~~ as follows:

(i) For passenger cars, light-duty trucks, and MDPVs certified to a chassis dynamometer tailpipe emission standard, the OBD II system shall detect a misfire malfunction that would cause a vehicle's NMHC, CO, NOx, or PM emissions to exceed 1.5 times any of the applicable FTP standards.

(ii) For medium-duty vehicles (including MDPVs) certified to an engine dynamometer tailpipe emission standard, the OBD II system shall detect a misfire malfunction when the percentage of misfire is equal to or exceeds five percent ~~2.0 times any of the applicable NMHC, CO, and NOx standards or 0.03 g/bhp-hr PM as measured from an applicable cycle emission test~~.

(B) The manufacturers shall evaluate the percentage of misfire as follows:

(i) For passenger cars, light-duty trucks, and MDPVs certified to a chassis dynamometer tailpipe emission standard, ~~M~~manufacturers shall determine the percentage of misfire evaluated in 1000 revolution increments that would cause NMHC, CO, NOx, or PM emissions from an emission durability demonstration vehicle to exceed the levels specified in section (f)(3.2.2)(A) if the percentage of misfire were present from the beginning of the test. To establish this percentage of misfire, the manufacturer shall utilize misfire events occurring at equally spaced, complete engine cycle intervals, across randomly selected cylinders throughout each 1000-revolution increment. If this percentage of misfire is determined to be lower than one percent, the manufacturer may set the malfunction criteria at one percent.

(ii) For medium-duty vehicles (including MDPVs) certified to an engine dynamometer tailpipe emission standard, the manufacturer shall evaluate the percentage of misfire in 1000 revolution increments.

(C) Subject to Executive Officer approval, a manufacturer may employ other revolution increments. The Executive Officer shall grant approval upon determining that the manufacturer has demonstrated that the strategy would be equally effective and timely in detecting misfire.

(3.2.3) A malfunction shall be detected if the percentage of misfire established in section (f)(3.2.2)~~(B)~~ is exceeded regardless of the pattern of misfire events (e.g., random, equally spaced, continuous).

(3.2.4) For multiple cylinder misfire situations that result in a misfire rate greater than or equal to 50 percent of all engine firings, the OBD II system shall only be required to detect a misfire malfunction for situations that are caused by a single component failure.

(3.2.5) Upon request by the manufacturer and upon determining that the manufacturer has submitted data and/or engineering evaluation which support the request, the Executive Officer shall revise the percentage of misfire malfunction criteria in section (f)(3.2.2)(A)(ii) upward to exclude detection of misfire that cannot cause the vehicle's NMHC, CO, and NOx emissions to exceed 2.0 times the applicable standards and the vehicle's PM emissions to exceed 0.03 g/bhp-hr as measured from an applicable cycle emission test.

* * * *

(3.3) Monitoring Conditions:

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(3.3.1) Except as provided in section (f)(3.3.2), ~~T~~the OBD II system shall monitor for misfires identified in section (f)(3.2.1) during engine idle conditions at least once per driving cycle in which the monitoring conditions for misfire are met. A manufacturer shall submit monitoring conditions to the Executive Officer for approval. The Executive Officer shall approve manufacturer-defined monitoring conditions that are determined (based on manufacturer-submitted data and/or other engineering documentation) to: (i) be technically necessary to ensure robust detection of malfunctions (e.g., avoid false passes and false detection of malfunctions), (ii) require no more than 1000 cumulative engine revolutions, and (iii) do not require any single continuous idle operation of more than 15 seconds to make a determination that a malfunction is present (e.g., a decision can be made with data gathered during several idle operations of 15 seconds or less); or satisfy the requirements of (d)(3.1) with alternative engine operating conditions.

(3.3.2) Manufacturers may request Executive Officer approval to use alternate monitoring conditions (e.g., off-idle) in lieu of the monitoring conditions specified in section (f)(3.3.1). The Executive Officer shall approve alternate monitoring conditions that are determined (based on manufacturer-submitted data and/or other engineering documentation) to ensure equivalent robust detection of malfunctions and equivalent timeliness in detection of malfunctions.

(3.3.3) ~~Additionally, f~~For misfires identified in section (f)(3.2.2) ~~2010 and subsequent model year vehicles subject to (f)(3.2.2)~~, the OBD II system shall monitor for misfire as follows:

(A) For passenger cars, light-duty trucks, and MDPVs certified to a chassis dynamometer tailpipe emission standard, ~~T~~the OBD II system shall continuously monitor for misfire under all positive torque engine speeds and load conditions.

(B) For medium-duty vehicles (including MDPVs) certified to an engine dynamometer tailpipe emission standard, the OBD II system shall continuously monitor for misfire under the following conditions:

(i) For 2010 through 2018 model year vehicles and 2019 and subsequent model year vehicles that are not included in the phase-in specified in section (f)(3.3.3)(B)(ii), under positive torque conditions with engine speed up to 75 percent of the maximum-rated engine speed and engine load up to 75 percent maximum-rated load except within the following range: the engine operating region bound by the positive torque line (i.e., engine load with transmission in neutral) and the two following engine-operating points: engine speed of 50 percent of maximum-rated engine speed with the engine load at the positive torque line, and 75 percent of the maximum-rated engine speed with the engine load 5 percent above the positive torque line.

(ii) For 20 percent of 2019 model year, 50 percent of 2020 model year, and 100 percent of 2021 model year medium-duty vehicles (percentage based on the manufacturer's projected California sales volume for all medium-duty diesel vehicles), under all positive torque engine speed and load conditions.

~~(B)~~(C) If a monitoring system cannot detect all misfire patterns under all required engine speed and load conditions as required in sections (f)(3.3.3)(A) and (B), the manufacturer may request Executive Officer approval to accept the monitoring system. In evaluating the manufacturer's request, the Executive Officer shall consider the following factors: the magnitude of the region(s) in which misfire detection is limited, the degree to which misfire detection is limited in the region(s) (i.e., the probability of detection of misfire events), the frequency with which said region(s) are expected to be encountered in-use, the type of misfire patterns for which misfire detection is troublesome, ~~and~~ demonstration that the monitoring technology employed is not inherently incapable of detecting misfire under required conditions (i.e., compliance can be achieved on other engines)<u>, and the extent to which the most reliable monitoring method developed is unable to ensure robust detection of misfire in the region(s)</u>. The evaluation shall be based on the following misfire patterns: equally spaced misfire occurring on randomly selected cylinders, single cylinder continuous misfire, and paired cylinder (cylinders firing at the same crank angle) continuous misfire.

(3.4) MIL Illumination and Fault Code Storage:

(3.4.1) General requirements for MIL illumination and fault code storage are set forth in section (d)(2).

(3.4.2) Additionally, for 2010 and subsequent model year vehicles subject to (f)(3.2.2):

(A) Upon detection of the percentage of misfire specified in section (f)(3.2.2)~~(B)~~, the following criteria shall apply for MIL illumination and fault code storage:

(i) A pending fault code shall be stored no later than after the fourth exceedance of the percentage of misfire specified in section (f)(3.2.2)~~(B)~~ during a single driving cycle.

(ii) If a pending fault code is stored, the OBD II system shall illuminate the MIL and store a confirmed fault code within 10 seconds if the percentage of misfire specified in section (f)(3.2.2)~~(B)~~ is again exceeded four times during: (a) the driving cycle immediately following the storage of the pending fault code, regardless of the conditions encountered during the driving cycle; or (b) on the next driving cycle in which similar conditions (see section (c)) to the engine conditions that occurred when the pending fault code was stored are encountered.

(iii) The pending fault code may be erased at the end of the next driving cycle in which similar conditions to the engine conditions that occurred when the pending fault code was stored have been encountered without an exceedance of the specified percentage of misfire. The pending code may also be erased if similar conditions are not encountered during the next 80 driving cycles immediately following initial detection of the malfunction.

* * * *

(4) *Fuel System Monitoring*

(4.1) Requirement:

The OBD II system shall monitor the fuel delivery system to determine its ability to comply with ~~emission~~ applicable standards. The individual electronic components (e.g., actuators, valves, sensors, pumps) that are used in the fuel system and not specifically addressed in this section shall be monitored in accordance with the comprehensive component requirements in section (f)(15).

* * * *

(5) *Exhaust Gas Sensor Monitoring*

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(5.2) Malfunction Criteria:

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(5.2.2) NOx and PM sensors:

(A) Sensor performance faults: The OBD II system shall detect a malfunction prior to any failure or deterioration of the sensor voltage, resistance, impedance, current, response rate, amplitude, offset, or other characteristic(s) that would cause a vehicle's emissions to exceed:

* * * *

(ii) For medium-duty vehicles (including MDPVs) certified to an engine dynamometer tailpipe emission standard:

a. 2.5 times the applicable NMHC standards, the applicable NOx standard by more than 0.5 g/bhp-hr (e.g., cause NOx emissions to exceed 0.7 g/bhp-hr if the emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test or 0.05 g/bhp-hr PM as measured from an applicable cycle emission test for 2007 through 2009 model year vehicles;

b. 2.5 times the applicable NMHC standards, the applicable NOx standard by more than 0.4 g/bhp-hr (e.g., cause NOx emissions to exceed 0.6 g/bhp-hr if the emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test or 0.05 g/bhp-hr PM as measured from an applicable cycle emission test for 2010 through 2012 model year vehicles; ~~and~~

c. 2.0 times the applicable NMHC standard, the applicable NOx standard by more than 0.3 g/bhp-hr (e.g., cause NOx emissions to exceed 0.5 g/bhp-hr if the emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test, or 0.03 g/bhp-hr PM as measured from an applicable cycle emission test for 2013 through 2015 model year vehicles; and

~~c~~d. 2.0 times the applicable NMHC standards, the applicable NOx standard by more than 0.2 g/bhp-hr (e.g., cause NOx emissions to exceed 0.4 g/bhp-hr if the emission standard is 0.2 g/bhp-hr) as measured from an applicable cycle emission test or 0.03 g/bhp-hr

PM as measured from an applicable cycle emission test for ~~2013~~ 2016 and subsequent model year vehicles.

* * * *

(5.3) Monitoring Conditions:

(5.3.1) Exhaust Gas Sensors

(A) Manufacturers shall define the monitoring conditions for malfunctions identified in sections (f)(5.2.1)(A)(i), (5.2.1)(B)(i), ~~and~~ (5.2.2)(A), and (5.2.2)(D) (e.g., sensor performance faults) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements). For all 2010 and subsequent model year vehicles, for purposes of tracking and reporting as required in section (d)(3.2.2), all monitors used to detect malfunctions identified in sections (f)(5.2.1)(A)(i), (5.2.1)(B)(i), ~~and~~ (5.2.2)(A), and for 2016 and subsequent model year medium-duty vehicles certified to an engine dynamometer tailpipe emission standard, section (f)(5.2.2)(D) shall be tracked separately but reported as a single set of values as specified in section (d)(5.2.2).

(B) Manufacturers shall define the monitoring conditions for malfunctions identified in sections (f)(5.2.1)(A)(iv)~~,~~ and (5.2.1)(B)(iv)~~, and (5.2.2)(D)~~ (e.g., monitoring capability) in accordance with sections (d)(3.1) and (d)(3.2) (i.e., minimum ratio requirements) with the exception that monitoring shall occur every time the monitoring conditions are met during the driving cycle in lieu of once per driving cycle as required in section (d)(3.1.2).

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(9) *Particulate Matter (PM) Filter Monitoring*

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(9.2) Malfunction Criteria:

(9.2.1) Filtering Performance:

(A) The OBD II system shall detect a malfunction prior to a decrease in the filtering capability of the PM filter that would cause a vehicle's PM emissions to exceed:

* * * *

(ii) For medium-duty vehicles (including MDPVs) certified to an engine dynamometer tailpipe emission standard:

a. 0.09 g/bhp-hr PM as measured from an applicable cycle emission test for 2004 through 2009 model year vehicles;

b. 0.07 g/bhp-hr PM as measured from an applicable cycle emission test for 2010 through 2012 model year vehicles; and

c. 0.03 g/bhp-hr PM as measured from an applicable cycle emission test for 2013 and subsequent model year vehicles.

(iii) For 2014 through 2015 model year medium-duty vehicles (including MDPVs) certified to an engine dynamometer tailpipe emission standard, the manufacturer shall use the malfunction criteria in section (f)(9.2.1)(A)(ii)c. above without using the provisions of section (f)(17.1) to exclude specific failure modes on vehicles under one of the following two options below:

a. At least 20 percent of 2014 model year vehicles and at least 20 percent of 2015 model year vehicles (percentage based on the manufacturer's projected California sales volume for all medium-duty diesel vehicles), or
b. At least 50 percent of 2015 model year vehicles (percentage based on the manufacturer's projected California sales volume for all medium-duty diesel vehicles).

(iv) For the phase-in schedules described in section (f)(9.2.1)(A)(iii) above, the manufacturer may not use an alternate phase-in schedule as defined in section (c) in lieu of the required phase-in schedules.

* * * *

(9.2.4) NMHC conversion: For 201~~0~~5 and subsequent model year passenger cars, light-duty trucks, and MDPVs certified to a chassis dynamometer tailpipe emission standard and 201~~3~~5 and subsequent model year medium-duty vehicles (including MDPVs) certified to an engine dynamometer tailpipe emission standard with catalyzed PM filters that convert NMHC emissions, the OBD II system shall monitor the catalyst function of the PM filter and detect a malfunction when the NMHC conversion capability decreases to the point that NMHC emissions exceed the applicable emission levels specified in section (f)(9.2.2)(A). If no failure or deterioration of the NMHC conversion capability could result in a vehicle's NMHC emissions exceeding these emission levels, the OBD II system shall detect a malfunction when the system has no detectable amount of NMHC conversion capability. PM filters are exempt from NMHC conversion capability monitoring if no malfunction of the PM filter's NMHC conversion capability can cause emissions to (1) increase by 15 percent or more of the applicable full useful life standard as measured from an applicable emission test cycle; or (2) exceed the applicable full useful life standard as measured from an applicable emission test cycle.

* * * *

(15) Comprehensive Component Monitoring

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(15.2) Malfunction Criteria:

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(15.2.2) Output Components/Systems:

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(F) For ~~2013~~2015 and subsequent model year vehicles that utilize fuel control system components (e.g., injectors, fuel pump) that have tolerance compensation features implemented in hardware or software during production or repair procedures (e.g., individually coded injectors for flow characteristics that are programmed into an electronic control unit to compensate for injector to injector tolerances, fuel pumps that use in-line resistors to correct for differences in fuel pump volume output), the components shall be monitored to ensure the proper compensation is being used.

(i) The system shall detect a fault if the compensation being used by the control system does not match the compensation designated for the installed component (e.g., the flow characteristic coding designated on a specific injector does not match the compensation being used by the fuel control system for that injector). If a manufacturer demonstrates that a single component (e.g., injector) using the wrong compensation cannot cause a measurable increase in emissions during any reasonable driving condition, the manufacturer shall detect a malfunction for the minimum number of components using the wrong compensation needed to cause an emission increase. Further, the stored fault code shall identify the specific component that does not match the compensation.

(ii) Monitoring of the fuel control system components under section (f)(15.2.2)(F)(i) is not required if the manufacturer demonstrates that no fault of the components' tolerance compensation features (e.g., wrong compensation being used) could cause emissions to (1) increase by 15 percent or more of the applicable full useful life standard as measured from an applicable emission test cycle; or (2) exceed the applicable full useful life standard as measured from an applicable emission test cycle. For purposes of determining if the emission criteria above are met, the manufacturers shall request Executive Officer approval of the test plan for which the emission impact will be determined. The test plan shall include the combination of failed components and the degree of mismatch (e.g., wrong compensation) used as well as the test procedure and emission test cycles used to demonstrate the emission impact, including the necessary preconditioning cycles used by the system to correct or adapt for any mismatch and mitigate the emission impact. Executive Officer approval shall be granted upon determining that the manufacturer has submitted data and/or engineering analysis that demonstrate that the conditions necessary for the system to correct or adapt will readily occur in a timely manner during in-use operation and that the test conditions represent worst case emissions from typical in-use service actions when considering the distribution and variance of the compensation values and parts (e.g., replacement of one or more plus-one-sigma injectors with minus-one-sigma injectors without updating of the compensation value).

* * * *

(17) *Exceptions to Monitoring Requirements*

(17.1) Except as provided in sections (f)(17.1.1) through (17.1.4) below, upon request of a manufacturer or upon the best engineering judgment of ARB, the Executive Officer may revise the emission threshold for a malfunction on any diagnostic required in section (f) for medium-duty vehicles if the most reliable monitoring method developed requires a higher threshold to prevent ~~significant errors of commission in detecting~~ false indications of a malfunction. Additionally, except as specified in section (f)(9.2.1)(A)(iii), for 2007 through ~~2009~~2013 model year light-duty vehicles and 2007 through ~~2012~~~~2013~~ 2015 model year medium-duty vehicles, the Executive Officer may revise the PM filter malfunction criteria of section (f)(9.2.1) to exclude detection of specific failure modes (e.g., combined failure of partially melted and partially cracked substrates) if the most reliable monitoring method developed requires the exclusion of specific failure modes to prevent ~~significant errors of commission in detecting~~ false indications of a malfunction.

* * * *

(17.1.5) For 2004 through 2015 model year medium-duty diesel vehicles (except MDPVs) certified to a chassis dynamometer tailpipe emission standard, the monitoring requirements and malfunction criteria in section (f) applicable to medium-duty diesel vehicles certified to an engine dynamometer tailpipe emission standard shall apply. However, the manufacturer shall request Executive Officer approval of manufacturer-proposed medium-duty chassis dynamometer-based malfunction criteria in lieu of the engine dynamometer-based malfunction criteria required for each monitor in section (f). The Executive Officer shall approve the request upon finding that:

(A) the manufacturer has used good engineering judgment in determining the malfunction criteria,

(B) the malfunction criteria will provide for similar timeliness in detection of malfunctioning components with respect to detection of malfunctions on medium-duty diesel vehicles certified to an engine dynamometer tailpipe emission standard,

(C) the malfunction criteria are set as stringently as technologically feasible with respect to indicating a malfunction at the lowest possible tailpipe emission levels (but not lower than 1.5 times the chassis dynamometer tailpipe emission standard the vehicle is certified to), considering the best available monitoring technology to the extent that it is known or should have been known to the manufacturer,

(D) the malfunction criteria will prevent detection of a malfunction when the monitored component is within the performance specifications for components aged to the end of the full useful life, and

(E) the manufacturer has provided emission data showing the emission levels at which the malfunctions are detected.

(17.1.6) For 2016 and subsequent model year medium-duty diesel vehicles (except MDPVs) certified to a chassis dynamometer tailpipe emission standard, the following monitoring requirements and malfunction criteria shall apply:

(A) Except as provided for in sections (f)(17.1.6)(B) and (C) below, the monitoring requirements and malfunction criteria in section (f) applicable to passenger cars, light-duty trucks, and MDPVs certified to a chassis dynamometer tailpipe emission standard shall apply.

(B) For NMHC catalyst conversion efficiency monitoring (section (f)(1.2.2)), the manufacturer shall detect an NMHC catalyst malfunction when the catalyst conversion capability decreases to the point that emissions exceed 1.75 times the applicable FTP NMHC or NOx standards.

(C) For misfire monitoring (section (f)(3)), the manufacturer shall use the monitoring requirements and malfunction criteria applicable to medium-duty vehicles certified to an engine dynamometer tailpipe emission standard.

* * * *

(17.2) Whenever the requirements in section (f) of this regulation require a manufacturer to meet a specific phase-in schedule:

(17.2.1) The phase-in percentages shall be based on the manufacturer's projected sales volume for all vehicles subject to the requirements of title 13, CCR section 1968.2 unless specifically stated otherwise in section (f).

(17.2.2) Manufacturers may use an alternate phase-in schedule in lieu of the required phase-in schedule if the alternate phase-in schedule provides for equivalent compliance volume as defined in section (c) except as specifically noted for the phase-in ~~of~~ for in-use monitor performance ratio monitoring conditions in section (d)(3.2) and the PM filter monitor in section (f)(9.2.1)(A).

(17.2.3) Small volume manufacturers may use an alternate phase-in schedule in accordance with section (f)(17.2.2) in lieu of the required phase-in schedule or may use a different schedule as follows:

(A) For the diesel PM filter monitor phase-in schedule in section (f)(9.2.1)(A)(iii), the manufacturer may use the malfunction criteria in section (f)(9.2.1)(A)(ii)c. for all 2014 and 2015 model year medium-duty vehicles in lieu of the malfunction criteria and required phase-in schedule in section (f)(9.2.1)(A)(iii).

(B) For phase-in schedules not listed in section (f)(17.2.3)(A) above, the manufacturer may meet the requirement on all vehicles by the final year of the phase-in in lieu of meeting the specific phase-in requirements for each model year.

* * * *

(h) *Monitoring System Demonstration Requirements For Certification*

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(4) *Required Testing for Diesel/Compression-ignition vehicles:*
Except as provided below, the manufacturer shall perform single-fault testing based on the applicable test with the following components/systems set at their malfunction criteria limits as determined by the manufacturer for meeting the requirements of section (f).

* * * *

(4.3) Misfire Monitoring: For 2010 and subsequent model year vehicles subject to section (f)(3.2.2)<u>(A)(i)</u>, the manufacturer shall perform a test at the malfunction criteria limit specified in section (f)(3.2.2). A misfire monitor demonstration test is not required for vehicles not subject to section (f)(3.2.2)<u>(A)(i)</u>.

* * * *

(i) *Certification Documentation*

(1) When submitting an application for certification of a test group, the manufacturer shall submit the following documentation. If any of the items listed below are standardized for all of a manufacturer's test groups, the manufacturer may, for each model year, submit one set of documents covering the standardized items for all of its test groups.

(1.1) For the required documentation not standardized across all test groups, the manufacturer may propose to the Executive Officer that documentation covering a specified combination of test groups be used. These combinations shall be known as "OBD II groups". Executive Officer approval shall be granted for those groupings that include test groups using the same OBD II strategies and similar calibrations. If approved by the Executive Officer, the manufacturer may submit one set of documentation from one or more representative test group(s) that are a part of the OBD II group. The Executive Officer shall determine whether a selected test group(s) is representative of the OBD II group as a whole. To be approved as representative, the test group(s) must possess the most stringent <u>exhaust</u> emission standards and OBD II monitoring requirements and cover all of the emission control devices within the OBD II group.

* * * *

(2) The following information shall be submitted as "Part 1" of the certification application. Except as provided below for demonstration data, the Executive Officer will not issue an Executive Order certifying the covered vehicles without the information having been provided. The information must include:

* * * *

<u>(2.5) Data supporting the misfire monitor:</u>

~~(2.5)~~(2.5.1) For gasoline vehicles, data supporting the misfire monitor~~,~~ shall includ~~ing~~e:

(A) The established percentage of misfire that can be tolerated without damaging the catalyst over the full range of engine speed and load conditions.

(B) Data demonstrating the probability of detection of misfire events of the misfire monitoring system over the full engine speed and load operating range for the following misfire patterns: random cylinders misfiring at the malfunction criteria established in section (e)(3.2.2), one cylinder continuously misfiring, and paired cylinders continuously misfiring.

(C) Data identifying all disablement of misfire monitoring that occurs during the FTP and US06 cycles. For every disablement that occurs during the cycles, the data should identify: when the disablement occurred relative to the driver's trace, the number of engine revolutions that each disablement was present for, and which disable condition documented in the certification application caused the disablement. The data shall be submitted in the standardized format detailed in Attachment A: Misfire Disablement and Detection Chart of ARB Mail-Out #06-23, December 21, 2006, incorporated by reference.

(D) Manufacturers are not required to use the durability demonstration vehicle to collect the misfire data for sections (i)(2.5.1)(A) though (~~2.5.3~~C).

(2.5.2) For diesel medium-duty vehicles subject to the monitoring requirements of section (f)(3.2.2), data supporting the misfire monitor shall include:

(A) Data demonstrating the probability of detection of misfire events of the misfire monitoring system over the required engine speed and load operating range for the following misfire patterns: random cylinders misfiring at the malfunction criteria established in section (f)(3.2.2), one cylinder continuously misfiring, and paired cylinders continuously misfiring.

(B) Data identifying all disablement of misfire monitoring that occurs during the chassis dynamometer FTP and Unified cycles. For every disablement that occurs during the cycles, the data shall identify: when the disablement occurred relative to the driver's trace, the number of engine revolutions that each disablement was present for, and which disable condition documented in the certification application caused the disablement. The number of 1000-revolution intervals completed and the number of 1000-revoluation intervals in which the misfire threshold was exceeded shall also be identified. The data shall be submitted in the standardized format detailed in Attachment A: Misfire Disablement and Detection Chart of ARB Mail-Out #06-23.

* * * *

(j) *Production Vehicle Evaluation Testing.*

* * * *

(2) *Verification of Monitoring Requirements.*

* * * *

(2.3) Evaluation requirements:

* * * *

(2.3.4) Malfunctions may be mechanically implanted or electronically simulated but internal on-board computer hardware or software changes may not be used to simulate malfunctions. Emission testing to confirm that the malfunction is detected before the appropriate ~~emission standards are~~ malfunction threshold (e.g., 1.5 times the applicable standards) is exceeded is not required.

* * * *

NOTE: Authority cited: Sections 39010, 39600, 39601, 43000.5, 43013, 43016, 43018, 43100, 43101, 43104, 43105, 43105.5, and 43106, Health and Safety Code. Reference: Sections 39002, 39003, 39010, 39018, 39021.5, 39024, 39024.5, 39027, 39027.3, 39028, 39029, 39031, 39032, 39032.5, 39033, 39035, 39037.05, 39037.5, 39038, 39039, 39040, 39042, 39042.5, 39046, 39047, 39053, 39054, 39058, 39059, 39060, 39515, 39600, 39601, 43000, 43000.5, 43004, 43006, 43013, 43016, 43018, 43100, 43101, 43102, 43104, 43105, 43105.5, 43106, 43150, 43151, 43152, 43153, 43154, 43155, 43156, 43204, 43211, and 43212, Health and Safety Code.

Appendix C

PROPOSED REGULATION ORDER

Amend section 1971.5, title 13, California Code of Regulations, to read as follows:

Note: The proposed amendments are shown in underline to indicate additions and ~~strikeout~~ to indicate deletions from the existing regulatory text. Various portions of the regulations that are not modified by the proposed amendments are omitted from the text shown and indicated by " * * * * ".

§ 1971.5. Enforcement of Malfunction and Diagnostic System Requirements for 2010 and Subsequent Model-Year Heavy-Duty Engines.

(a) *General.*

* * * *

(3) *Definitions.*

The definitions applicable to these rules include those set forth in Health and Safety Code section 39010 et seq. and in Cal. Code Regs., title 13, section 1900(b) and section 1971.1(c), which are incorporated by reference herein. The following definitions are specifically applicable to section 1971.5 and take precedence over any contrary definitions.

* * * *

"*OBD Emission Testing*" refers to testing conducted to determine compliance with the malfunction criteria in Cal. Code Regs., title 13, section 1971.1(e) through (g) that are based on a multiple of, or an additive to, a tailpipe emission standard or an absolute measurement from an applicable emission test cycle (e.g., 1.5 times the applicable federal test procedure (FTP) emission standards, PM standard plus 0.02 g/bhp-hr, PM level of 0.03 g/bhp-hr as measured from an applicable emission test cycle).

* * * *

(b) *Testing Procedures for ARB-Conducted Testing.*

* * * *

(3) *Engine Selection for ARB-Conducted Enforcement Testing.*

* * * *

(C) Protocol for Procuring Engines for Test Sample Group.

(i) For OBD emission and ratio testing, the Executive Officer shall determine the appropriate manner for procuring engines. In making his or her determination, the Executive Officer shall consider the nature of the nonconformance and the scope of the engine class. The method used shall ensure that engines are recruited from more than one source. Methods used may include obtaining lists of engine owners from specific sources (e.g., engine manufacturers, motor vehicle registration records) and soliciting participation from owners, discussing with fleet or rental operations to locate engines in the engine class, or using methods used by the manufacturer to procure engines for the manufacturer-run heavy duty diesel in-use testing program established pursuant to 70 Federal Register 34594 ~~to procure engines consistent with the procurement process followed by the Executive Officer under Cal. Code Regs., title 13, section 2137 (e.g., obtaining lists of all vehicles in the motor vehicle class within a specified geographical area, mailing postcards soliciting participation of vehicles within the specified area, selecting vehicles from those that responded to the solicitation, inspecting selected vehicles to determine whether appropriate to include in sample group, etc.)~~. In selecting engines for OBD emission testing, the Executive Officer shall include only engines meeting the criteria set forth in section (b)(3)(D)(i) below. For OBD ratio testing, the Executive Officer shall include only engines meeting the criteria set forth in section (b)(3)(D)(ii) below.

* * * *

(D) Engines to be included in a Test Sample Group:

* * * *

(ii) In selecting engines to be included in a test sample group for enforcement OBD ratio testing, the Executive Officer shall include only engines that:

a. Are certified to the requirements of Cal. Code Regs., title 13, section 1971.1.

b. Have collected sufficient engine operation data for the monitor to be tested. For monitors required to meet the in-use monitor performance ratio and to track and report ratio data pursuant to Cal. Code Regs., title 13, section 1971.1(d)(3.2), sufficient engine operation data shall mean the denominator meets the criteria set forth in sections (b)(3)(D)(ii)1. through 5. below. For monitors required to meet the in-use monitor performance ratio but not required to track and report ratio data pursuant to Cal. Code Regs., title 13, section 1971.1(d)(3.2), sufficient engine operation data shall mean that engines that have a denominator that meets the criteria set forth in sections (b)(3)(D)(ii)1. through 5. below after undergoing testing as set forth in section (b)(4)(C)(ii) below. Specifically, the denominator, as defined in Cal. Code Regs., title 13, section 1971.1(d)(4.3), for the monitor to be tested must have a value equal to or greater than:

1. 150 for gasoline evaporative system and secondary air system monitors, and gasoline monitors utilizing a denominator incremented in accordance with Cal. Code Regs., title 13, section 1971.1(d)(4.3.2)(D), (E), and (F) (e.g., cold start monitors, variable valve timing and/or control system monitors, etc.), or
2. 300 for gasoline catalyst, oxygen sensor, EGR, and all other component monitors.

3. 50 for diesel PM filter monitors, ~~and~~ NMHC converting catalyst monitors, PM sensor monitors, and PM sensor heater monitors ~~and other diesel monitors~~ using a denominator incremented in accordance with Cal. Code Regs., title 13, section 1971.1(d)(4.3.2)(E), (F), (G) or (H), or
4. 150 for diesel monitors utilizing a denominator incremented in accordance with Cal. Code Regs., title 13, section 1971.1(d)(4.3.2)(D), (E), or (F) (e.g., cold start monitors, comprehensive component output component monitors, etc.) and not covered in section (b)(3)(D)(ii)3. above, or
5. 300 for all other diesel monitors not covered under sections (b)(3)(D)(ii)3. and 4. above.

* * * *

(6) *Finding of Nonconformance after Enforcement Testing.*
After conducting enforcement testing pursuant to section (b)(4) above, the Executive Officer shall make a finding of nonconformance of the OBD system in the identified engine class under the respective tests for the applicable model year(s) as follows:
(A) OBD Emission Testing.
(i) For 2010 through 2012 model year engines:
a. Engines certified as an OBD parent rating (i.e., the engine rating subject to the "full OBD" requirement under Cal. Code Regs., title 13, section 1971.1(d)(7.1.1)), shall be considered nonconforming if the emission test results indicate that 50 percent or more of the engines in the test sample group do not properly illuminate the MIL when emissions exceed 2.0 times the malfunction criteria (e.g., 5.0 times the standard if the malfunction criterion is 2.5 times the standard) ~~on the applicable standard (i.e., FTP or SET)~~.

* * * *

(ii) For 2013 through 2015 model year engines:
a. All engines classified as OBD parent and child ratings subject to Cal. Code Regs., title 13, section 1971.1(d)(7.2.2) shall be considered to be nonconforming if the emission test results indicate that 50 percent or more of the engines in the test sample group do not properly illuminate the MIL when emissions exceed 2.0 times the malfunction criteria (e.g., 4.0 times the standard if the malfunction criterion is 2.0 times the standard) ~~on the applicable standard (i.e., FTP or SET)~~.

* * * *

(iii) For 2016 through 2018 model year engines:
a. PM filter monitors on engines subject to the malfunction criteria of Cal. Code Regs., title 13, sections 1971.1(e)(8.2.1)(~~C~~D) and (E) shall be considered to be nonconforming if the emission test results indicate that 50 percent or more of the engines in the test sample group do not properly illuminate the MIL when emissions exceed 2.0 times the malfunction criteria (e.g., PM emission level of 0.06 g/bhp-hr if the

malfunction criterion is 0.03 g/bhp-hr) on ~~either~~ any of the applicable standards (i.e., FTP or SET).

b. Monitors on engines and engine ratings previously certified to Cal. Code Regs., title 13, section 1971.1(d)(7.2.3) for extrapolated OBD in the 2013 through 2015 model years shall be considered nonconforming if the emission test results indicate that 50 percent or more of the engines in the test sample group do not properly illuminate the MIL when emissions exceed 2.0 times the malfunction criteria (e.g., 4.0 times the standard if the malfunction criterion is 2.0 times the standard) on ~~either~~ any of the applicable standards (i.e., FTP or SET).

c. Monitors on engines not covered under sections (b)(6)(A)(iii)a. and b. above shall be considered nonconforming if the emission test results indicate that 50 percent or more of the engines in the test sample group do not properly illuminate the MIL when emissions exceed the malfunction criteria on ~~either~~ any of the applicable standards (i.e., FTP or SET).

(iv) For 2019 and subsequent model year engines, any engine shall be considered nonconforming if the results of the tests indicate that 50 percent or more of the engines in the test sample do not properly illuminate the MIL when emissions exceed the malfunction criteria on ~~either~~ any of the applicable standards (i.e., FTP or SET).

(v) The Executive Officer may not consider an OBD system nonconforming solely due to a failure or deterioration mode of a monitored component or system that could not have been reasonably foreseen to occur by the manufacturer.

(B) OBD Ratio Testing.

(i) 2013 through 2015 model year engines certified to a ratio of 0.100 in accordance with Cal. Code Regs., title 13, section 1971.1(d)(3.2.2) and PM filter filtering performance monitors (section 1971.1(e)(8.2.1)) and missing substrate monitors (section 1971.1(e)(8.2.5)) on 2016 through 2018 model year engines shall be considered nonconforming if the data collected from the engines in the test sample group indicate either that the average in-use monitor performance ratio for one or more of the monitors in the test sample group is less than 0.050 or that 66.0 percent or more of the engines in the test sample group have an in-use monitor performance ratio of less than 0.050 for the same monitor.

(ii) Except as provided above in section (b)(6)(B)(i) above, 2016 and subsequent model year engines certified to a ratio of 0.100 in accordance with Cal. Code Regs., title 13, section 1971.1(d)(3.2.2) shall be considered nonconforming if the data collected from the engines in the test sample group indicate either that the average in-use monitor performance ratio for one or more of the monitors in the test sample group is less than 0.088 or that 66.0 percent or more of the engines in the test sample group have an in-use monitor performance ratio of less than 0.100 for the same monitor.

(C) All Other OBD Testing.

* * * *

(ii) Engines shall be considered nonconforming if the results of the testing indicate that at least 30 percent of the engines in the test sample group do not comply with one or more of the requirements of Cal. Code Regs., title 13, section 1971.1 while the engine is running and while in the key on, engine off position such that off-board equipment designed to access the following parameters via the standards referenced in Cal. Code Regs., title 13, section 1971.1 for 2013 and subsequent model year engines cannot obtain valid and correct data for the following parameters:

* * * *

b. The current MIL command status while the MIL is commanded off and while the MIL is commanded on in accordance with SAE J1979/J1939 and Cal. Code Regs., title 13, section 1971.1(h)(4.2), and in accordance with SAE J1979/J1939 and Cal. Code Regs., title 13, section 1971.1(d)(2.1.2) during the MIL functional check and, if applicable Cal. Code Regs., title 13, section 1971.1(h)(4.1.~~3~~6) during the MIL readiness status check;

* * * *

(d) *Remedial Action.*

* * * *

(3) *Ordered Remedial Action-Mandatory Recall.*

(A) Except as provided in sections (d)(3)(B) below, the Executive Officer shall order the recall and repair of all engines in an engine class that have been determined to be equipped with a nonconforming OBD system if enforcement testing conducted pursuant to sections (b) or (c) above or information received from the manufacturer indicates that:

(i) For major monitors required to meet the in-use performance ratio pursuant to Cal. Code Regs., title 13, section 1971.1(d)(3.2) and subject to the nonconformance criteria of section (b)(6)(B)(ii) on 2016 and subsequent model year engines, the average in-use monitor performance ratio for one or more of the major monitors in the test sample group is less than or equal to 33.0 percent of the applicable required minimum ratio established in Cal. Code Regs., title 13, section 1971.1(d)(3.2.2) (e.g., if the required ratio is 0.100, less than or equal to a ratio of 0.033) or 66.0 percent or more of the vehicles in the test sample group have an in-use monitor performance ratio of less than or equal to 33.0 percent of the applicable required minimum ratio established in Cal. Code Regs., title 13, section 1971.1(d)(3.2.2) for the same major monitor.

(ii) For major monitors required to indicate a malfunction before emissions exceed a certain emission threshold, when the engine is tested in a vehicle and operated so as to reasonably encounter all monitoring conditions disclosed in the manufacturer's certification application, the OBD system is unable to detect and illuminate the MIL for a malfunction of a component/system monitored by the major monitor prior to emissions exceeding:

a. For 2013 through 2015 model year OBD parent and child ratings subject to the "full OBD" requirement under Cal. Code Regs., title 13, section 1971.1(d)(7.2.2), three times the applicable major monitor malfunction criteria (e.g., if the malfunction criteria is 2.5 times the applicable standard, recall would be required when emissions exceed 7.5 times the applicable standard, or if the malfunction criteria is the PM standard plus 0.02 g/bhp-hr and the PM standard is 0.01 g/bhp-hr, recall would be required when emissions exceeded 0.09 g-bhp-hr).

b. For 2016 through 2018 model year engines:

1. For engine ratings previously certified to Cal. Code Regs., title 13, section 1971.1(d)(7.2.3) for "extrapolated OBD" in the 2013 through 2015 model years, three times the applicable major monitor malfunction criteria (e.g., if the malfunction criteria is 2.5 times the applicable standard, recall would be required when emissions exceed 7.5 times the applicable standard, or if the malfunction criteria is the PM standard plus 0.02 g/bhp-hr and the PM standard is 0.01 g/bhp-hr, recall would be required when emissions exceeded 0.09 g-bhp-hr), and
2. For all other engine ratings, three times the malfunction criteria for PM filter monitors subject to Cal. Code Regs., title 13, sections 1971.1(e)(8.2.1)(~~C~~D) and (E) (e.g., if the malfunction criteria is the PM standard plus 0.02 g/bhp-hr and the PM standard is 0.01 g/bhp-hr, recall would be required when emissions exceeded 0.09 g-bhp-hr) and two times the malfunction criteria for all other applicable major monitors.

c. For 2019 and subsequent model year engines, two times the applicable major monitor malfunction criteria (e.g., if the malfunction criteria is 2.5 times the applicable standards, recall would be required when emissions exceed 5.0 times the applicable standards).

(iii) For misfire monitor:

a. Gasoline misfire monitor: For 2016 and subsequent model year gasoline engines, the monitor for misfire causing catalyst damage is unable to properly detect and illuminate the MIL for misfire rates that are more than 20 percentage points greater than the misfire rates disclosed by the manufacturer in its certification application as causing catalyst damage (e.g., if the disclosed misfire rate is 12 percent, recall would be required if the misfire rate is greater than 32 percent without proper detection).

b. Diesel misfire monitor: For 2019 and subsequent model year diesel engines, the misfire monitor is unable to properly detect and illuminate the MIL for misfire rates that are more than 10 percentage points greater than the misfire malfunction criteria specified in section Cal. Code Regs., title 13, section 1971.1(e)(2.2.2) (e.g., misfire rate more than 15 percent if the misfire malfunction criteria is 5 percent).

(iv) For 2016 and subsequent model year gasoline engines, when the engine is tested in a vehicle and operated so as to reasonably encounter all monitoring conditions disclosed in the manufacturer's certification application, the evaporative system monitor is unable to detect and illuminate the MIL for a cumulative leak or leaks in the evaporative system equivalent to that caused by an orifice with a diameter of at least 1.5 times the diameter of the required orifice in Cal. Code Regs., title 13, section 1971.1(f)(7.2.2)(B).

(v) When the engine is tested in a vehicle and operated so as to reasonably encounter all monitoring conditions disclosed in the manufacturer's certification application, the OBD system cannot detect and illuminate the MIL for a malfunction of a component that effectively disables a major monitor and the major monitor, by being disabled, meets the criteria for recall identified in sections (d)(3)(A)(ii) or (iv) above (e.g. is unable to detect and illuminate the MIL for malfunctions that cause FTP emissions to exceed two times the malfunction criteria).

(vi) For 2013 and subsequent model year diesel engines, when the engine is tested in a vehicle and operated so as to reasonably encounter all monitoring conditions disclosed in the manufacturer's certification application, the PM filter monitor is unable to detect and illuminate the MIL for any of the following:

a. a missing substrate fault in accordance with title 13, CCR section 1971.1(e)(8.2.5); or

b. a malfunction of the PM filter that causes PM emissions to be equal to or greater than the emission level of the engine, as measured from an applicable emission test cycle (i.e., FTP or SET), with the PM filter substrate completely removed.

~~(vi)~~(vii) The engine class cannot be tested so as to obtain valid test results in accordance with the criteria identified in section (b)(6)(C)(ii) due to the nonconforming OBD II system.

* * * *

NOTE: Authority cited: Sections 39010, 39600, 39601, 43000.5, 43013, 43016, 43018, 43100, 43101, 43104, 43105, 43105.5, 43106, 43154, 43211, and 43212, Health and Safety Code. Reference: Sections 39002, 39003, 39010, 39018, 39021.5, 39024, 39024.5, 39027, 39027.3, 39028, 39029, 39031, 39032, 39032.5, 39033, 39035, 39037.05, 39037.5, 39038, 39039, 39040, 39042, 39042.5, 39046, 39047, 39053, 39054, 39058, 39059, 39060, 39515, 39600, 39601, 43000, 43000.5, 43004, 43006, 43013, 43016, 43018, 43100, 43101, 43102, 43104, 43105, 43105.5, 43106, 43150, 43151, 43152, 43153, 43154, 43155, 43156, 43204, 43211, and 43212, Health and Safety Code.

Appendix D

PROPOSED REGULATION ORDER

Amend section 1968.5, title 13, California Code of Regulations, to read as follows:

Note: The amendments that were approved by the Board at the January 23, 2012 board hearing are shown in single underline to indicate additions and ~~single strikeout~~ to indicate deletions from the existing regulatory text, while the amendments proposed during this rulemaking are shown in double underline to indicate additions and ~~double strikeout~~ to indicate deletions from the existing regulatory text. Various portions of the regulations that are not modified by the proposed amendments are omitted from the text shown and indicated by " * * * * ".

§ 1968.5. Enforcement of Malfunction and Diagnostic System Requirements for 2004 and Subsequent Model-Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines.

* * * *

(b) *Testing Procedures*

* * * *

(3) *Vehicle Selection for Enforcement Testing.*

* * * *

(D) *Vehicles to be included in a Test Sample Group.*

* * * *

(ii) In selecting vehicles to be included in a test sample group for enforcement OBD II ratio testing, the Executive Officer shall include only vehicles that:

a. Are certified to the requirements of title 13, CCR section 1968.2.

b. Have collected sufficient vehicle operation data for the monitor to be tested. For monitors required to meet the in-use monitor performance ratio and to track and report ratio data pursuant to title 13, CCR section 1968.2(d)(3.2), sufficient vehicle operation data shall mean the denominator meets the criteria set forth in sections (b)(3)(D)(ii)1. through 3. below. For monitors required to meet the in-use monitor performance ratio but not required to track and report ratio data pursuant to title 13, CCR section 1968.2(d)(3.2), sufficient vehicle operation data shall mean that vehicles that have a denominator that meets the criteria set forth in sections (b)(3)(D)(ii)1. through 3. below after undergoing testing as set forth in section (b)(4)(C)(ii) below. Specifically, the denominator, as defined in title 13, CCR section 1968.2(d)(4.3), for the monitor to be tested must have a value equal to or greater than:

1. 150 for evaporative system monitors, secondary air system monitors, and monitors utilizing a denominator incremented in accordance with title 13, CCR sections 1968.2(d)(4.3.2)(E) or (F)

(e.g., cold start monitors, air conditioning system monitors, etc.) and not covered in section (b)(3)(D)(ii)2. below, or

2. 50 for PM filter monitors, ~~and~~ NMHC converting ~~oxidation~~ catalyst monitors, PM sensor monitors, and PM sensor heater monitors utilizing a denominator incremented in accordance with title 13, CCR section 1968.2(d)(4.3.2)(F), (G), (H), or (I), or
3. 300 for catalyst, oxygen sensor, EGR, VVT, and all other component monitors not covered in sections (b)(3)(D)(ii)1. and 2. above.

* * * *

(6) *Finding of Nonconformance after Enforcement Testing.*
After conducting enforcement testing pursuant to section (b)(4) above, the Executive Officer shall make a finding of nonconformance of the OBD II system in the identified motor vehicle class if:
(A) *OBD II Emission Testing.*

* * * *

(ii) *Intermediate In-Use Diesel Thresholds.*

a. For 2007 through 2012 model year vehicles subject to diesel/compression-ignition monitoring requirements in title 13, CCR section 1968.2(f)~~.~~, the results of the OBD II emission tests indicate that 50 percent or more of the vehicles in the test sample do not properly illuminate the MIL when emissions exceed:

* * * *

d. For 2013 through 2015 model year medium-duty vehicles, with respect to the NOx malfunction criteria for the NOx converting catalyst conversion efficiency monitor (title 13, CCR section 1968.2(f)(2.2.2)), reductant delivery performance monitor (title 13, CCR section 1968.2(f)(2.2.3)(A)), and NOx sensor monitor (title 13, CCR section 1968.2(f)(5.2.2)(A)), the Executive Officer shall make a finding of nonconformance of the OBD II system if the results of the OBD II emission tests indicate that 50 percent or more of the vehicles in the test sample do not properly illuminate the MIL when emissions exceed an additional 0.2 g/bhp-hr above the NOx malfunction criteria defined in title 13, CCR section 1968.2(f)(2.2.2)(A)(ii)c. or 1968.2(f)(5.2.2)(A)(ii)c.
e. For 2013 through 2015 model year medium-duty vehicles, for the PM filter filtering performance monitor (title 13, CCR section 1968.2(f)(9.2.1)), the Executive Officer shall make a finding of nonconformance of the OBD II system if the results of the OBD II emission tests indicate that 50 percent or more of the vehicles in the test sample do not properly illuminate the MIL when emissions exceed 0.05 g/bhp-hr.

(iii) *Final In-Use Thresholds.* For 2009 and subsequent model year vehicles subject to the gasoline/spark-ignited requirements of title 13, CCR section 1968.2(e) and, except as provided in sections (b)(6)(A)(ii)d. and e. above, for 2013 and subsequent model year vehicles subject to the diesel/compression-ignition requirements of title 13, CCR section 1968.2(f), the results of the OBD II emission tests indicate that 50 percent or more of the vehicles in the test sample do not properly illuminate the MIL when the emission malfunction criteria defined in title 13, CCR sections 1968.2(e) or (f) are exceeded.

(B) *OBD II Ratio Testing.*

(i) For monitors specified in sections (b)(6)(B)(i)a. through e. below, the data collected from the vehicles in the test sample indicate either that the average in-use monitor performance ratio for one or more of the monitors in the test sample group is less than 0.100 or that 66.0 percent or more of the vehicles in the test sample group have an in-use monitor performance ratio of less than 0.100 for the same monitor:

a. monitors on 2004 through ~~20142016-~~2018 model year vehicles certified to a ratio of 0.100 in accordance with title 13, CCR section 1968.2(d)(3.2.1)-(D),

* * * *

(c) *Remedial Action*

* * * *

(3) *Ordered Remedial Action-Mandatory Recall.*

(A) Except as provided in sections (c)(3)(B) below, the Executive Officer shall order the recall and repair of all vehicles in a motor vehicle class that have been determined to be equipped with a nonconforming OBD II system if enforcement testing conducted pursuant to section (b) above or information received from the manufacturer indicates that:

(i) For monitors on 2007 and subsequent model year vehicles certified to the ratios in title 13, CCR sections 1968.2(d)(3.2.1)(A) through (C), the average in-use monitor performance ratio for one or more of the major monitors in the test sample group is less than or equal to 33.0 percent of the applicable required minimum ratio established in title 13, CCR section 1968.2(d)(3.2.1) (e.g., if the required ratio is 0.336, less than or equal to a ratio of 0.111) or 66.0 percent or more of the vehicles in the test sample group have an in-use monitor performance ratio of less than or equal to 33.0 percent of the applicable required minimum ratio established in title 13, CCR section 1968.2(d)(3.2.1) for the same major monitor. For monitors on 2004 through ~~20142016~~ 2018 model year vehicles certified to the 0.100 ratio in title 13, CCR section 1968.2(d)(3.2.1)(D), the Executive Officer shall determine the remedial action for nonconformances regarding the in-use monitor performance ratio in accordance with section (c)(4) below.

(ii) When the vehicle is tested on-road and driven so as to reasonably encounter all monitoring conditions disclosed in the manufacturer's certification application, the OBD II system is unable to detect and illuminate the MIL for a malfunction of a component/system monitored by a major monitor (other than the monitors for misfire causing catalyst damage and the evaporative system) prior to emissions exceeding two times the malfunction criteria of title 13, CCR sections 1968.2(e) and (f) (e.g., if the malfunction criteria is 1.75 times the applicable FTP standard, recall would be required when emissions exceed 3.5 times the applicable FTP standard or if the malfunction criteria is the PM standard plus 0.02 g/bhp-hr and the PM standard is 0.01 g/bhp-hr, recall would be required when emissions exceed 0.06 g/bhp-hr). Additionally, for the first two years that a new major monitor is required in title 13, CCR section 1968.2(e) (e.g., 2006 and 2007 model year for cold start strategy monitoring in title 13, CCR section 1968.2(e)(11)), the Executive Officer shall use three times the malfunction criteria in lieu of two times the malfunction criteria (e.g., if the malfunction criterion is 1.5 times the applicable FTP standard, recall would be required when emissions exceed 4.5 times the applicable FTP standard). Additionally, for major monitors on 2007 through 2009 model year vehicles certified to the monitoring requirements in title 13, CCR section 1968.2(f) and for the PM filter filtering performance monitor (title 13, CCR section 1968.2(f)(9.2.1)) on 2013 model year medium-duty vehicles, the Executive Officer shall determine the remedial action for nonconformances regarding emission exceedance in accordance with section (c)(4) below in lieu of the criteria in section (c)(3)(ii). For purposes of the emission exceedance determination, carbon monoxide (CO) emissions are not considered.

(iii) For misfire monitors:

a. Gasoline misfire monitor: The monitor for misfire causing catalyst damage is unable to properly detect and illuminate the MIL for misfire rates that are more than 20 percentage points greater than the misfire rates disclosed by the manufacturer in its certification application as causing catalyst damage (e.g., if the disclosed misfire rate is 12 percent, recall would be required if the misfire rate is greater than 32 percent without proper detection).

b. Diesel misfire monitor: For 2019 and subsequent model year medium-duty diesel vehicles, the misfire monitor is unable to properly detect and illuminate the MIL for misfire rates that are more than 10 percentage points greater than the misfire malfunction criteria specified in title 13, CCR section 1968.2(f)(3.2.2) (e.g., misfire rate more than 15 percent if the misfire malfunction criteria is 5 percent).

(iv) When the vehicle is tested on-road and driven so as to reasonably encounter all monitoring conditions disclosed in the manufacturer's certification application, the evaporative system monitor is unable to detect and illuminate the MIL for a cumulative leak or leaks in the evaporative system equivalent to that caused by an orifice with a diameter of at least 1.5 times the diameter of the required orifice in title 13, CCR section 1968.2(e)(4.2.2)(C).

(v) When the vehicle is tested on-road and driven so as to reasonably encounter all monitoring conditions disclosed in the manufacturer's certification application, the OBD II system cannot detect and illuminate the MIL for a malfunction of a component that effectively disables a major monitor and the major monitor, by being disabled, meets the criteria for recall identified in sections (c)(3)(A)(ii) or (iv) above (e.g. is unable to detect and illuminate the MIL for malfunctions that cause FTP emissions to exceed two times the malfunction criteria).

(vi) For 2013 and subsequent model year medium-duty diesel vehicles, when the vehicle is tested on-road and driven so as to reasonably encounter all monitoring conditions disclosed in the manufacturer's certification application, the PM filter monitor is unable to detect and illuminate the MIL for any of the following:

a. a missing substrate fault in accordance with title 13, CCR section 1968.2(f)(9.2.5); or

b. a malfunction of the PM filter that causes PM emissions to be equal to or greater than the emission level of the engine or vehicle, as measured from an applicable emission test cycle (i.e., FTP or SET), with the PM filter substrate completely removed.

~~(vi)~~ (vii) The motor vehicle class cannot be tested so as to obtain valid test results in accordance with the criteria identified in section (b)(6)(C)(ii) due to the nonconforming OBD II system.

* * * *

NOTE: Authority cited: Sections 39010, 39600, 39601, 43000.5, 43013, 43016, 43018, 43100, 43101, 43104, 43105, 43105.5, 43106, 43154, 43211, and 43212, Health and Safety Code. Reference: Sections 39002, 39003, 39010, 39018, 39021.5, 39024, 39024.5, 39027, 39027.3, 39028, 39029, 39031, 39032, 39032.5, 39033, 39035, 39037.05, 39037.5, 39038, 39039, 39040, 39042, 39042.5, 39046, 39047, 39053, 39054, 39058, 39059, 39060, 39515, 39600,-39601, 43000, 43000.5, 43004, 43006, 43013, 43016, 43018, 43100, 43101, 43102, 43104, 43105, 43105.5, 43106, 43150, 43151, 43152, 43153, 43154, 43155, 43156, 43204, 43211, and 43212, Health and Safety Code.

TITLE 13. CALIFORNIA AIR RESOURCES BOARD

NOTICE OF PUBLIC HEARING TO CONSIDER AMENDMENTS TO THE VERIFICATION PROCEDURE, WARRANTY AND IN-USE COMPLIANCE REQUIREMENTS FOR IN-USE STRATEGIES TO CONTROL EMISSIONS FROM DIESEL ENGINES

The Air Resources Board (ARB or Board) will conduct a public hearing at the time and place noted below to consider adopting amendments to the Verification Procedure, Warranty and In-Use Compliance Requirements for In-Use Strategies to Control Emissions from Diesel Engines.

DATE: August 23, 2012

TIME: 9:00 a.m.

PLACE: California Environmental Protection Agency
Air Resources Board
Byron Sher Auditorium
1001 I Street
Sacramento, California 95814

This item may be considered at a two day meeting of the Board, which will commence at 9:00 a.m., August 23, 2012, and may continue at 8:30 a.m., on August 24, 2012. This item may not be considered until August 24, 2012. Please consult the agenda for the meeting, which will be available at least 10 days before August 23, 2012, to determine the day on which this item will be considered.

INFORMATIVE DIGEST OF PROPOSED ACTION AND POLICY STATEMENT OVERVIEW

Sections Affected: Proposed amendments to California Code of Regulations (CCR), title 13, sections 2700, 2701, 2702, 2703, 2704, 2705, 2706, 2707, 2708, 2709, 2710 and 2711.

Background:

In 1998, ARB identified diesel particulate matter (PM) as a toxic air contaminant (title 17, CCR, section 93000). A toxic air contaminant is an air pollutant that may cause or contribute to an increase in mortality or serious illness, or which may pose a present or potential hazard to human health. Diesel PM is of particular concern because it is distributed over large regions, thus resulting in widespread public exposure.

To address this large-scale health concern, in 2000, ARB adopted the Diesel Risk Reduction Plan (Diesel RRP) with the goal of reducing PM emissions and their associated health risks by 85 percent by the year 2020. The Diesel RRP identified a number of key measures to achieve this goal: more stringent standards for all new diesel-fueled engines and vehicles, retrofitting in-use diesel engines with diesel emission control strategies, and the use of low-sulfur diesel fuel.

To support the Diesel RRP, staff developed a verification procedure (Procedure) for in-use diesel emission control strategies (strategies or DECS) that was adopted by the Board in May 2002. The Procedure is used by staff to evaluate in-use DECS to ensure they achieve real and durable PM emissions reductions. It specifies emissions and durability test procedures, establishes warranty requirements, and in-use compliance testing requirements. Strategies that meet all of the Procedure's requirements are verified and thus become candidate compliance options to meet ARB fleet regulations that require the control of diesel emissions from in-use fleets.

In-use fleet regulations rely on having verified diesel emission control strategies available to fleet owners as a compliance option. Diesel vehicles and equipment for which regulations have already been adopted include transit buses (title 13, CCR, section 2023, et seq.), solid waste collection vehicles (title 13, CCR, section 2021, et seq.), vehicles that belong to public agencies and utilities (title 13, CCR, section 2022, et seq.), mobile cargo handling equipment at ports and intermodal rail yards (title 13, CCR, section 2479), transport refrigeration units (title 13, CCR, section 2477), off-road diesel equipment (title 13 CCR, section 2449 et seq.), and private on-road diesel vehicles (title 13, CCR, section 2025 et seq.). These regulations provide several paths to compliance, one of which is the installation of verified diesel emission control strategies on existing engines.

Although applying for verification is voluntary, several DECS manufacturers have experienced reduced sales of DECS due to the global recession and recent changes to ARB's fleet regulations that extended deadlines to install DECS. In response, ARB staff reviewed the Procedure and proposes amendments to reduce certain of the Procedure's testing requirements. Staff believes that a number of amendments to the Procedure could be made while still ensuring that it serves the needs of the in-use fleet regulations and device end-users.

Objectives and Benefits of the Proposed Amendments:

To address concerns voiced by verification applicants regarding the testing costs associated with the Procedure's in-use compliance requirements, staff is proposing amendments that would reduce the amount of in-use testing that the Procedure currently requires. Specifically, staff proposes to replace one phase of in-use emissions testing with field testing, increase the sales thresholds that determine when testing must begin, provide for functionality testing of supporting components, provide a pathway to complete the required in-use testing using only one phase of emissions tests, and streamline the in-use compliance process. These proposed changes would reduce the cost to verification applicants while preserving the Procedure's goals and objectives.

In support of these proposed amendments, staff has also proposed amendments to add new language to section 2709 (In-Use Compliance Requirements) specifying the conditions for passing in-use compliance testing. The proposed changes are necessary to accommodate the introduction of field testing and the inclusion of visual and functional tests, and to ensure that the current deterioration factors are appropriate for all covered pollutants. Under these proposed amendments, verification applicants would propose appropriate test criteria for Executive Officer approval based on the design and operational characteristics of their particular devices.

Staff's proposed amendments would also add recall provisions and modify and clarify the annual warranty reporting requirements for applicants and installers. Staff's proposal would provide the Executive Officer with recall authority based on criteria such as a failure to meet the requirements for passing in-use compliance testing, failure of an operational feature, warrantable failures of the same part or component in excess of 4 percent of the number of engines using the strategy, or for emission safety considerations. Staff's proposal also clarifies how the existing 4 percent threshold for warrantable failures is determined and clarifies the existing installation warranty requirements and requires installers of verified strategies to begin submitting annual installation warranty reports similar to the product warranty reports currently submitted by applicants. These changes would ensure the end-users of verified devices remain protected and will result in better installation and maintenance practices. Staff is continuing to investigate additional changes to the Procedure to assist verification applicants in investigating and resolving warranty claims.

Staff is also proposing several amendments that are generally intended to provide more specificity and clarity to the existing requirements. These include conditions under which an application may be terminated; engine maintenance criteria that must be provided by the applicant to their authorized installers for verified device pre-installation compatibility assessment; minimum operational data monitoring and storage requirements for backpressure monitoring systems; emission control groups and test engine selection criteria; labeling durability and replacement; alternative diesel fuels and fuel additives requirements; verified retrofit tampering prohibition; and safety evaluation requirements.

Staff also proposes to correct several format and numbering errors in section 2702, add several definitions to section 2701, identify the appropriate contact and mailing addresses for application submittals, clarify the durability demonstration period for locomotive verifications, add clarifying language to identify what may be considered a design modification regarding an applicant's DECS, and clarify the methodology used to determine emissions reductions. These changes would not affect the stringency of the verification process but would simply modify the existing evaluation protocol and implement the original intent of the regulation.

Lastly, staff also, at the request of the regulated entities, proposes to extend the conditional verification timeframe for off-road strategies from one to two years. This would benefit verification applicants by allowing them additional time to complete their conditional verification requirements.

Overall, staff's proposed amendments would provide additional flexibility and economic relief to applicants while ensuring that DECS verified by ARB continue to be durable and effective in reducing emissions from existing diesel vehicles. The proposed amendments would also strengthen and preserve critical end-user protections to ensure the safe and effective use of DECS to meet ARB's various fleet rules.

CONSISTENCY AND COMPATABILITY WITH EXISTING STATE REGULATIONS

The proposed amendments are consistent with existing State regulations and simply modify an existing protocol used to evaluate diesel emission control strategies.

COMPARABLE FEDERAL REGULATIONS

United States Environmental Protection Agency (U.S. EPA) has published a draft document, "General Verification Protocol for Diesel Exhaust Catalysts, Particulate Filters, and Engine Modification Control Technologies for Highway and Nonroad Use Diesel Engines," but has not promulgated formal regulations for this verification protocol. That verification protocol is intended to support the voluntary retrofit programs initiated by U.S. EPA, while staff's proposal is to support ARB's Diesel RRP and all the associated in-use fleet regulations. Additionally, the U.S. EPA program affords no warranty protection.

AVAILABILITY OF DOCUMENTS

ARB staff has prepared a Staff Report: Initial Statement of Reasons (ISOR) for the proposed regulatory action, which includes a summary of the economic and environmental impacts of the proposal. The report is entitled: *Proposed Amendments to the Verification Procedure, Warranty and In-Use Compliance Requirements for In-Use Strategies to Control Emissions from Diesel Engines.*

Copies of the ISOR and the full text of the proposed regulatory language, in underline and strikeout format to allow for comparison with the existing regulations, may be accessed on ARB's website listed below, or may be obtained from the Public Information Office, Air Resources Board, 1001 I Street, Visitors and Environmental Services Center, First Floor, Sacramento, California, 95814, (916) 322-2990, on July 5, 2012.

FINAL STATEMENT OF REASONS AVAILABILITY

Upon its completion, the Final Statement of Reasons (FSOR) will be available and copies may be requested from the agency contact persons in this notice, or may be accessed on the ARB website, listed below.

AGENCY CONTACT PERSONS

Inquiries concerning the substance of the proposed regulation may be directed to the designated agency contact persons, Mr. Keith A. Macias, Manager, (626) 575-6600, or Mr. Dean Bloudoff, Air Resources Engineer, (916) 322-8987.

Further, non-substantive inquiries concerning the proposed administrative action may be directed to Ms. Trini Balcazar, Regulations Coordinator, (916) 445-9564. The Board has compiled a record for this rulemaking action, which includes all the information upon which the proposal is based. This material is available for inspection upon request to the contact persons.

INTERNET ACCESS

This notice, the Initial Statement of Reasons (ISOR), and all subsequent regulatory documents, including the FSOR, when completed, are available on the ARB website for this rulemaking at http://www.arb.ca.gov/regact/2012/verdev2012/verdev2012.htm

FISCAL IMPACT

The determinations of the Board's Executive Officer concerning the costs or savings necessarily incurred by public agencies and private persons and businesses in reasonable compliance with the proposed amendments are presented below.

ECONOMIC IMPACT ASSESSMENT/ANALYSIS

Pursuant to Government Code sections 11346.5(a)(5) and 11346.5(a)(6), the Executive Officer has determined that the proposed regulatory action would not create costs or savings to any State agency or in federal funding to the State, costs or mandate to any local agency or school district, whether or not reimbursable by the State pursuant to Government Code, title 2, division 4, part 7 (commencing with section 17500), or other nondiscretionary cost or savings to State or local agencies, except ARB. ARB will require one additional staff person to monitor and investigate warranty issues in calendar years 2013 and thereafter. Total annual staff costs are estimated to be $187,000.

COST IMPACTS ON REPRESENTATIVE PRIVATE PERSONS OR BUSINESSES

In developing this regulatory proposal, ARB staff evaluated the potential economic impacts on representative private persons or businesses. The proposed amendments to the Procedure would lower costs to the DECS industry by reducing the amount of required in-use compliance testing and allowing additional unit sales before this testing is required. The addition of in-field tests, functional component testing, and streamlining the in-use compliance process will further reduce the costs associated with the in-use compliance requirements.

The lower cost could be offset by the costs of a potential recall event however. The Procedure currently includes less direct provisions that provide for remedial measures in the event of a failure associated with an applicant's DECS, so even without the addition of the proposed recall provisions it is assumed that applicants have made appropriate financial preparations and that such costs are already being incurred. Should a recall event occur, DECS installers and other maintenance providers will likely see an increased demand for system replacement or repairs, while applicants may see their savings eliminated. However, applicants that produce a robust system are unlikely to be subject to a recall event and will realize a long-term financial benefit from the reduction in the amount of in-use testing.

The proposed amendment requiring the submission of an annual installation warranty report is estimated to individually cost each installer approximately $960 each year, and the total estimated annual statewide reporting cost is $73,000 based on the number of businesses that are currently installing ARB verified devices. However, these costs will likely be offset by reduced installer costs associated with better and earlier identification of any in-field issues before they escalate into significant repairs, maintenance issues, and penalties. The remaining amendments represent procedural changes and clarifications and should not result in any significant impacts on businesses.

Overall, the proposed amendments are estimated to provide a savings to industry of approximately $2.1 million to $5.6 million and reduce future verification costs by approximately 10 percent. Because no direct emissions benefits are associated with staff's proposal, no cost effectiveness analysis could be performed.

SIGNIFICANT STATEWIDE ADVERSE ECONOMIC IMPACT DIRECTLY AFFECTING BUSINESS, INCLUDING ABILITY TO COMPETE

The Executive Officer has made an initial determination that the proposed regulatory action would not have a significant statewide adverse economic impact directly affecting businesses, including the ability of California businesses to compete with businesses in other states, or on representative private persons.

STATEMENT OF THE RESULTS OF THE ECONOMIC IMPACT ASSESSMENT PREPARED PURSUANT TO GOVERNMENT CODE SEC. 11346.3(b)

The Executive Officer has determined that the proposed regulatory action would not affect the creation or elimination of jobs within the State of California, the creation of new businesses or elimination of existing businesses within the State of California, or the expansion of businesses currently doing business within the State of California.

BENEFITS OF THE PROPOSED REGULATION

A detailed assessment of the economic impacts of the proposed regulatory action can be found in the Economic Impact Analysis in ISOR.

EFFECT ON SMALL BUSINESS

The Executive Officer has also determined, pursuant to CCR, title 1, section 4, that the proposed regulatory action would potentially affect small businesses, especially installers of verified devices. Installers who choose to install these verified devices would incur costs due to increased reporting requirements.

In accordance with Government Code sections 11346.3(c) and 11346.5(a)(11), the Executive Officer has found that the reporting requirements of the regulation which apply to businesses are necessary for the health, safety, and welfare of the people of the State of California.

ALTERNATIVES

Before taking final action on the proposed regulatory action, the Board must determine that no reasonable alternative considered by the Board, or that has otherwise been identified and brought to the attention of the Board would be more effective in carrying out the purpose for which the action is proposed, or would be as effective and less burdensome to affected private persons than the proposed action, or would be more cost-effective to affected private persons and equally effective in implementing the statutory policy or other provisions of law.

ENVIRONMENTAL ANALYSIS

In accordance with the ARB's certified regulatory program, CCR, title 17, sections 60006 through 60007, and the California Environmental Quality Act, Public Resources Code section 21080.5, ARB has conducted an analysis of the potential for significant adverse and beneficial environmental impacts associated with the proposed regulatory action. The environmental analysis of the proposed regulatory action can be found in Chapter IV of the ISOR.

SUBMITTAL OF COMMENTS AND WRITTEN COMMENT PERIOD

Interested members of the public may also present comments orally or in writing at the meeting, and comments may be submitted by postal mail or by electronic submittal before the meeting. The public comment period for this regulatory action will begin on Monday, July 9, 2012. To be considered by the Board, written comments, not physically submitted at the meeting, must be submitted on or after Monday, July 9, 2012 and received **no later than 12:00 noon on Wednesday, August 22, 2012**, and must be addressed to the following:

Postal mail: Clerk of the Board, Air Resources Board
1001 I Street, Sacramento, California 95814

Electronic submittal: http://www.arb.ca.gov/lispub/comm/bclist.php

You can sign up online in advance to speak at the Board meeting when you submit an electronic board item comment. For more information go to: http://www.arb.ca.gov/board/online-signup.htm.

Please note that under the California Public Records Act (Gov. Code, § 6250 et seq.), your written and oral comments, attachments, and associated contact information (e.g., your address, phone, email, etc.) become part of the public record and can be released to the public upon request.

ARB requests that written and email statements on this item be filed at least 10 days prior to the hearing so that ARB staff and Board members have additional time to consider each comment. The Board encourages members of the public to bring to the attention of staff in advance of the hearing any suggestions for modification of the proposed regulatory action.

Additionally, the Board requests, but does not require that persons who submit written comments to the Board reference the title of the proposal in their comments to facilitate review.

STATUTORY AUTHORITY AND REFERENCES

This regulatory action is proposed under that authority granted in Health and Safety Code, sections 39002, 39003, 39500, 39600, 39601, 39650-39675, 40000, 43000, 43000.5, 43011, 43013, 43018, 43105, 43600, and 43700. This action is proposed to implement, interpret and make specific sections 39650-39675, 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107, and 43204-43205.5 of the Health and Safety Code and title 17, CCR, section 93000.

PURPOSE, BENEFITS, AND GOALS

The Procedure is used to verify the emissions reduction capabilities of candidate DECS and ensures that they remain durable throughout their warrantable life. Regulated fleets may elect to retrofit their existing engines and if so, are required to use a DECS verified by ARB under the Procedure. Due to declining DECS sales, applicants for verification have expressed market concerns and proposed several alternatives to the current in-use compliance testing requirements with the intent of reducing the costs of the required testing. Staff evaluated these proposals and used them as the basis for the proposed amendments.

The proposed amendments would reduce costs to the applicants and streamline the in-use compliance requirements. The proposed amendments would also better define the application and review process, clarify the high backpressure notification requirements, clarify the attributes that define an emission control group, provide additional guidance regarding the selection of test engines, add a more defined pre-installation assessment to better ascertain an engine's suitability prior to retrofit, ensure installers are properly trained, clarify safety testing requirements, clarify the warranty reporting requirements, clarify the testing and labeling requirements for fuel-based strategies, provide allowances for restricted use emergency standby engines, and provide applicants additional time to complete an off-road conditional verification.

The proposed amendments provide short-term financial savings to all applicants by reducing the amount of required in-use compliance testing by up to one-half and allowing additional sales before this testing is required. The addition of functional in-field tests and the alternative test schedule further reduces the costs associated with the in-use compliance requirements. Streamlining the in-use compliance process and providing additional time for applicants to complete their conditional verifications provides even greater financial flexibility. The addition of recall provisions and clarifications to the warranty reporting requirements are necessary to maintain the stringency of the Procedure and to protect end-users. The proposed amendments provide the economic flexibility requested by applicants while maintaining the effectiveness of the Procedure and ensuring that end-users of these devices remain protected.

HEARING PROCEDURES

The public hearing will be conducted in accordance with the California Administrative Procedure Act, Government Code, title 2, division 3, part 1, chapter 3.5 (commencing with section 11340).

Following the public hearing, the Board may adopt the regulatory language as originally proposed, or with non-substantial or grammatical modifications. The Board may also approve the proposed regulatory language with other modifications if the text as modified is sufficiently related to the originally proposed text that the public was adequately placed on notice that the regulatory language as modified could result from the proposed regulatory action; in such event the full regulatory text, with the modifications clearly indicated, will be made available to the public, for written comment, at least 15-days before it is adopted.

The public may request a copy of the modified regulatory text from the ARB's Public Information Office, Air Resources Board, 1001 I Street, Visitors and Environmental Services Center, First Floor, Sacramento, California, 95814, (916) 322-2990.

SPECIAL ACCOMMODATION REQUEST

Special accommodation or language needs can be provided for any of the following:

- An interpreter to be available at the hearing;
- Documents available in an alternate format or another language; or
- A disability-related reasonable accommodation.

To request these special accommodations or language needs, please contact the Clerk of the Board at (916) 322-5594 or by facsimile at (916) 322-3928 as soon as possible, but no later than 10 business days before the scheduled Board hearing.
TTY/TDD/Speech to Speech users may dial 711 for the California Relay Service.

Comodidad especial o necesidad de otro idioma puede ser proveido para alguna de las siguientes:

- Un intérprete que esté disponible en la audiencia.
- Documentos disponibles en un formato alterno u otro idioma.
- Una acomodación razonable relacionados con una incapacidad.

Para solicitar estas comodidades especiales o necesidades de otro idioma, por favor llame a la officina del Consejo al (916) 322-5594 o envie un fax a (916) 322-3928 lo mas pronto possible, pero no menos de 10 dias de trabajo antes del dia programado para la audencia del Consejo. TTY/TDD/Personas que necesiten este servicio pueden marcar el 711 para el Servicio de Retransmisión de Mensajes de California.

CALIFORNIA AIR RESOURCES BOARD

James N. Goldstene
Executive Officer

Date: 6/26/12

The energy challenge facing California is real. Every Californian needs to take immediate action to reduce energy consumption. For a list of simple ways you can reduce demand and cut your energy costs, see our website at www.arb.ca.gov

State of California
AIR RESOURCES BOARD

STAFF REPORT: Initial Statement of Reasons for Rulemaking

PROPOSED AMENDMENTS TO THE VERIFICATION PROCEDURE, WARRANTY AND IN-USE COMPLIANCE REQUIREMENTS FOR IN-USE STRATEGIES TO CONTROL EMISSIONS FROM DIESEL ENGINES

Date of Release: July 5, 2012
Scheduled for Consideration: August 23, 2012

EXECUTIVE SUMMARY

In 2000, the Air Resources Board (ARB or Board) adopted the Diesel Risk Reduction Plan (Diesel RRP) to address the health risks posed by particulate matter (PM) emissions from diesel engines. One of the key proposals identified in the Diesel RRP to mitigate these emissions requires retrofitting in-use diesel engines with diesel emission control strategies (DECS). To ensure that any DECS used achieves the goals and intents of the Diesel RRP, staff developed the *Verification Procedure, Warranty and In-Use Compliance Requirements for In-Use Strategies to Control Emissions from Diesel Engines* (the Procedure), which the Board adopted in May 2002. The Procedure is used to verify the effectiveness of a candidate DECS through emissions, durability, and field testing, and includes on-going evaluation through warranty reporting and in-use compliance requirements. The Procedure ensures that any DECS used by a regulated fleet achieves real and durable reductions of PM and oxides of nitrogen (NOx) emissions.

Although application for verification under the Procedure is voluntary, several DECS manufacturers, referred to as applicants by the Procedure and throughout this report, have recently expressed market concerns due to the global recession and recent changes to ARB's fleet rules. Delays in the implementation of several fleet rules have led to reduced sales for applicants, especially for DECS designed for off-road engines and equipment. In addition, applicants have stated that the costs associated with the in-use compliance testing requirements of the Procedure, coupled with the effects of the global recession, have created a significant financial challenge. Staff was asked to evaluate these claims and if practicable, to propose changes to the Procedure that would mitigate applicants' concerns.

Staff is proposing amendments to the Procedure which will significantly lower the costs associated with the required in-use compliance testing while maintaining the stringency and robustness of DECS to support ARB's in-use fleet rules, allow additional unit sales before this testing must begin, add less-costly in-field tests to reduce the need to remove and replace entire systems, add an alternative test schedule to further reduce in-use testing requirements, streamline the in-use compliance process to provide applicants with additional flexibility, extend the time allowed to complete a conditional off-road verification, provide the Executive Officer with recall authority, improve and clarify the application and review process, clarify safety demonstrations, and address several in-field issues. The amendments proposed by staff will:

- Reduce in-use testing costs by replacing one phase of in-use compliance emissions testing with in-field testing
- Significantly increase the sales triggers that determine when in-use testing must begin
- Add functional testing to reduce the need to remove and replace entire systems for in-use compliance emissions testing
- Further reduce in-use testing costs by providing a pathway to complete in-use compliance using only one phase of testing

- Streamline the in-use compliance process
- Extend the time allowed to complete a conditional off-road verification
- Ensure the same level of end-user protections by adding recall provisions
- Further define the verification application and review process
- Add additional, more explicit pre-installation assessment and installer requirements for clarity
- Clarify the high backpressure notification requirements
- Clarify safety testing requirements
- Add additional allowances for restricted use emergency standby engines
- Clarify the warranty reporting requirements and require installers to begin submitting an annual installation warranty report
- Clarify the attributes of an emission control group and the selection of test engines
- Clarify the testing requirements for alternative fuels and fuel additives
- Provide other corrections and clarifications

Reducing the amount of laboratory type in-use compliance testing required by the Procedure will greatly ease the financial burden to applicants. The current Procedure requires two phases of in-use testing in an emissions laboratory. Staff's proposal replaces one phase of emissions laboratory dynamometer-based in-use testing with less expensive field testing. In addition, the proposal includes an option that would allow applicants to move directly to in-use emissions testing allowing them to complete their in-use compliance requirements with only one phase of testing. Also, to better ensure high levels of protections are afforded to the end-users of retrofit devices, staff has included recall provisions, clarified safety testing requirements, and clarified the warranty reporting requirements for applicants and installers. These changes, along with increasing the sales thresholds, adding in-field functional tests, and extending the time required to complete a conditional off-road verification, should provide significant financial relief to applicants while maintaining the stringency and robustness of the verification program.

Requiring installers of verified devices to begin submitting an annual installation warranty report will result in an additional cost for all installers, but this is not anticipated to be significant and the required reports will help ensure that installers are honoring the warranty requirements and better identify installation issues before they become significant. In addition, staff's proposal clarifies the application and review process, the high backpressure notification requirements, the attributes that should be addressed when determining an emission control group, and includes guidance on the selection of test engines. These changes are designed to provide additional information for applicants of new verifications and better define the requirements of the Procedure. Staff's proposal adds a more specific assessment that will help determine a candidate engines' suitability prior to retrofit, and includes more explicit requirements to ensure installers and end-users are properly trained regarding the operation and maintenance of these devices. These last changes are being proposed to ensure the effectiveness of this technology and to protect the purchasers of retrofit devices. Staff's proposal also clarifies the warranty reporting requirements by defining what constitutes a warranty claim, what applicants and installers are expected to report, and how to determine when a supplemental report may be required. Additionally, staff's proposal clarifies the testing and labeling requirements for strategies that employ either alternative diesel fuels or fuel additives. Finally, staff has included allowances for restricted use emergency standby engines designed to address issues associated with the pre-installation compatibility assessment requirements.

While the proposed amendments have no direct emissions benefits, they ensure that the Procedure continues to provide verified emission control devices that enable other ARB rules to achieve greater reductions in diesel PM and NO_x emissions. The Procedure will help ARB in its efforts to implement the Diesel RRP and better protect public health. In addition, several of the proposed amendments provide indirect emissions benefits by ensuring better installation and maintenance practices.

The proposed amendments to the Procedure would provide substantial financial relief to the DECS industry by reducing the amount of required in-use compliance testing by up to one-half and allowing additional unit sales before this testing is required. Streamlining the process and adding additional in-field tests will further reduce the costs associated with the in-use compliance requirements. The addition of the proposed recall provisions and the proposed amendment requiring the submission of an annual installation warranty reports are necessary to maintain the stringency of the Procedure and to ensure the in-use performance of DECS. These proposed changes may offset some of the cost savings from the proposed changes to the in-use compliance requirements. The remaining amendments represent procedural changes and clarifications and should not result in any significant economic impacts. Overall, the proposed amendments are estimated to provide a savings to industry of approximately $2.1 million to $5.6 million.

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APPENDICES

CHAPTER I

BACKGROUND

A. INTRODUCTION

This report with associated appendices represents the Initial Statement of Reasons (ISOR) for Proposed Rulemaking required by the California Administrative Procedures Act. In this report, the Air Resources Board (ARB or Board) staff describes proposed amendments to the *Verification Procedure, Warranty and In-Use Compliance Requirements for In-Use Strategies to Control Emissions from Diesel Engines* (the Procedure) which is codified in the California Code of Regulations (CCR), Title 13, sections 2700-2711. The Procedure, developed to support California's Diesel Risk Reduction Plan (Diesel RRP), is used to verify the emissions reduction capabilities of candidate diesel emission control strategies (DECS) and ensures that they remain durable throughout their warrantable life.

Regulations adopted implementing the Diesel RRP and the State Implementation Plan (SIP) require fleets to retrofit or replace their diesel engines in vehicles and equipment operated in the State, referred to as fleet rules. To meet these fleet rules, fleets may elect to retrofit their existing engines or turnover their fleets to newer, cleaner engines. If they elect to retrofit they are required to use a DECS verified by ARB under the Procedure. The verification program is therefore a critical element of the Diesel RRP and the SIP.

B. DIESEL PM AND THE ESTABLISHMENT OF THE VERIFICATION PROCEDURE

In 1998 ARB identified diesel particulate matter (PM) as a toxic air contaminant. A toxic air contaminant is an air pollutant that may cause or contribute to an increase in mortality or serious illness, or which may pose a present or potential hazard to human health. Diesel PM is of particular concern because it is distributed over large regions, thus resulting in widespread public exposure.

Diesel PM is the largest contributor to health risk posed by toxic air pollutants, constituting approximately 70 percent of the total statewide risk[1]. To address this large-scale health concern, ARB adopted the Diesel RRP in 2000 (ARB, 2000). One of the primary goals of the Diesel RRP is to reduce emissions of diesel PM from California's existing in-use fleet through the implementation of various fleet rules. The Diesel RRP outlines measures to protect public health that include the use of diesel emission control

[1] ARB, 2000. *Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles.* http://www.arb.ca.gov/diesel/documents/rrpFinal.pdf. Accessed December 6, 2011

strategies, or "DECS", with existing diesel vehicles and equipment in on-road, off-road, and stationary applications, as well as other diesel powered applications. To date, ARB has adopted fleet rules covering transit buses (title 13, CCR, section 2023, et seq.), solid waste collection vehicles (title 13, CCR, section 2021, et seq.), vehicles that belong to public agencies and utilities (title 13, CCR, section 2022, et seq.), mobile cargo handling equipment at ports and intermodal rail yards (title 13, CCR, section 2479), transport refrigeration units (title 13, CCR, section 2477), off-road diesel equipment (title 13 CCR, section 2449 et seq.), and private on-road diesel vehicles (title 13, CCR, section 2025 et seq.). To be able to implement those measures, ARB must first verify that candidate emission control technologies are effective in reducing emissions and remain durable throughout their useful life.

In response to that requirement, ARB staff developed the Procedure to verify systems that provide real and durable reductions in diesel PM emissions. The Board adopted the Procedure at a public hearing held on May 16, 2002, and has subsequently amended it several times since. The Procedure represents a cooperative inter-divisional effort within ARB and though the primary function of the Procedure is to support the Diesel RRP, it also quantifies oxides of nitrogen (NO_x) reductions in light of California's persistent ozone problem and in support of its SIP commitments. The Procedure encompasses on-road, off-road, stationary, and marine applications, as well as DECS specifically designed to work with Transport Refrigeration Units, Auxiliary Power Units, and diesel powered cargo handling equipment. The Procedure is designed to evaluate a broad range of technologies, including aftertreatment systems, alternative diesel fuels, and fuel additives. It establishes emission and durability testing requirements that applicants must meet in order for their products to receive verification, specific procedures for quantifying their level of effectiveness, and establishes warranty and in-use compliance testing requirements.

C. OVERVIEW OF THE VERIFICATION PROGRAM

The verification process, as defined by the Procedure, ensures DECS used to satisfy fleet rule requirements achieve real and durable emissions reductions. An applicant seeking to verify a DECS must satisfy emissions testing, a durability demonstration, meet specific warranty requirements, and after DECS has been in operation for a specified period of time, meet the in-use compliance requirements of the Procedure.

Currently, to initiate the verification process, an applicant first submits a preliminary application containing detailed information describing the product, including the scientific and engineering basis of how the product works, and information regarding how they will comply with the testing requirements of the Procedure. In this initial stage, staff is careful to evaluate the strengths and weaknesses of the technology, whether the proposed testing and test engine will enable a meaningful evaluation of the product's performance and durability, and any additional issues unique to the system that must be addressed over the course of the verification. Verification requires that testing and other submitted information supports the emissions control group (those engines and applications that will be covered by the verification) and demonstrates successful system performance.

Following verification, applicants must honor the warranty and in-use compliance requirements of the Procedure. Applicants must submit annual warranty reports to ARB which provide summaries of warranty claims, production and sales information of systems sold or leased in California, and descriptions of the nature of the claims and what actions were taken by the applicant to address them.

1. Other Verification Programs

U.S. EPA administers another well-known voluntary retrofit program as part of their National Clean Diesel Campaign (NCDC). Authorized as part of the Energy Policy Act of 2005, U.S. EPA's voluntary retrofit program is similar to ARB's and is designed to encourage owners of fleets of diesel powered vehicles and equipment to retrofit their engines with verified DECS. The Diesel Emissions Reduction Act (DERA) authorizes funding to help fleet owners reduce these emissions. U.S. EPA's program evaluates diesel emission reduction technologies through emissions and durability testing. Verified technologies are listed on the NCDC website at: http://epa.gov/cleandiesel/verification/verif-list.htm. After receiving verification, applicants are still responsible for meeting in-use compliance requirements similar to the Procedure, but U.S. EPA's program has no warranty requirements.

Another well-known program used to evaluate diesel emission reduction technologies is called Verminderung der Emissionen von Realmaschinen im Tunnelbau (VERT). VERT program is a testing procedure required by the Swiss Agency for the Environment, Forests, and Landscape and the Swiss occupational health agency to evaluate control technologies sold and used in underground workplaces, construction sites, and road vehicles in Switzerland. VERT requires at least 90 percent reduction in elemental carbon mass and at least 95 percent reduction in particle count. Verified technologies are listed on VERT website at: http://www.vert-certification.eu/attachments/048_VERT-Filter-List_October_2010.pdf.

D. LEGAL REQUIREMENTS

ARB has authority under California law to adopt the proposed regulatory amendments. California Health and Safety Code sections 43000, 43000.5, 43013(b) and 43018 provide broad authority for ARB to adopt emission standards and other regulations to reduce emissions from new and in-use on-road vehicular and other mobile sources. Under Health and Safety Code sections 43013(b) and 43018, ARB is directly authorized to adopt emission standards for off-road vehicular sources, as expeditiously as possible, to meet State ambient air quality standards. ARB is further mandated by California law under Health and Safety Code section 39667 to adopt Air Toxic Control Measures for new and in-use vehicular sources, for identified toxic air contaminants, such as diesel PM.

Under federal and California law, ARB is the primary agency in California responsible for making certain that all regions of the State attain and maintain National Ambient Air Quality Standards. To achieve this, California must adopt all feasible measures to obtain the necessary emission reductions, including measures for new and existing stationary and mobile sources.

E. PROBLEM

ARB received a request from DECS manufacturers, referred to as applicants by the Procedure and throughout this report, to evaluate the economic impact of recent changes to the fleet rules and the on-going global recession. Due to the fleet rule changes, current California Occupational Safety and Health Program (Cal/OSHA) requirements for off-road vehicles and engines, and the global recession, sales of DECS have significantly declined for most applicants. Through the applicants' industry group, the Manufacturers of Emission Controls Association (MECA), several alternatives to the current in-use compliance requirements were proposed in an effort to reduce the costs associated with the Procedure. Staff evaluated these proposals and used them as the basis for the proposed amendments. In addition, staff has included additional proposed amendments designed to: better define the application and review process for new verifications, clarify the high backpressure notification requirements, clarify the attributes that define an emission control group, provide additional guidance regarding the selection of test engines, add a more defined pre-installation assessment to better ascertain an engine's suitability prior to retrofit, ensure installers are properly trained, clarify safety testing requirements, clarify the warranty reporting requirements, clarify the testing and labeling requirements for fuel-based strategies, provide allowances for restricted use emergency standby engines, and other clarifying language designed to provide improved support for the fleet rules. The proposed amendments are necessary to reduce the cost to currently verified and future applicants, to streamline the in-use compliance process, and to update the Procedure.

F. PURPOSE AND BENEFITS OF THE REGULATION

The purpose of the proposed amendments is to provide economic relief to applicants to the Procedure, to streamline the in-use compliance process, and to update the Procedure. Due to declining DECS sales, applicants to the Procedure have expressed market concerns and proposed several alternatives to the current in-use compliance testing requirements with the intent of reducing the costs of the required testing. Staff evaluated these proposals and used them as the basis for the proposed amendments.

The proposed amendments would provide significant financial relief to the applicants and streamline the in-use compliance requirements. The proposed amendments would also better define the application and review process, clarify the high backpressure notification requirements, clarify the attributes that define an emission control group, provide additional guidance regarding the selection of test engines, add a more defined pre-installation assessment to better ascertain an engine's suitability prior to retrofit, ensure installers are properly trained, clarify safety testing requirements, clarify the warranty reporting requirements, clarify the testing and labeling requirements for fuel-based strategies, provide allowances for restricted use emergency standby engines, and provide applicants additional time to complete an off-road conditional verification.

The proposed amendments would provide financial savings to all applicants by reducing the amount of required in-use compliance testing by up to one-half and allow additional sales before this testing is required. The addition of functional in-field tests and the alternative test schedule further reduces the costs associated with the in-use compliance requirements. Streamlining the in-use compliance process and providing additional time for applicants to complete their conditional verifications provides even greater financial flexibility. The addition of recall provisions and clarifications to the warranty reporting requirements are necessary to maintain the stringency of the Procedure and to protect end-users. The proposed amendments provide the economic flexibility requested by applicants while maintaining the effectiveness of the Procedure and ensuring that end-users of these devices remain protected. Overall, the proposed amendments are expected to reduce DECS industry's costs associated with verification by $2.1 million to $5.6 million for currently verified systems. For a more detailed discussion of the impacts and benefits of the proposed amendments, see Chapter VII.

G. PUBLIC PROCESS

In order to facilitate public comment during the development of the proposed amendments, staff held two public workshops at ARB offices located in El Monte that were well attended by applicants, device installers, and other stakeholders. The dates and materials presented at the workshops are available on ARB's Verification Procedure website at http://www.arb.ca.gov/diesel/verdev/verdev.htm. Staff also held several meetings with MECA and individual companies to discuss the proposal. Based on these meetings, staff was able to incorporate input from stakeholders in the development of this proposal. Staff considered several alternatives to the proposal but concluded that the proposed amendments offer the best means of providing economic flexibility to applicants while maintaining strong end-user protections and the integrity of the Procedure.

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CHAPTER II

DESCRIPTION OF PROBLEM, PROPOSED SOLUTIONS, AND RATIONALE FOR EACH PROPOSED AMENDMENT

A. INTRODUCTION

The following sections describe the general provisions of the existing Procedure, the problems identified during the public process, the proposed solutions, and the rationale for each proposed amendment.

B. IN-USE COMPLIANCE REQUIREMENTS

To provide protections to end-users of ARB verified DECS, the Procedure requires applicants conduct in-use compliance testing to validate that units sold to end-users are as effective as those tested for verification and to make sure that in-use systems are functioning in terms of their required emissions reductions and durability throughout the required warranty period. Currently, in-use compliance testing must begin when 50 units of a given DECS family have been sold or leased in the California market. The Procedure specifies the same type of laboratory based emissions testing (typically dynamometer testing) applicants performed to receive their initial verification. Testing is conducted in 2 different phases for each DECS family and applicants are required to submit an in-use compliance testing proposal for review and approval by ARB's Executive Officer before any testing is performed. Currently, phase 1 testing proposals are due no later than 90 days after selling the 50th unit and the phase 2 proposals within 3 years. Applicants must test a minimum of 4 candidate test units per DECS family for each phase. These are units that have been deployed into service and are in actual use by end-users. In the event that one of the 4 candidate test units fails, applicants must test 2 additional units for each failure, but are allowed to test no more than 10 units per DECS family. The conditions for passing in-use compliance testing are that the first 4 test units must meet the applicable emissions standards, or if more than 4 units are tested, at least 70 percent of all units tested must meet the standards. Following each phase of testing applicants must submit an in-use compliance report to the Executive Officer: for phase 1 testing this report is due within 18 months of selling the 50th unit, and for phase 2, within 4 years.

The current sales trigger of 50 units, coupled with the requirement that applicants select candidate test units for in-use testing that have been operated for 25 percent of their minimum warranty period or for one year was designed to resolve any problems associated with DECS before having widespread application of these systems in the market. However, retrofit technologies have matured significantly since the adoption of the Verification Procedure. While in-use testing is still necessary to validate the durability and emission performance of these strategies, staff believes that functional in-field testing rather than dynamometer-based emissions testing is sufficient to initially identify performance issues associated with newly verified systems. This is based on staff's field testing experience and information from DECS manufacturers, where DECS inspection and functional testing has provided the ability to ensure that the system is being operated properly and functioning according to its verification. This process has also had the added benefit of identifying concerns in the field between the operator, installer, and DECS manufacturer. DECS manufacturers have also indicated that if they experience issues with their systems that most of these issues generally occur soon after an applicant enters the marketplace (i.e., initial year of production), and are typically readily identified through comprehensive field testing.

Staff's proposal continues to require 2 phases of testing but replaces the more costly Phase 1 dynamometer-based laboratory emissions testing with field testing. For field testing, rather than removing the DECS for testing in an emissions testing facility, applicants will be required to perform less expensive specific visual and functional tests in field to verify that their emission control systems continue to remain functional and durable. This will greatly reduce the costs of in-use compliance testing by replacing one phase of dynamometer-based emissions testing with in-field tests. While functional in-field testing cannot quantify a DECS specific emissions reduction levels, it can identify performance issues before widespread application of these mature technologies is achieved at a lower cost to all applicants. All applicants will still be required to perform full emissions testing to validate verified emissions reduction levels, but at a later date during their second phase of testing. This proposed change will reduce the cost of compliance for current and future applicants to the Procedure.

Along with this proposed change, staff has included an alternative test schedule that provides an option to complete in-use compliance testing using only one set of in-use compliance tests, but requires applicants to move directly to the more costly emissions testing. The alternative test schedule would allow applicants an option to complete their required in-use compliance testing by performing only one set of in-use compliance tests, provided they agree to perform emissions testing after reaching the first sales trigger. The alternative test schedule would be performed in place of the less costly field testing provided applicants can identify and select test units that have been operated for at least 60 percent of their minimum warranty period or for three years. This option, performed after reaching the lower sales trigger, would provide both early identification of any potential performance issues and validation of verified emissions reduction levels. This provides applicants with an option to further reduce compliance costs by eliminating the need for future emissions testing.

To further assist applicants to the Procedure, staff is also proposing to increase the number of units that trigger when the in-use compliance process must begin. Rather than requiring in-use testing after the sale or lease of 50 units, staff's proposal provides for in-use field testing after the sale or lease of 100 units, and in-use compliance emissions testing after the sale or lease of 300 units. This will provide applicants additional time to prepare for in-use testing. For more information on the rationale used to select these proposed sales triggers, please see Appendix B.

Most applicants are meeting the 50 unit sales trigger less than a year after receiving verification. Performing an additional set of emissions tests shortly after an applicant's initial verification testing is costly and uninformative, especially if in-use compliance testing is triggered too soon after an applicant enters the marketplace. However, the trigger to start in-use testing must be set such that it will not significantly delay testing, which could result in potential problems not being identified until a significant number of units have been deployed. Overall, staff believes that in-use testing should be required so that the results are available to staff before the warranty period for an applicant's initial post-verification sales has expired. These larger sales triggers will continue to provide staff with in-use compliance test results before an applicant's initial sales have exceeded their minimum warranty period, which is generally 5 years. Staff is proposing these changes to address these issues and to further reduce each applicant's per unit overhead costs. Applicants will have more time and profit from the sale of additional units allowing them to better prepare for the Procedure's mandatory in-use compliance testing.

Some DECS use an entirely fuel-based approach to achieve their emissions reductions. For entirely fuel-based strategies, there are no components or parts that would constitute a sales unit so staff's proposed sales triggers don't apply. To address this, staff is proposing a maximum threshold coupled with a time requirement that will ultimately trigger when in-use compliance testing must begin: when 6 million gallons of an alternative or treated diesel fuel has been used or 3 years after receiving verification, whichever comes first. This will allow one volume requirement to suffice for both types of entirely fuel-based strategies, additives or alternative fuels, and provide a time-limit to ensure in-use testing is performed in a timely manner. However, unlike a hardware-based strategy, staff does not believe that field testing is a viable option for entirely fuel-based DECS. For entirely fuel-based strategies, there are no components to visually inspect, nor are there any sensors or displays to test for functionality. Therefore, it is proposed that entirely fuel-based DECS only be required to perform in-use compliance emissions testing after meeting either the proposed sales trigger or 3 years after receiving verification, whichever comes first.

Finally, staff thoroughly reviewed the remaining in-use compliance testing requirements to determine if any other changes were feasible that might provide applicants with lower compliance costs without compromising the integrity of the in-use testing program. Staff was able to identify two additional changes: allowing applicants to perform functional tests of supporting system components during in-use compliance emissions testing rather than the current practice of removing and replacing the entire system, and providing an option that allows applicants to request the use of only one size of emissions test engine provided it can be used to demonstrate compliance for the entire DECS family. Therefore, these proposed changes are also included in staff's proposal.

The remaining proposed amendments to the Procedure's in-use compliance requirements are necessary to implement staff's proposed field testing provisions, support the increased sales triggers, support functional testing of supporting system components and the use of one emissions test engine, and to clarify and streamline the process. These proposed amendments include:

Test Phases. The Procedure currently requires 2 phases of testing identified as Phase 1 and Phase 2. This naming convention is no longer appropriate based on staff's proposed amendments. Therefore, staff proposes identifying what was previously Phase 1 as "field testing", and Phase 2 as "emissions testing". This naming convention aligns with staff's proposal and provides clarity for applicants to the Procedure.

Age of Test Units. For in-use compliance testing, the Procedure currently requires applicants to identify and select test units from actual in-use vehicles or equipment that have been operated, or "aged", as follows: for Phase 1 the test units must have been operated at least 25 percent of their minimum warranty period or for 1 year, whichever comes first, and for Phase 2, between 60 and 80 percent of their minimum warranty period. For field testing, no change in the age of the test units is required. However, for emissions testing, applicants have stated that locating test units that fall within the required 60 to 80 percent window is difficult. To streamline the selection process, staff's proposal specifies that test units selected for emissions testing must be operated at least 60 percent of their minimum warranty period or for 3 years, whichever comes first. This broader range with respect to the minimum warranty period or elapsed time will make identifying and selecting test units easier for all applicants.

In-Use Compliance Testing Proposal. The Procedure requires applicants to begin the in-use compliance process by submitting an in-use compliance testing proposal to ARB's Executive Officer for review and approval. The current language requires applicants to submit their proposal 90 days after selling the 50th unit for Phase 1 testing and no later than 3 years after selling the 50th unit for Phase 2. To support the increased sales triggers it is necessary to change the submission times to align with staff's proposed amendments. Therefore, staff's proposal provides applicants 90 days in which to submit their proposals for Executive Officer review and approval after reaching the appropriate sales trigger. Staff's proposal also includes language detailing the type and level of information necessary for a prompt and successful review of an applicant's testing proposal. These changes align the submission deadlines with staff's proposal and streamline the existing in-use compliance testing proposal development and review process.

Selection of Diesel Emission Control Strategies for Testing. The Procedure requires applicants to identify a representative sample of installed DECS for potential in-use testing. Currently, applicants are identifying 10 units as this is the maximum number of systems that may be tested per DECS family. However, the Procedure does not define what constitutes a representative sample, nor does it state that this representative sample must consist of 10 systems. To address this, staff's proposal requires applicants identify 10 installed DECS for possible in-use testing (both field and emissions testing) and provides guidance on how to determine a representative sample. These proposed changes will streamline the process, clarify the requirements for applicants, and ensure that the required information is submitted in each testing proposal.

Selection of Test Engines. The Procedure currently requires applicants to select a test engine or engines for in-use compliance emissions testing that are in a proper state of maintenance but does not define this term. For clarity, staff added language to this section to identify what constitutes a proper state of maintenance for an emissions test engine.

Number of DECS to be Tested. Currently, applicants are required to test a minimum of four candidate test units for each Phase of in-use compliance testing and test two additional units for each failure up to a maximum of ten. Staff's proposed in-use compliance emissions testing makes no changes to these requirements. However, staff's proposed field testing makes a quantitative comparison with the original test units used for verification difficult. To align with staff's field testing proposal an increase in the test sample size is necessary to ensure that the required testing can identify potential performance issues for all systems in an applicant's DECS family. Therefore, staff's proposal requires applicants to test a minimum of eight candidate test units for field testing and test two additional units for any failure up to a maximum of ten. By requiring that a sufficient number of DECS are tested during field tests, potential performance issues will be identified thus ensuring the same level of protection for the end-users of these devices that the Procedure currently provides while reducing overall compliance costs.

In-Use Compliance Field Testing. To support staff's proposal it is necessary to add additional language to the Procedure describing the general requirements for the field testing provisions. This section describes the general requirements and instructs applicants to develop a test methodology that they can use in-field to determine if their DECS family continues to remain durable, functional, and is successfully reducing emissions. Staff's proposal requires applicants to submit their proposed test methodology to the Executive Officer for review and approval prior to performing field tests. The proposed changes will provide necessary guidance and clarity for applicants to the Procedure and the addition of field tests will reduce in-use testing costs for all applicants.

In-Use Compliance Emissions Testing. To support staff's proposal to allow functional testing of supporting components prior to removal of the core components of the system for emissions testing, staff added additional language to this section identifying the general requirements for developing these tests. Staff's proposal requires applicants to submit their proposed functional tests as part of their testing proposal for Executive Officer review and approval prior to in-use compliance emissions testing. The proposed changes provide necessary guidance to applicants of the Procedure and the functional testing option will result in reduced in-use compliance costs.

In-Use Compliance Report. To support the proposed sales triggers, the change in the naming convention, and to address entirely fuel-based strategies, staff's proposal modifies this section. Currently, the Procedure requires applicants to submit their Phase 1 report within 18 months after meeting the 50 unit sales trigger and then the Phase 2 report within 4 years. Additionally, the Procedure does not specifically mention how entirely fuel-based strategies are to make this determination. To address these issues staff's proposal requires applicants to submit their field or emissions testing in-use compliance reports no later than 18 months after meeting the appropriate sales trigger. Staff's proposal also requires applicants of entirely fuel-based strategies to submit their in-use compliance report no later than 18 months after 6 million gallons of an alternative or treated diesel fuel has been used or 3 years after receiving verification, whichever comes first. These proposed changes are necessary to align this section with staff's current proposal.

Conditions for Passing In-use Compliance Testing. Staff is proposing changes to the conditions for passing in-use compliance testing to address the proposed field testing requirements and the addition of functional tests. Currently, an individual DECS meets the requirements for passing in-use compliance for either Phase of testing if it reduces emissions by at least 90 percent of the lower bound of the emission reduction level it was originally verified to and meets the nitrogen dioxide (NO_2) requirements of the Procedure. In addition, each DECS family name passes in-use compliance testing if the first 4 units meet these requirements or if more than 4 units are tested, 70 percent of all units tested must meet the requirements. For in-use compliance emissions testing, staff's proposal adds an additional requirement stipulating adherence to the functional test requirements defined in the applicants approved emissions testing proposal. For in-use compliance field testing, staff's proposal requires either the first 8 units tested to meet the functional test requirements defined in the applicants approved field testing proposal or if more than 8 units are tested, a minimum of 9 units must meet these requirements. The proposed changes are necessary to align the conditions for passing in-use compliance with staff's current proposal.

C. CONDITIONAL VERIFICATION

Conditional verification allows applicants to market their products as ARB verified prior to receiving full verification after completing only one-third of the required minimum durability demonstration period. Applicants must complete the remaining demonstration period within one year after receiving conditional verification. One of the effects of the global recession is a significant slowdown in construction and construction related industries. This sector provides that greatest opportunity for applicants seeking an off-road durability demonstration vehicle.

In an effort to provide additional economic relief to applicants to the Procedure, staff proposes allowing conditionally verified off-road strategies an additional year to fulfill the requirements necessary to achieve full verification. The Procedure currently allows applicants to conditionally verify DECS intended for off-road, stationary, marine, Rubber-Tired Gantry (RTG) crane, Auxiliary Power Unit (APU), and Transport Refrigeration Unit (TRU) applications. Therefore, staff's proposal extends the time for applicants of conditionally verified off-road strategies to complete the requirements for full verification to two years. This proposed change will allow applicants additional time to complete this work while profiting from an additional year of sales.

D. RECALL PROVISIONS

To ensure that end-users of verified devices are provided with the same level of protections that the Procedure's current in-use compliance requirements offer, and to address safety issues or the potential for catastrophic failure, staff's proposal provides the Executive Officer with recall authority. While the proposed changes to the in-use compliance requirements provide economic relief to all applicants, the increased sales triggers will result in additional units being deployed in-field before in-use testing is required. Though staff's proposed changes to the in-use compliance testing requirements are sufficient to identify potential performance issues, once identified, the only recourse available to deal with them are to request a voluntary recall, lower an applicant's verification level, revoke their verification entirely, and/or assess monetary penalties for a violation of the Procedure. This does little to provide relief to end-users and may not address all systems that remain deployed on vehicles and engines of in-use fleets. Similarly, issues of safety or catastrophic failure, high warranty claim rates, or other serious problems identified with deployed systems can only be addressed in the same fashion. To address these issues, staff's proposal includes new recall provisions.

The intent of the proposed recall provisions is to require corrective action by an applicant to the Procedure for a systemic defect of their DECS family or to address issues of safety or catastrophic failure. Staff's proposal provides the Executive Officer with the authority to determine whether the recall of a DECS family is appropriate based on a review of an applicant's in-use compliance report, remedial report, warranty report, enforcement testing results, or other information. Staff's proposal clarifies that this determination will be based on: the potential for catastrophic or other safety related failures, failure to meet the conditions for passing in-use compliance testing, valid warranty claims for the same part or component that exceed 4 percent of the number of deployed systems, or if a substantial number of units experience a failure of an operational feature (e.g., strategy used to signal high backpressure). If the Executive Officer determines that a recall is necessary to address one or more of these systemic defects, applicants will be required to submit a recall plan within 60 days specifying potential remedial actions. Staff's proposal also specifies that the proposed recall provisions apply to an applicant's entire DECS family, which may include all strategies sold as California verified. A complete discussion of the proposed recall provisions, including the minimum requirements for an applicant's recall plan, can be found in Chapter VII of this report. The proposed recall provisions are necessary to support staff's proposed changes to the in-use compliance requirements, to address safety issues or the potential for catastrophic failure, and to better protect end-users of these devices.

E. WARRANTY REQUIREMENTS

The procedure currently requires applicants to warrant their verified products and specifies minimum warranty periods by DECS application. Staff's proposal clarifies the existing warranty requirements to ensure that all applicants to the Procedure are aware that they must extend this coverage to components used to match DECS to the target engine. This clarification is needed to ensure that end-users of these devices are fully protected by the existing warranty requirements. The Procedure also requires applicants to submit an annual warranty report to the Executive Officer and staff has added clarifying language to identify the type of information that should be submitted by applicants. These changes are necessary to streamline the process, clarify the requirements, and ensure that the required information is submitted by all applicants.

The Procedure currently also requires applicants to submit a supplemental warranty report within 30 days if warranty claims exceed a 4 percent threshold. However, the threshold requiring the supplemental report is ambiguous and requires further clarification. Staff's proposal clarifies this requirement by defining that the 4 percent threshold applies to claims received for the same part or component, and is only determined based on valid warranty claims. Staff's proposal also defines 2 new terms to further clarify the requirement: warranty claim and valid warranty claim. These changes are necessary to clearly define the requirements, ensure reports are submitted when appropriate, and to support staff's proposed recall provisions. As previously discussed, exceeding the 4 percent threshold may subject an applicant's DECS family to the proposed recall provisions.

In addition to the product warranty, the Procedure currently requires installers of verified DECS to provide end-users with warranty protections. Though the warranty period is the same as the product warranty provided by applicants, installers are only required to warrant that the installation is free from defects in materials and workmanship. During the public process several installers indicated that the terms of coverage are not clearly defined, therefore staff's proposal clarifies the installation warranty requirements to assist installers. Staff's proposal also includes a new provision requiring installers to begin submitting annual installation warranty reports and to share this information with the applicant (DECS manufacturer) for which they are authorized to install. Installers are often the main point of contact for end-users and the Procedure has always assumed that any requests for warranty service would be forwarded to the appropriate applicant (DECS manufacturer) and would therefore appear in their annual warranty report. However, during the public process staff was made aware that this is not always the case. To address this problem staff's proposal requires installers of verified DECS to submit an annual installation warranty report. These changes are necessary to clarify the requirements, identify potential installation issues, and ensure that the required information is submitted by all installers to their respective applicants and the Executive Officer.

F. PRE-INSTALLATION COMPATIBILITY ASSESSMENT

The Procedure currently includes pre-installation compatibility assessment procedures. These assessments help ensure that candidate engines are properly screened prior to retrofit. In order for a verified DECS to function as designed, the candidate engine must be operating properly. The pre-installation compatibility assessment procedures are designed to identify mechanical problems with the candidate engine that must be corrected prior to retrofit. However, even with the recent adoption and implementation of some basic assessment procedures, in-field problems are still being reported by fleets and individuals. Several of these reports seem to indicate that candidate engines were retrofit even though they were likely in a very poor state of maintenance. To address this staff's proposal adds additional requirements to the pre-installation compatibility assessment procedures to better assess the condition of the candidate engine prior to retrofit.

Staff's proposal requires applicants to the Procedure to establish specific criteria that installers will use to assess each engine prior to retrofit and specifies minimum criteria such as: a smoke opacity limit, oil consumption limits, fuel inspection requirements, and visual inspections. Because these assessments must identify each candidate engine's current state of maintenance, staff's proposal stipulates that installers must perform these checks no more than 15 days prior to retrofit. Also, to address currently verified DECS, staff's proposal requires applicants of currently verified systems to establish and implement the enhanced assessment criteria within six months following the adoption of the regulation. These changes are necessary to ensure that any mechanical problems experienced by a candidate engine are identified and appropriately addressed prior to its retrofit.

In addition to assessing the mechanical condition of the candidate engine prior to retrofit, the Procedure requires measurement of its exhaust gas temperature if it is to be retrofit with a DECS that has an exhaust gas temperature requirement. Most passive systems have a minimum temperature threshold that must be met for successful operation. This is determined by measuring the exhaust gas temperature for a minimum of 24 hours during normal operation. Staff's proposal clarifies that this measurement must occur during the most challenging pattern of use and that end-users must be notified that any significant change in this pattern of use could result in performance issues with their DECS. In addition, staff was made aware during the public process that the restricted use requirements of some emergency standby engines make operating the engine for the minimum 24 hour assessment period problematic. Therefore, staff has added a new provision that allows owners of emergency standby engines permitted by a California Air District the option of proposing a period of less than 24 hours to the Executive Officer for these types of temperature assessments. These changes are necessary to ensure that the exhaust gas temperature requirements are appropriately assessed, that end-users understand the significance of these requirements, and that emergency standby engines subject to the fleet rules have the ability to select retrofit as a potential compliance option.

G. INSTALLER REQUIREMENTS AND END-USER TRAINING

Staff's proposal requires applicants to the Procedure to provide added oversight during the installation of their verified strategies and includes additional requirements for installers. The proposed changes require applicants to develop criteria they will use to begin authorizing installers of their products and specifies that no person or company may install an ARB verified DECS unless trained and authorized by the party that holds the verification. In addition, staff's proposal clarifies that installers must comply with the enhanced pre-installation compatibility assessment requirements, must provide an installation warranty, and includes general requirements that all installers must adhere to. Currently, anyone may install an ARB verified DECS with little or no training and limited contact with the party that holds the verification. This has led to poor installation practices that result in problems in the field and dissatisfied end-users. These changes are necessary to ensure that verified DECS are properly installed and that all the terms and conditions of verification Executive Order are being addressed by both applicants and installers. In addition, to ensure that end-users are properly trained in the use and maintenance of these systems, staff's proposal includes provisions that require basic end-user training following installation. While all applicants are currently providing some level of end-user training these changes are necessary to specify minimum training requirements that must be met by either the applicant or their authorized installer thus ensuring that end-users can safely and effectively operate and maintain these systems.

H. APPLICATION AND REVIEW PROCESS

Staff's proposal includes clarifications and additional specificity to the application and review process currently used by staff to evaluate an applicant's DECS. The proposed changes are designed to better identify the procedures followed by staff and delineate the process into clearly defined categories that applicants must follow. During the public process applicants requested a review of the current Procedure with the intent of streamlining the application and review process if possible and staff's changes are in response to this request. These changes will also help applicants more effectively manage their resources by providing them added information they can use to determine if they're ready to enter the verification process. This will keep the process moving forward without unnecessary delays or the termination of their verification application. The proposed clarifications are necessary to streamline and better define the application and review process.

I. OTHER PROPOSED AMENDMENTS

The remaining proposed amendments are necessary to streamline the application and review process and clarify and update the Procedure. These proposed amendments include:

<u>Design Modifications</u>. The Procedure currently specifies that any design modifications to a verified DECS be evaluated under the Procedure. Since a design modification may change the effectiveness or durability of an applicant's DECS, these types of system changes are reviewed and processed in a fashion similar to an initial verification application. Staff's proposal includes clarifying language to support the proposed changes to the application and review process and updates this section to include a list of specific examples that would be viewed as a design change. While not intended to be comprehensive, the list includes major parts, components, materials, catalyst loadings and wash coats, and other application specific criteria that could impact the overall performance and/or durability of a system. These changes are necessary to streamline the application and review process by providing additional guidance to applicants.

<u>Selection of DECS for Testing and Right of Entry</u>. The Procedure currently provides the Executive Officer with the authority to request that applicants provide a reasonable number of verified DECS for testing and/or inspection. Staff's proposal updates these requirements by clarifying that this may include DECS in the possession of an authorized dealer or distributor and includes "right-of-entry" provisions for an agent or employee of ARB for the purpose of selecting and securing test units. These changes are necessary to update the Procedure and facilitate confirmatory testing.

<u>Testing on an Emission Control Group Basis</u>. The Procedure has always required applicants to perform emissions and durability testing of their DECS on an emission control group basis. An emission control group is a selection of engines and/or vehicles that share similar design and operational characteristics making them individually representative of the entire group. Staff's proposal includes clarifying language to explain this policy more explicitly in the Procedure and identifies attributes which define a distinct emission control group and therefore, should be considered by applicants when selecting an appropriate test engine or durability demonstration vehicle/engine combination. These changes are necessary to streamline the application and review process.

<u>DECS Sizing During Emissions and Durability Testing</u>. Staff's proposal clarifies that applicants to the Procedure must appropriately size their DECS for emissions testing and durability demonstrations and includes information regarding multiple filter configurations. Applicants generally provide DECS in multiple sizes to accommodate different engine power ratings. Over or under sizing a DECS can change emissions testing results and is not representative of proper installation practices. Applicants that neglect to address these issues may inadvertently generate test data that cannot be

used to support their verification effort. This may lead to delays in the review of their application and is therefore necessary to streamline the application and review process.

Durability Testing. Applicants to the Procedure are required to demonstrate the durability of their DECS during the verification process. Durability demonstrations used to support verifications are almost always carried out in-field, duplicating the real-world conditions that an applicant's DECS will experience once in the hands of the end-user. Staff believes that this type of durability testing yields stresses to an applicant's DECS that are difficult, if not impossible, to re-create in a laboratory environment. However, the Procedure currently includes provisions allowing applicants to request the use of a laboratory-based durability demonstration. To better simulate real-world conditions for extremely demanding environments, staff's proposal clarifies that laboratory-based durability demonstrations are not acceptable as primary durability data for on-road, off-road, and APU applications. Applicants may continue to request, at the Executive Officer's discretion, a laboratory-based demonstration but only as secondary supporting data. These changes will streamline the application and review process by clarifying this requirement for applicants before they submit their applications for review.

Electronic System Codes. Staff's proposal includes a clarification that instructs applicants to submit error codes, fault codes, and high backpressure codes generated by their DECS control or operational monitoring system during a durability or field demonstration. If any codes occur during these tests the Procedure requires they be submitted and staff's proposal clarifies this requirement so that staff can determine the magnitude and severity of the potential fault. In the past, some applicants have failed to submit these codes requiring staff to request them which delays the review process. Therefore, these changes update the Procedure and will help streamline the application and review process.

High Backpressure Notification and Data Monitoring and Storage. The Procedure currently requires all filter-based DECS be installed with a backpressure monitor as a means of notifying the operator of high backpressure conditions. High backpressure conditions can result in significant damage to the system or the engine. Staff's proposal includes updated language that specifically identifies the minimum requirements that must be met by an applicant's backpressure monitor. These minimum requirements are currently in use by a majority of applicants. These changes are necessary to update the Procedure by clarifying the minimum requirements for all applicants. In addition, staff's proposal requires applicants to submit any software or hardware necessary to download and view the recorded data. This added requirement is necessary to allow staff to monitor in-use systems and ensure that they are functioning properly and adhering to the minimum requirements.

Determination of Emissions Reductions. Staff's proposal clarifies the method used by the Executive Officer when categorizing an applicant's DECS to an appropriate Level or Mark. Because the calculations for determining emissions reductions are based on the averages of several replicate test sets, staff's proposal clarifies that each test set submitted with the application must be greater than or equal to the minimum emissions reduction level that defines the Level or Mark. Furthermore, staff's proposal makes it clear that it is not sufficient for the average reduction from all tests to exceed the minimum value of the Level or Mark if one of the reductions in the average is below the minimum requirements for that Level or Mark. These changes are needed to update the Procedure by clarifying how the Executive Officer calculates an applicant's percent emissions reduction.

Labeling Requirements. Staff has clarified the language regarding how DECS labels should be constructed and affixed to make it clear that the labels must remain legible and resist tampering for the duration of a strategy's minimum warranty period. In addition, to address the issue of missing labels, staff has added a provision that requires end-users to notify applicants in the event of a missing or damaged label and specifies that the applicant must issue an ARB approved replacement label within 45 days. This change is proposed to update the Procedure by addressing in-field issues associated with missing system labels.

Verification of Alternative Diesel Fuels and Fuel Additives. The Procedure provides for the verification of fuel-based DECS and these are generally categorized as either fuel additives or alternative diesel fuels. Under the Procedure, all fuel-based strategies must undergo a more comprehensive evaluation than other control systems which rely on emissions reductions through the use of hardware alone. For example, all fuel-based strategies must be evaluated through the multimedia process as required by Health and Safety Code Section 43830.8, which includes evaluations from all divisions within the California Environmental Protection Agency. In addition, the Procedure requires that these strategies be in compliance with applicable federal, state, and local government requirements, including registration with U.S. EPA. To assist applicants, staff's proposal updates the testing requirements, addresses an oversight regarding the labeling requirements for these types of strategies, specifies that applicants obtain U.S. EPA registration before submitting their preliminary verification application to ARB, and removes an erroneous provision for conditional verification that is not allowed by the Procedure. These changes are necessary to align the testing requirements for these types of strategies with other sections in the Procedure, provide accurate information to applicants, and update the Procedure. This will streamline the application and review process for these types of strategies. A more complete discussion of the proposed changes can be found in Chapter VII.

Compliance. Staff proposes updating the Procedure by clarifying that all ARB verified DECS must be properly installed and maintained and that tampering with an installed ARB verified DECS is not allowed. These changes are necessary to update the Procedure and support staff's other proposed amendments.

Safety Considerations. Staff's proposal clarifies the requirements that applicants address safety and the potential for catastrophic failure of their strategy's while in use. The Procedure currently requires applicants to address in their preliminary application any potential safety issues associated with their strategy. Staff's proposal updates the Procedure and clarifies that applicants must provide an analysis of all potential safety and catastrophic failure issues associated with the use of their DECS including an analysis of all potential failure modes. Staff's proposal also clarifies that the Executive Officer may require additional safety testing by an independent test facility and may require design modifications to a DECS both before and after receiving verification. These updates are necessary to ensure that verified strategies can be safely deployed in-field, to update the application requirements, and to protect end-users.

Applicability. Staff added the term "market-ready" to clarify that the Procedure applies to market-ready in-use strategies and not prototypes. The Procedure is not designed to review the performance of prototype systems, only those strategies that are fully designed and ready to enter the marketplace. In addition, to streamline the application process, staff's proposal provides the Executive Officer with the ability to request an applicant submit a market-ready DECS to support their preliminary application. This will ensure that all applicants are ready to enter into the verification process and will support staff's other proposed amendments designed to streamline the application and review process.

Application Process Overview. Staff's proposal updates the language in the application overview section clarifying the policy that requires applicants to propose a test plan commensurate with their proposed emission control groups. This change is necessary to support staff's proposed amendments.

Submission of Applications, Correspondence, and Reports. Staff's proposal updates the Procedure to remedy an oversight and now directs applications intended for use with stationary or RTG cranes applications to the appropriate ARB Branch. This change is necessary to streamline the application and review process.

Concurrent Submission of Service Bulletins. Staff's proposal updates the Procedure by clarifying that applicants are required to submit any technical service bulletins or other service related information provided to end-users, authorized installers, or distributors concurrently to ARB. This change is necessary to support staff's proposed amendments.

Application Format. Staff's proposal corrects several format and numbering errors in the information outline of section 2702 and adds clarifying language stipulating that applicants must submit the raw, real-time data collected during emissions testing and specifying that applicants are required to submit sample scale drawings of both the original and replacement labels for their DECS with their preliminary application. These changes are necessary to streamline the application and review process.

Verification Transfers. Staff's proposal updates the Procedure by adding language requiring applicants to submit a plan detailing how they will comply with the Procedures in-use compliance requirements when requesting a verification transfer.

Durability Demonstration Periods. Staff's proposal clarifies that the minimum durability demonstration period for locomotive verifications is 3000 hours.

Definitions. Staff's proposal adds definitions for the terms "Days", "Market-ready", "Recall", "Rubber-tired Gantry Crane", "Valid Warranty Claim" and "Warranty Claim", and modifies the definition of the term "baseline". These changes are necessary to support staff's proposed amendments.

Language Correction. Throughout the Procedure staff removed the word "system" where appropriate and replaced it with "strategy", as in "Diesel Emission Control Strategy", for consistency and clarity.

CHAPTER III

REGULATORY ALTERNATIVES

A. INTRODUCTION

As part of the regulatory development process, staff considered three alternatives to determine whether other approaches could provide flexibility to DECS manufacturers while maintaining the integrity of the Procedure. This section discusses these alternatives and the reasons why staff ultimately determined they are not better than the proposed amendments addressed in detail in Chapter II. No alternative considered by the agency would be more effective in carrying out the purpose for which the regulation is proposed or would be as effective as or less burdensome to affected private persons than the proposed regulation.

B. ALTERNATIVE A: DO NOT AMEND THE PROCEDURE

Failure to adopt the proposed amendments will forgo the economic benefits applicants would realize. Applicants will be required to perform two phases of in-use compliance emissions testing and this process must begin after selling or leasing 50 units in the California market. This would eliminate the increase in the sales triggers and the corresponding reduction in per unit overhead costs and additional time this change provides to applicants to the Procedure. Failure to adopt the proposed amendments would also eliminate the alternative test schedule, fail to adequately address entirely fuel-based strategies, and would not provide any alternatives regarding the need for applicants to use multiple test engines for in-use testing. Applicants would be required to remove and replace each system during the in-use compliance process, including items that may not provide useful information regarding the efficacy or durability of their verified systems. This would eliminate the much needed financial flexibility staff's proposal provides to applicants to the Procedure and would eliminate the streamlining of both the in-use compliance process and the application and review process. Without the recall provisions and warranty changes staff's ability to address potential problems with an applicant's DECS would be limited, resulting in fewer protections to the end-users of these devices. Failure to adopt the changes to the pre-installation compatibility assessments will continue to result in the retrofit of some candidate engines that are in a poor state of maintenance leading to poor performance and dissatisfied end-users. In addition, off-road DECS manufacturers would not be allowed additional time to complete their conditional off-road verifications, several critical parts of the Procedure would not be updated, and issues regarding the safe use and application of these strategies would not be adequately addressed.

C. ALTERNATIVE B: ADOPT 500 UNIT SALES TRIGGER

The U.S. EPA's Voluntary Retrofit Program currently requires in-use testing after the sale of 500 units nationwide. During the public process, applicants to the Procedure requested that staff consider adopting this sales trigger. While staff agrees that the current sales trigger of 50 units is too low both with respect to the cost of the required in-use testing and in regards to how quickly applicants are reaching the trigger after receiving their initial verification, staff does not believe that adopting a 500 unit sales trigger is appropriate. U.S. EPA's retrofit program is administered in all 50 states and ARB's in only one, California. Simply aligning the sales thresholds of both verification programs does not address the vast difference in market sizes that they represent. In the original staff report for the verification program, staff stated that they based the 50 unit sales number on U.S. EPA's Voluntary Retrofit Program (ARB 2002). To be consistent with U.S. EPA's sales trigger of 500 units nationwide, 50 units were originally selected since California possessed approximately 10 percent of the nation's population at that time.

Staff rejected this alternative due to the vast differences in market size of the two programs and because of concerns relating to the availability of an applicant's in-use test data. Allowing a sales trigger this large would delay most applicants in use testing to the point that their initial post-verification sales were well past their minimum warranty period. In-use test data submitted after the expiration of a devices warranty period is not supportive of ARB's verification program and provides limited protections to the end-users of these devices. Staff's proposal significantly increases the sales trigger before in-use emissions testing is required and includes lower cost field testing after the sale of 100 units to identify any performance issues before widespread application of an applicant's verified strategy occurs. Staff's proposal provides the requested economic relief without sacrificing the end-user protections the current in-use compliance provisions provide.

D. ALTERNATIVE C: ADOPT MAXIMUM BACKPRESSURE LIMITS

Staff considered adopting maximum backpressure limits that all applicants to the Procedure would be required to meet for verification. Setting limits that apply to all applicants equally would streamline the verification process and standardize DECS for end-users. However, ARB verifies DECS for a wide variety of vehicles and equipment making the selection of one set of backpressure requirements difficult. Staff worked closely with stakeholders but ultimately rejected adopting one set of backpressure limits for all types of DECS. Staff will continue to investigate the feasibility of requiring a universal backpressure requirement. Staff opted instead to clarify the existing requirements and require applicants to provide the software or hardware necessary to download and view all recorded backpressure data. This will allow staff to monitor the situation and to collect the data necessary to support additional changes if they are determined to be feasible.

CHAPTER IV

ENVIRONMENTAL IMPACTS ANALYSIS

A. INTRODUCTION

Based on ARB's review, staff has determined that implementation of the proposed amendments to the Procedure would not result in a significant effect on the environment. This analysis provides the basis for reaching this conclusion.

B. ENVIRONMENTAL REVIEW PROCESS

ARB is the lead agency for the proposed regulation and has prepared this environmental analysis pursuant to its certified regulatory program. Public Resources Code §21080.5 of the California Environmental Quality Act (CEQA) allows public agencies with regulatory programs to prepare a plan or other written document in lieu of an environmental impact report or negative declaration once the Secretary of the Natural Resources Agency has certified the regulatory program. ARB's regulatory program was certified by the Secretary of Natural Resources Agency[2]. As required by ARB's certified regulatory program, and the policy and substantive requirements of CEQA, ARB prepares an environmental analysis (EA) to assess the potential for significant long or short-term adverse environmental impacts associated with a proposed action[3]. In accordance with ARB's regulations, the analysis also describes any beneficial environmental impacts[4]. The CEQA Guidelines environmental checklist was used to consider the potential for significant impacts[5]. In accordance with ARB's certified regulatory program, this environmental analysis is included in the Staff Report: ISOR for the rulemaking[6].

If comments received during the public review period raise significant environmental issues, staff will summarize and respond to the comments in writing. The written responses will be included in the Final Statement of Reasons (FSOR) for the regulation. In accordance with ARB's certified regulatory program, the decision maker will approve the written responses prior to taking final action on any proposal[7]. If the regulation is adopted, a Notice of Decision will be posted on ARB's website and filed with the Secretary of the Natural Resources Agency for public inspection[8].

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[2] CEQA Guidelines §15251(d); California Code of Regulation (CCR), title 17, section 60005-60008
[3] CCR title 17, section 60005(b)
[4] CCR title 17, section 60005(d)
[5] CEQA Guidelines, Appendix G
[6] CCR title 17, section 60005
[7] CCR title 17, section 60007(a)
[8] CCR title 17, section 60007(b)

C. IMPACTS ANALYSIS

ARB has determined that this proposed action would not have a significant effect on the environment. The proposed amendments to the Procedure consist of minor administrative and procedural changes that will clarify definitions, add recall provisions, and change monitoring, testing, and reporting requirements for applicants who voluntarily participate in DECS verification process.

The proposed amendments do not change the stringency or effectiveness of the verification process or significantly impact the existing evaluation methodology of candidate diesel emission control strategies. The proposed action would simply modify an existing methodology and protocol for evaluating diesel emission control strategies. Because the Verification Procedure is not designed to generate additional emission reductions, but rather to ensure reductions occur as planned, the proposed amendments include multiple clarifications regarding the requirements for verification, a well-defined application and review process, and additional installation pre-assessment and installer requirements. These are proposed to assist applicants in their future verification efforts and to address in-field issues by ensuring that each applicant's verified technology is correctly applied. Again, these changes do not affect the stringency of the verification process but simply modify the existing evaluation protocol and better ensure that expected emissions benefits are realized. Therefore, the proposed amendments will not result in any change in emissions.

Overall, because the proposed amendments will not result in a change in the types, attributes, or number of verified diesel emission control strategies produced, these changes would neither require nor be reasonably expected to elicit a compliance response from a covered entity that could result in a physical change to the environment, directly or indirectly.

CHAPTER V

AIR QUALITY AND ENVIRONMENTAL JUSTICE

A. AIR QUALITY

The proposed amendments simply modify an existing methodology and protocol used to evaluate diesel emission control strategies. No direct emissions benefits are associated with staff's proposal. Therefore, no cost effectiveness analysis could be performed.

B. ENVIRONMENTAL JUSTICE

The objectives of ARB's statewide regulatory programs are better air quality and reduced health risk for all residents throughout California. The Board has a policy that community health and environmental justice concerns be addressed in all of ARB's regulatory programs. This is consistent with ARB's environmental justice policy of reducing exposure to air pollutants and reducing the adverse impacts from toxic air contaminants in all communities, including low-income and minority communities.

State law defines environmental justice as the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies (Senate Bill 115, Solis; Statutes of 1999, CH. 690; Government Code section 65040.12 (c)). The Board has established a framework for incorporating environmental justice into ARB's programs consistent with the directives of State law. The policies developed apply to all communities in California, but recognize that environmental justice issues have been raised more in the context of low-income and minority communities, which sometimes experience higher exposures to some pollutants as a result of the cumulative impacts of air pollution from multiple mobile, commercial, industrial, area wide, and other sources. For over 25 years, ARB, local air districts, and federal air pollution control programs have made substantial progress towards improving the air Quality in California. However, some communities continue to experience higher exposures than others as a result of the cumulative impacts of air pollution from multiple mobile and stationary sources and thus suffer a disproportionate level of adverse health effects.

The Diesel RRP is effectively reducing the risk associated with exposure to air pollutants and the adverse impacts from toxic air contaminates in all communities, including low-income and minority communities. The Procedure plays a vital role in supporting the Diesel RRP by ensuring that DECS applied to in-use vehicles achieve real and durable PM and NO_x emissions reductions. Thus, it is consistent with ARB's environmental justice policy of reducing exposure to air pollutants and reducing the adverse impacts from toxic air contaminates in all communities, including low-income and minority communities.

The proposed amendments do not change the stringency of the Procedure so there is no emissions impact associated with the proposal. However, ARB will continue to evaluate diesel emission control strategies as these technologies improve and will review the Procedure as additional relevant scientific evidence becomes available to make certain that the health of the public is protected.

To ensure that everyone has an opportunity to stay informed and participate fully in the development of the proposal, staff held several public workshops, multiple conference calls and meetings with affected industry, and distributed information through the internet and on ARB's public website, as described in Chapter I of this report.

CHAPTER VI

ECONOMIC IMPACT ANALYSIS PREPARED PURSUANT TO GOVERNMENT CODE SEC. 11346.3

A. LEGAL REQUIREMENTS

Section 11346.3 of the Government Code requires State agencies to assess the potential for adverse economic impacts on California business enterprises and individuals when proposing to adopt or amend any administrative regulation. The assessment shall include a consideration of the impact of the proposed regulation on California jobs, business expansion, elimination or creation, and the ability of California business to compete with business in other states.

State agencies are also required to estimate the cost or savings to any State or local agency and school district in accordance with instructions adopted by the Department of Finance. The estimate is to include any non-discretionary cost or savings to the local agencies and the cost or savings in federal funding to the State.

The determinations of the Board's Executive Officer concerning the costs or savings necessarily incurred by public agencies and private persons and businesses in reasonable compliance with the proposed amendments are presented below.

B. ESTIMATED COSTS OF THE PROPOSED AMENDMENTS

The proposed amendments to the Procedure are intended to provide financial flexibility to applicants[9] while maintaining the integrity of the verification program. Staff's proposal reduces the amount of required in-use compliance testing by up to one-half and allows additional sales before this testing is required. The addition of functional in-field tests and the alternative test schedule further reduces the costs associated with the in-use compliance requirements. Streamlining the in-use compliance process and providing additional time for applicants to complete their conditional verifications provides even greater financial flexibility. These proposed changes provide substantial economic relief to applicants, especially in the short term. The addition of recall provisions and clarifications to the warranty reporting requirements are necessary to maintain the stringency of the Procedure and ensure the in-use performance of DECS, but may offset some of the cost savings provided above. Staff has analyzed each proposed amendment to determine potential economic impacts. For more information on the methodology used to calculate the estimated costs and savings of staff's proposal, please see Appendix C.

[9] DECS manufacturers are referred to as "applicants" in the Procedure and throughout this report.

Overall, the proposed amendments to the Procedure are estimated to save the DECS industry approximately $2.1 million to $5.6 million. Below is a description of the potential cost or savings of each of the proposed major amendments to the Procedure.

In-Use Compliance Requirements. The proposed amendments to the Procedures in-use compliance requirements would reduce an applicant's in-use testing costs by up to one-half. The addition of functional in-field tests, the alternative test schedule, and streamlining the process provides even greater financial flexibility to all applicants. Staff estimates the overall savings to DECS industry (specifically companies that already have verified DECS) from the proposed changes will be approximately $5 million to $5.7 million for currently verified DECS families. For companies pursuing verification for new products, the proposed changes could reduce overall verification costs by 10 percent.

Recall Provisions. The proposed recall provisions could potentially increase long-term costs for all applicants and have the potential to create a significant economic impact for any applicant subject to a recall action. The Procedure currently includes provisions that provide for remedial measures in the event of a failure associated with applicant's DECS family, so even without the addition of the proposed recall provisions it is assumed that applicants have made appropriate financial preparations and that such costs are already being incurred. Though the proposed recall provisions do not impose a direct cost to industry, staff estimates that in the event of a recall action the potential economic impact could be up to $2.8 million for an applicant of a verified on-road system.

Installation Warranty Reporting. Staff's proposal requiring authorized installers to submit an annual installation warranty report will result in an additional cost for each installer. Staff estimates that the proposed changes will cost each installer approximately $960 each year. This represents an annual statewide reporting cost of $73,000 based on 76 businesses that are currently installing ARB verified retrofit devices.

Pre-Installation Compatibility Assessment, Installer Requirements, and End-User training. Staff's proposals requiring applicants to specify additional pre-installation assessment criteria, additional requirements for installers, and end-user training are not expected to result in any significant economic impacts.

Application and Review Process. The proposed changes to the application and review process should have no economic impact. Staff's proposal merely defines the application and review process to better define the requirements for verification and the process used by staff in reviewing verification applications.

Impacts of Other Clarifications. None of the remaining proposed clarifications to the Procedure are expected to result in any additional costs or savings, because they implement the original intent of the regulation.

C. POTENTIAL IMPACT ON BUSINESSES, BUSINESS COMPETITIVENESS, EMPLOYMENT, AND BUSINESS CREATION, ELIMINATION, OR EXPANSION

Potential Impact on Businesses. The proposed amendments to the Procedure's in-use compliance requirements would provide substantial reduce the cost to applicants by reducing the amount of required in-use compliance testing, providing multiple testing options, allowing additional unit sales before this testing is required, providing in-field functional testing, and streamlining the process. The proposed changes will reduce the costs associated with the in-use compliance requirements and are expected to provide a savings to industry of approximately $5 million to $5.7 million for the currently verified DECS families, and reduce the overall costs of future verifications by 10 percent.

The proposed recall provisions could potentially create a significant economic impact for any applicant subject to a recall action. However, the Procedure currently includes less direct provisions that provide for remedial measures in the event of a failure of an applicant's DECS family, so even without the addition of the proposed recall provisions it is assumed that applicants have made appropriate financial preparations and that such costs are already being incurred. Should a recall event occur applicants may see their savings from the proposed changes to the in-use compliance requirements eliminated. Staff estimates the potential economic impact of a recall action could be up to $2.8 million. However, applicants that produce a robust system are unlikely to be subject to a recall and would realize the economic benefits from the reduction in the amount of in-use testing.

The proposed amendment requiring the submission of an annual installation warranty report will cost each installer approximately $960 each year. However, the benefit of receiving these reports outweighs the relatively low cost of the reporting. The estimated annual statewide reporting cost is $73,000 based on 76 businesses that are currently installing ARB verified DECS.

The remaining amendments represent procedural changes and clarifications and should not result in any significant impacts on businesses. Overall, the proposed amendments are expected to provide a savings to the DECS industry of approximately $2.1 million to $5.6 million.

Potential Impact on Business Competitiveness. The requirements for verification under the Procedure apply to any business that elects to participate in the program regardless of its location. Staff's proposal does nothing to alter the applicability of the program, and does not hold California business to a different standard than non-California business. Manufacturers that participate in the verification program need to provide detailed information and data on their products in accordance with the Procedure. The proposed amendments do not change the voluntary nature of the Procedure or its applicability to all businesses that manufacture or market diesel emission control technologies regardless of their location. As previously stated, installers of verified products will incur an additional reporting expense of $960 per year.

Potential Impact on Employment. The proposed amendments to the Procedure are not expected to cause a noticeable change in California employment and payroll. Staff does not believe the regulatory proposal would result in the loss of jobs. As previously noted, participation in the program is voluntary. If and when the recall provisions are used is unknown, so there is no assurance that an increase in the demand for repairs will materialize. Even if a recall occurs, most repair businesses are expected to handle the additional work with their existing employees.

Potential Impact of Business Creation, Elimination or Expansion. The proposed amendments to the Procedure will not impact the status of California business in a noticeably different way from the current version of the Procedure. The proposed amendments could potentially affect small businesses, especially installers of verified devices. Installers who choose to install these verified devices would incur costs due to increased reporting requirements but these costs are not expected to be significant. Overall, staff expects that the proposed amendments to the Procedure will have no significant adverse impact the status of California businesses, including small businesses.

D. Potential Impact to California State or Local Agencies

Staff does not expect the proposed amendments to the Procedure to have a fiscal impact on any local or State agency except ARB to monitor warranty reports, investigate potential warranty claims, and develop and maintain a warranty tracking database in fiscal year 2013/2014 and thereafter. One additional staff will be needed to effectively implement the proposed amendments. The total annual staff costs are estimated to be $187,000 (including $175,000 for staff costs and $12,000 for travel expenses).

CHAPTER VII

SUMMARY OF PROPOSED REGULATORY CHANGES

A. SUMMARY OF PROPOSED REGULATORY CHANGES

This section provides an explanation or rationale for each proposed change included in the proposed regulation order in Appendix A. to the *Verification Procedure, Warranty and In-Use Compliance Requirements for In-Use Strategies to Control Emissions from Diesel Engines* (the Procedure).

Amendments to Title 13, CCR, Section 2700. Applicability.

Modifications to this section include the addition of the term "market-ready" to clearly identify that the Procedure is intended to apply to market-ready DECS that are fully designed, developed, and ready for introduction into commerce.

Amendments to Title 13, CCR, Section 2701. Definitions.

Changes to this section include modifications to definitions to update the Procedure and the addition of terms needed to support the proposed amendments.

The following definitions are being modified:

(9) The definition of "Baseline" is being modified to clarify that the term refers to an engine or test vehicle in its original equipment manufacturers configuration. Modified or altered engines or test vehicles cannot reasonably be expected to produce baseline emissions test results.

(29) The definition of "Installer" is being modified for updating numbering and to include the additional designation of "Authorized Installer" to support staff's proposed amendment that requires applicants to authorize the installers of their verified DECS.

The following definitions are being modified for minor edits and updated numbering:

(14) "Diesel Emission Control Strategy",
(15) "Diesel Emission Control Strategy Family Name", (16) "Diesel Engine",
(17) "Diesel-Fueled Auxiliary Power System", (18) "Distributor",
(19) "Donor Vehicle/Engine", (20) "Durability", (21) "Emergency Standby Engine",
(22) "Emergency Use", (23) "Emission Control Group", (24) "End User",
(25) "Executive Officer", (26) "Executive Order", (27) "Fuel Additive", (28) "Hot Start",
(30) "Locomotive", (31) "Marine Engine", (33) "Portable Engine", (36) "Re-designation",
(37) "Regeneration", (38) "Repower", (39) "Revoke", (41) "Seller",

(42) "Stationary Engine", (43) "Transport Refrigeration Unit",
(44) "Unidirectional Device Design and Installation", (45) "Used Verified Device",
(47) "Verification", (49) "Warrantable Condition"

The following definitions are being added:

(13) The definition of "Days" is being added to clarify that the various submission time limits are determined based on normal working days of ARB.

(32) The definition of "Market-Ready" is being added and is used to define a diesel emission control strategy that is ready for application to the Procedure.

(34) The definition of "Quarterly Reports" is being added to support the reporting requirements of the proposed recall provisions.

(35) The regulation has changed and now provides ARB's Executive Officer with recall authority to remedy the systemic failure of an applicant's verified strategy, or to address issues of safety or the potential for catastrophic failure. Therefore, a definition of "Recall" is being added to the regulation.

(40) The Procedure can be used to verify a diesel emission control strategy intended for use with a rubber-tired gantry crane, therefore, a definition of "Rubber-Tired Gantry Crane" is being added to the regulation.

(46) Applicants to the Procedure are required to submit annual warranty reports once their products are verified, and may need to submit supplemental reports if valid warranty claims exceed a 4 percent threshold. Therefore, a definition of "Valid Warranty Claim" is being added to the regulation. Also, the definition is needed to clarify how applicants are to determine if the 4 percent threshold has been exceeded.

(48) Applicants are required to address all warranty claims in their annual reports, but must take specific actions if valid warranty claims exceed 4 percent. Therefore, a definition of "Warranty Claim" has been added to the regulation to clarify the difference between the 2 types of warranty claims.

Amendments to Title 13, CCR, Section 2702. Application Process.

This section identifies the requirements necessary for application to the Procedure, the application review process, the verification Levels or Marks that may be assigned to an applicant's DECS family by the Executive Officer, the requirements for extending an existing verification, modifying the design of a verification, verification transfers, requirements for pre-existing data from other verification programs, addresses the treatment of confidential information, identifies ARB testing and inspection requirements for verified products including right of entry provisions, and the procedures including penalties that may be assessed by the Executive Officer for violating the requirements of the application process.

(a) Overview. The modifications to this section include minor edits and clarify that applicants seeking to verify their product for more than one emissions control group must address this in their proposed test plan by including test engines and testing conditions that are representative of the least favorable conditions.

(b) Preliminary Verification Application. The modifications to this section are for minor edits and to provide the Executive Officer with the authority to request a market-ready DECS along with an applicant's preliminary verification application. The Procedure is not intended to address prototypes or concepts and unless an applicant is ready to enter the market place with their DECS at the time of application they cannot provide the detailed information necessary to successfully navigate the verification process. Previously ARB staff has received preliminary applications that were based on prototype systems that needed further research and development to become fully verified. Because the information needed to finish the application is not complete, the application is delayed and in some cases never completed. ARB staff processes applications in the order received so if the DECS is not market-ready, the application process will take longer to process and may hold up the verification process for other DECS manufacturers that have already submitted applications with market-ready systems. This amendment will allow ARB staff to process the application as well as help to expedite the verification process. This new requirement is necessary to address any DECS that may not be ready to complete the Procedure. Any DECS submitted will be returned to the applicant, at the applicant's expense, when verification is granted, denied, or withdrawn.

(b)(5)(c) This subsection was updated to correct the section reference.

(c) The modifications to this section are for minor edits and to remedy an oversight regarding the identification of the appropriate ARB Branch to which specific types of applications should be directed. The changes identify the appropriate ARB Branch for submitting locomotive, stationary, and rubber-tired gantry cranes applications.

(d) Application Format. This section includes a detailed outline of required information that applicants to the Procedure should use to develop their preliminary and final verification applications. The changes to this section include minor edits, elimination of duplicative information, and additional language necessary to update the Procedure. These include:

2.7 Additional clarifying language that the previously required safety discussion has been revised to include an analysis of all potential safety and catastrophic failure issues as identified in section 2706(w).

2.10.2 A new subsection requiring applicants to provide objective criteria in their applications for determining if a DECS has been properly cleaned.

3.1, 3.2, 3.3, 3.4, 3.5, and 3.5.1 These subsections were updated to correct the numbering sequence.
6.3 This subsection was updated to correct the section reference.

8.A. Replacing "laboratory" with "emissions" to clarify the appropriate test report.

8.A.1 Clarification that applicants must submit the raw, real-time data gathered by the emissions test facility for submission with their application.

8.C. Removal of this duplicative requirement.

8.E. Clarification that applicants are required to submit sample scale drawings of both their original and replacement DECS labels with their application.

(e) Preliminary Verification Application Review Process. Several new subsections have been added to clarify and provide specificity to the application and review process currently used by staff to evaluate an applicant's DECS to ensure that it meets the requirements of the Procedure.

(e)(1) Review for Completeness. The Executive Officer will notify applicant if preliminary application is complete within 30 days of receipt. If application is deemed incomplete, applicant will have three opportunities to submit missing information/data or application will be considered terminated.

(e)(2) Engineering and Compliance Review. After determining that the preliminary application is complete, the Executive Officer will conduct a technical review and determine if the application is adequate to support the development of a test plan. If deemed inadequate, the Executive Officer will request additional information. Applicant will have three opportunities to submit additional information/data or the application will be considered terminated.

(e)(3) Test Plan Approval Letter. Following the Engineering and Compliance review and determination that the application is adequate and satisfactory, the Executive Officer will issue a test plan approval letter within 45 days.

(e)(4) This new subsection provides instructions on what must be done if application is terminated and applicant wishes to attempt verification again. The applicant must wait 30 calendar days before submitting a new, revised preliminary application.

(f) Final Application Review Process. The changes to this section provide an expanded explanation of the final application review process. Four subsections were added as follows:

(f)(1) This subsection clarifies that a final application may not be reviewed by the Executive Officer unless a test plan approval letter has been issued to the applicant.

(f)(2) Review for Completeness. This subsection clarifies that the Executive Officer will review final application for completeness and applicant will have three opportunities to complete the application in the event information is missing.

(f)(3) Test Results and Compliance Review. This subsection clarifies that once the application is considered complete the Executive Officer will have 60 days to determine if the diesel emission control strategy merits verification and will classify it per the emission reduction levels of Table 1 as shown in this subsection.

(f)(4) This new subsection provides instructions on what must be done if the final application is terminated and the applicant wishes to attempt verification again. The applicant must wait 30 calendar days before submitting a new, revised final application.

(g) Application Termination. This new section provides language to clarify that in the event the Executive Officer terminates an application at any point in the application review process, the applicant must wait a minimum of 30 days to submit a new, revised application that addresses the deficiencies that caused the original termination.

(h) and (i) These sections were updated to correct the numbering sequence and section references.

(j) Design Modifications. This section was updated to correct the numbering sequence and new language was added to inform applicants that if the design of their DECS is modified at any point in the review process, the application will be considered terminated. Applicants may resubmit by following the requirements of sections 2702(g). Clarifying language was also added to provide examples of what is considered a design modification.

(k) Verification Transfers. This section was updated to correct the numbering sequence and a new subsection was added requiring applicants to submit In-Use Compliance plans per requirements of Section 2709 when requesting a verification transfer.

(l) and (m) These sections were updated to correct the numbering sequence.

(n) Recordkeeping Requirements. This section was updated to correct numbering sequences, section references, and to clarify that installers of DECS are now referred to as authorized installers. This last clarification is necessary to support the proposed requirement that applicants must train and authorize any person or company that installs their DECS.

(o) and (p) These sections were updated to correct the numbering sequence.

(q) This section was updated to correct the numbering sequence and new language added to clarify that the Executive Officer may request, for the purposes of inspection or testing, uninstalled DECS that are in the possession of an applicant's authorized dealer or distributor.

(r) This new section clarifies that ARB has the right of entry for the purposes of selecting new DECS for inspection or testing. The proposed changes are necessary to allow ARB staff, upon proper notice and presentation of credentials, the right to enter any facility for the identification and selection of DECS verified under the Procedure for testing and/or inspection.

(s) This section was updated to correct the numbering sequence and clarifying language added to include "recall plan" as one of the documents for which the Executive Officer may revoke or lower the verification level in the event that there are errors, omissions, inaccurate information, fraudulent or deficient submittals. This change is necessary to support the proposed recall provisions. An additional clarification also stipulates that any changes to the DECS that are not authorized by ARB will subject the applicant to enforcement action. This last change is necessary to support the proposed clarifications to section (j) Design Modifications.

Amendments to Title 13, CCR, 2703. Emission Testing Requirements.

The Procedure currently requires applicants to test their DECS to determine its emissions reduction capabilities on an emission control group basis. This section identifies the emissions testing requirements and test procedures that applicants must follow to verify the emissions reductions capabilities of their DECS. The proposed changes include clarifying language which define distinct emission control groups, provide guidance on test engine selection, and DECS sizing.

(a) Testing on an Emission Control Group Basis

(a)(1) This subsection was updated to correct the numbering sequence.

(a)(2) This new subsection was added to inform applicants that, when requesting verification for more than one emission control group, they must propose a test plan that includes one or more test engines that are representative of the least favorable conditions within the requested emission control group.

(a)(3) This new subsection was added to assist applicants in the selection of an emissions test engine. The proposed language clarifies the attributes of the emission control group that should be considered when selecting a representative emissions test engine. The proposed changes are necessary to provide guidance to applicants in the selection of an appropriate test engine.

(b) Test Engine Requirements and Pre-Conditioning.

(b)(1) This new subsection adds clarifying language stipulating that if an applicant's DECS has the potential to form NO_2 or other secondary emissions they must identify this in their application and requires them to provide information showing that their proposed emissions test engine is representative in regards to this potential.

(b)(2) This subsection was updated to correct the numbering sequence.

(c) Diesel Emission Control Strategy Requirements and Pre-conditioning. The term "Requirements and" was added to the name of this section to address the addition of new clarifying language designed to assist applicants.

(c)(1) This new subsection adds clarifying language instructing applicants to appropriately size the diesel emission control strategy in relation to the emissions test engine and stipulates that this must be based on DECS sizing information contained in their application. Applicants should not violate their DECS sizing criteria during emissions testing as this may alter test results. This new language also clarifies that if the sizing criteria is changed either after receiving a test plan approval or during the application review process, the application must be re-evaluated and a new test plan approved. Additionally, the proposed language advises applicants that any testing done prior to the sizing criteria approval may result in the rejection of test data.

(c)(2) This new subsection clarifies that if an applicant's DECS includes single and multiple filter designs, both designs must undergo full emissions and durability testing. Additionally, this language clarifies the conditions under which single and multiple filter configurations will not require separate emission and durability testing.

(c)(3) This subsection was updated to correct the numbering sequence.

Amendments to Title 13, CCR, Section 2704. Durability Testing Requirements.

The Procedure currently requires applicants to demonstrate the durability of their DECS through an actual field or laboratory based demonstration. This section identifies the durability demonstration requirements and the requirements for conditional verification. The proposed changes include clarifying language which define distinct emission control groups, provide guidance on durability engine selection, DECS sizing, and propose allowing additional time to complete off-road conditional verifications.

(a)(1) This new subsection clarifies that laboratory-based durability demonstrations are not acceptable as the primary durability data used to support verification for a DECS for on-road, off-road, or APU applications. This clarification is necessary as laboratory-based demonstrations are generally insufficient at recreating the conditions that an applicant's DECS experiences during normal use in these applications. However, applicant's may request that the Executive Officer consider a laboratory-based durability demonstration as secondary supporting data.

(a)(2) and (a)(3) These subsections were updated to correct the numbering sequences.

(b)(1) This new subsection was added to inform applicants that, when requesting verification for more than one emission control group, they must propose a test plan that includes one or more durability test engines and applications that are representative of the least favorable conditions within the requested emission control group.

(b)(2) This new subsection was added to assist applicants in the selection of a durability test engine. The proposed language clarifies the attributes of the emission control group that should be considered when selecting a representative durability test engine and application. The proposed changes are necessary to provide guidance to applicants in the selection of an appropriate durability test engine and application

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(c) Engine Selection and Sizing. This section was updated to correct the numbering sequence and the term "and Sizing" was added to the name of this section to address the addition of new clarifying language designed to assist applicants.

(c)(1) This subsection was modified to correct the numbering sequence and clarifying language has been added stipulating that applicants must identify the durability test engine, vehicle, and application. The proposed changes are designed to assist applicants by providing additional guidance in the development of their verification applications.

(c)(2) and (c)(3) These subsections were updated to correct the numbering sequence.

(c)(4) This new subsection adds clarifying language instructing applicants to appropriately size the diesel emission control strategy in relation to the durability test engine and stipulates that this must be based on DECS sizing information contained in their application. Applicants should not violate their DECS sizing criteria during durability testing as this may alter test results. This new language also clarifies that if the sizing criteria is changed either after receiving a test plan approval or during the application review process, the application must be re-evaluated and a new test plan approved. Additionally, the proposed language advises applicants that any testing done prior to the sizing criteria approval may result in the rejection of test data

(c)(5) This new subsection clarifies that if an applicant's DECS includes single and multiple filter designs, both designs must undergo full emissions and durability testing. Additionally, this language clarifies the conditions under which single and multiple filter configurations will not require separate emission and durability testing.

(d) Test Fuel. This section was updated to correct the numbering sequence.

(e) Service Accumulation. This section was updated to correct the numbering sequence and to identify the appropriate minimum durability demonstration period for locomotives.

(e)(2) This subsection was updated to clarify the temperature and backpressure data submission requirements. Applicants are required to submit the collected data electronically in a spreadsheet and clarifying language was added instructing applicants that failure to submit the data in an approved format will terminate the application process.

(e)(4) This new subsection clarifies that error codes, fault codes, and high backpressure codes that are generated by a diesel emission control strategy's electronic control system and/or operational monitoring system during the durability demonstration are to be submitted with the date and time each code occurs so that staff may validate that that system was durable and safe throughout the demonstration period.

(e)(5), (e)(6), and (e)(7) These subsections were updated to correct the numbering sequence.

(f) Third-Party Statement for In-field Durability Demonstrations. This section was updated to correct the numbering sequence.

(g) Test Cycle. This section was updated to correct the numbering sequence.

(h) Test Run. This section was updated to correct the numbering sequence.

(i) Maintenance During Durability Demonstration. This section was updated to correct the numbering sequence.

(j) Functional Testing of Monitoring and Notifications. This section was updated to correct the numbering sequence.

(k) Performance Requirements. This section was updated to correct the numbering sequence.

(l) Conditional Verification for Off-road and Stationary Applications. This section was modified to clarify the application categories, to extend the time allotted to complete a conditional verification for off-road applications from one year to two years, and to clarify that conditional verifications are not applicable to strategies that include the use of alternative diesel fuels or fuel additives.

(m) Failure During the Durability Demonstration Period. This section was updated to correct the numbering sequence.

Amendments to Title 13, CCR, Section 2705. Field Demonstration Requirements.

The Procedure currently requires applicants to demonstrate the compatibility of their DECS through an actual field demonstration. If an applicant performs an in-field durability demonstration it may be used to satisfy this requirement. This section identifies the field demonstration requirements. The proposed changes include clarifying language for submitting data collected during field demonstrations.

(c)(1) Temperature and Backpressure Measurement Requirements. This subsection was updated to clarify the temperature and backpressure data submission requirements. Applicants are required to submit the collected data electronically in a spreadsheet and clarifying language was added instructing applicants that failure to submit the data in an approved format will terminate the application process.

(c)(3) Electronic System Codes. This new subsection clarifies that error codes, fault codes, and high backpressure codes that are generated by a DECS electronic control system and/or operational monitoring system during the field demonstration are to be submitted with the date and time each code occurs so that staff may validate that that system was durable and safe throughout the demonstration period.

(c)(4) This subsection was updated to correct the numbering sequence.

(c)(5) This subsection was updated to correct the numbering sequence.

Amendments to Title 13, CCR, Section 2706. Other Requirements.

The Procedure currently has additional requirements such as an NO_2 allowance, limits on other pollutants, test procedures for fuel additives and selective catalytic reduction (SCR) strategies, data monitoring and labeling requirements, and additional requirements for both applicants and installers of verified DECS. This section identifies these additional requirements. The proposed changes to this section include verification process clarifications and several proposed amendments related to high backpressure notification and data monitoring and storage, pre-installation compatibility assessments, system labeling clarifications, additional requirements for installers, training requirements, and safety considerations.

(a)(4)(A)(3) This subsection was updated to correct the numbering sequence and to clarify that the date and time must also be recorded for all backpressure and temperature measurements.

(a)(4)(A)(4) This subsection was updated to correct the numbering sequence.

(a)(4)(C) In-use compliance testing. This section was modified by removing the reference to the first phase of in-use compliance testing. This modification is required to align this section with the proposed changes to the in-use compliance requirements. In-use tests are no longer referred to as phase 1 and 2, but are now referred to as "field" and "emissions" tests.

(b)(1)(A) Limits on Other Pollutants. This section has been modified to add a reasonable emission measurement tolerance level when measuring Non-Methane Hydrocarbon (NMHC) emissions. This is necessary because the current requirement of ten percent over baseline emissions levels for very low emissions engines may be not quantifiable with current laboratory procedures. This change provides a measurable allowance for test engines with near-zero NMHC levels.

(c) Fuel Additives. This section was modified to correct a typographical error.

(c)(5) This subsection has been modified to require applicants of DECS that use fuel additives to obtain U.S. EPA registration prior to submitting an application for verification. Reviewing an applicant's verification application that is concurrently seeking U.S. EPA registration can lead to delays in the verification process. This proposed change will streamline the verification process for all applicants.

(d) Alternative Diesel Fuels. This section has been modified to require applicants of DECS that use alternative diesel fuels to obtain U.S. EPA registration prior to submitting an application for verification. Reviewing an applicant's verification application that is concurrently seeking U.S. EPA registration can lead to delays in the verification process. This proposed change will streamline the verification process for all applicants.

(f)(3) The proposed modifications to this subsection are to clarify that an applicant's backpressure monitor must include, at a minimum, two distinct notification levels or "stages"; the first as the high backpressure limit is approached and the second, when it is reached or exceeded and that the second or final notification must be non-resettable by the end-user. This non-resettable condition is referred to as "latching". The proposed changes clarify that the latching feature, once triggered, must remain on if the vehicle or engine is turned off or loses power, and must immediately resume when the system or vehicle becomes operational. This will ensure that end-users of these systems can take appropriate action and avoid potential damage to their vehicles or equipment. The proposed changes also clarify that these requirements apply to any DECS that includes a DPF or other such device that can increase backpressure over time, such as a DPF used in combination with SCR. This subsection also clarifies that vehicles or equipment operated from multiple locations must include a secondary notification system on the vehicle or equipment to alert the operator of a high back pressure condition.

(f)(3)(A)(1) Clarifies that the final high backpressure must be non-resettable.

(f)(3)(A)(2) Clarifies that if the notification is triggered and the engine is then turned off, then it must resume when the engine is turned back on.

(f)(3)(A)(3) Clarifies that if the notification is triggered and the system loses power or becomes non-functional that the notification must resume when the system resumes operation. This change is necessary to ensure continuity of operation for all systems.

(f)(5) Clarifies that this subsection applies to all systems with backpressure monitors and removes the previous limitation that only specified this requirement for strategies that included an exhaust temperature requirement. The broader application is necessary to clarify the requirements and ensure that all end-users of these devices are informed of potential high backpressure conditions.

(f)(5)(B) This subsection provides clarifications that these systems record date and time for exhaust backpressure and exhaust gas temperature. Clarifications include specifying that the 200 hour recording capacity must include the date and time of measurement, and clarify that each record must consist of the instantaneous measurement or an average of no more than 30 seconds, provided the maximum and minimum values are also recorded for the same averaging period. The proposed changes are necessary to identify minimum requirements for all systems.

(f)(5)(C) This subsection clarifies that system error codes must also include high backpressure codes and each record must include the code and date and time it occurred. While most applicants are already using systems that meet these requirements, this clarification is necessary to identify minimum requirements for these systems that are clear and concise for all applicants.

(f)(6) This new subsection includes requirements that all applicants make available to the Executive Officer upon submission of an application for verification any software or hardware necessary to download and view all recorded data from their monitoring systems. In addition, this subsection requires currently verified DECS to submit any such software or hardware to the Executive Officer within six months following the effective date of these proposed amendments. These new requirements are needed to allow staff to monitor in-use systems and ensure that they are functioning properly and are adhering to the requirements of the Procedure.

(i)(2)(g) This subsection was updated to correct the section reference number.

(j)(1) System Labeling. This section has been modified to clarify that DECS labels must be constructed and affixed so they remain legible and resist tampering for the duration of each strategy's minimum warranty period. In addition, to address the issue of missing labels, a provision was added that requires end-users to notify applicants in the event of a missing or damaged label and specifies that the applicant must issue an ARB approved replacement label within 45 days. This last clarification is designed to address several in-field issues recently identified by staff regarding vehicles and equipment with missing labels.

(j)(2) This subsection was modified to correct typographical errors.

(l) Owner's Manual. This section has been modified to clarify minimum requirements that each applicants owner's manual must adhere to. The proposed changes are necessary to ensure that end-users receive the information necessary to safely operate and maintain their DECS. The proposed changes are as follows:

(l)(1) Table of Contents must be located at the beginning of the owner's manual and identifies the location of the subsection (2) through (18).

(l)(2) This clarifies that the manual must contain a statement alerting the end-user of their responsibility to maintain the candidate engine so that it continues to meet the pre-installation compatibility assessment conditions identified in section 2706(t).

(l)(3) This subsection was updated to correct the numbering sequence.

(l)(4) This subsection was updated to correct the numbering sequence.
(l)(5) This new subsection clarifies that applicants must provide criteria that can be used by end-users to determine if their DECS has been properly cleaned.

(l)(6), (l)(7), (l)(8), (l)(9), (l)(10), (l)(11), (l)(12), (l)(13), (l)(14), (l)(15), (l)(16), (l)(17), and (l)(18) These subsections were updated to correct the numbering sequence.

(n) Installation Manual. This section was modified to clarify that the installation manual needs to provide sufficient detail to enable the installer to properly install DECS. The proposed change is necessary to support the proposed clarifications to the installation warranty requirements.

(n)(1) This new subsection requires applicants to provide the criteria in their installation manual that they will use to authorize a person or company to install their verified device. The proposed change is necessary to support the proposed installer requirements.

(n)(2) This new subsection requires applicants to provide the criteria in their installation manual that they will use to revoke a person or company's authorization to install their verified device. The proposed change is necessary to support the proposed installer requirements.

(t) Pre-Installation Compatibility Assessment. This section describes the pre-installation compatibility assessment requirements required under the regulation that are used to demonstrate that the candidate engine being considered for retrofit is compatible with the verified DECS and meets conditions of the Executive Order prior to installation. The Procedure currently includes these assessment procedures in part to help ensure that candidate engines are properly screened prior to retrofit which results in fewer problems in the field. Modifications to this section are being proposed because even with these basic assessment procedures, in-field problems are still being reported by fleets and individuals. These reports indicate that candidate engines were retrofit even though they were likely in a very poor state of maintenance. To address this, the proposed amendments add additional requirements to the pre-installation compatibility assessment procedures to better ascertain the "health" of the candidate engine prior to retrofit.

(t) The modifications to this section include the identification of "authorized" installers to align with the proposed installer requirements. Also, new language is being proposed to clarify that the pre-installation compatibility assessment must ensure that the candidate engine meets all the terms and conditions of the Executive Order prior to DECS installation.

(t)(1) This new subsection requires all applicants to establish specific criteria to determine the suitability of the candidate engine prior to retrofit and provide this information to their installers. One such criterion must include a smoke opacity limit, as determined by the Society of Automotive Engineers J1667[2] test procedures, which can be used by DECS installers to determine if the candidate engine is in a proper state of maintenance. These changes are necessary to validate the condition of the candidate engine prior to installation.

(t)(1)(A) This new subsection specifies that applicants must establish specific criteria such as oil consumption limits, fuel inspection requirements, visual inspections, and other criteria they deem necessary to ensure that the candidate engine is appropriate for use with their verified DECS. Along with the smoke opacity limit, this will allow installers to validate the condition of the candidate engine prior to installation.

(t)(1)(B) The purpose of this new subsection is to require that all applicants select a smoke opacity limit they determine is best suited for use as a screening tool to ensure that their DECS is not installed on an engine in a poor state of maintenance.

(t)(1)(C) This new subsection requires applicants of currently verified DECS to propose a pre-assessment smoke opacity limit for their devices no later than six months following the effective date of the proposed changes.

(t)(1)(D) This new subsection requires applicants with DECS designed for engines and equipment that are unable to perform SAE J1667 smoke opacity test procedures to propose an alternate criterion to be used in its place.

(t)(2) This subsection was updated to correct the numbering sequence and to clarify that the exhaust gas temperature measurements used to determine if the temperature requirements specified by the Executive Order are satisfied must be based on the most challenging pattern of use of the engine. Also, this subsection has been clarified by identifying the applicant as the sole entity that may elect to assess a representative number of candidate engines from a fleet rather than each similar engine. These proposed changes are necessary to ensure that each installation of a DECS with a temperature requirement is done properly to eliminate performance issues.

(t)(2)(C) The modifications to this subsection include the identification of "authorized" installers to align with the proposed installer requirements and a clarification that specifies that the required written statement to the end-user must be provided to the same at the time of installation. Previously this requirement specified a time frame of no later than the date of installation. This results in pre-assessments being performed well in advance of the DECS installation. This has led to in-field problems from engine conditions that have deteriorated before the DECS installation occurred.

(t)(2)(C)(9) The modifications to this subsection include the identification of "authorized" installer to align with the proposed installer requirements and other minor proposed changes to align with the other proposed changes.

(t)(2)(C)(10) This new subsection was added to include the requirement that the applicant or authorized installer provide a written statement to end-use that any change in the pattern of use of the candidate engine that was assessed to determine if it meets the temperature requirements may cause the DECS to fail to meet the temperature requirements and how such a change may affect the performance of DECS.

(t)(2)(E), (t)(2)(E)(1), (t)(2)(E)(2), and (t)(2)(E)(3) These subsections were updated to correct the numbering sequence.

(t)(2)(E)(4) This subsection was updated to correct the numbering sequence. Additional modifications include an allowance to provide flexibility for permitted emergency standby engines with restricted use requirements to propose a period of less than 24 hours for measuring and recording the exhaust gas temperature. The regulation requires exhaust gas temperature of the candidate engine to be measured for at least 24 hours. This proposed change is necessary to ensure that emergency standby engines with restricted use requirements are provided with retrofit as a potential compliance option.

(t)(2)(E)(5), (t)(2)(E)(6), and (t)(2)(E)(7) These subsections were updated to correct the numbering sequence.

(t)(3) Modifications to this subsection include the clarification that additional compatible formats may be used to electronically submit all logged data such as Microsoft Access and an additional change in the language to clarify that the party conducting the pre-installation compatibility assessment may not necessarily be the installer.

(t)(4) This subsection was modified to correctly identify that the pre-assessment may be performed by the applicant or their authorized installer, that the pre-assessment must include the added criteria of 2706(t)1, and that the assessment must occur no more than 15 days prior to retrofit. These changes are necessary to implement the added pre-assessment criteria and to ensure that theses assessments are done such that they are still valid at the time of installation. However, this time frame only applies to the assessment performed to determine the state of maintenance of the candidate engine and not the suitability of the exhaust gas temperature profile.

(u) Requirements for Installers of Diesel Emissions Control Strategies. This new section specifies additional requirements for any party that install a verified DECS. The proposed changes require that applicants authorize the installers of their DECS, specifies that installers strictly adhere to all installation requirements of the party that holds the verification, including all pre-assessment criteria, and that they provide the required installation warranty. Also, the proposed modifications specify that no DECS may be installed over any occupied space, fuel tanks, or any other location deemed unacceptable by the party that holds the verification. These changes are necessary to ensure that any verified strategy is installed properly and safely and will help eliminate in-field issues.

(u)(1) This new subsection requires any party that installs a DECS be authorized and trained by the party that holds the verification.

(u)(2) This new subsection requires any party that installs a DECS comply with the pre-installation requirements.

(u)(3) This new subsection clarifies that any party that installs a DECS must strictly follow all applicable requirements of the party that holds the verification for proper installation.

(u)(4) This new subsection clarifies that any party that installs a DECS must offer an installation warranty.

(v) Training Requirements. This new section clarifies that the applicant must develop and maintain an ongoing training program, specifies minimum requirements for this training, and stipulates that end-users receive this training before the vehicle or equipment is put back into service following installation. The proposed changes are necessary to ensure that the end-users receive adequate training so they can safely operate and maintain their DECS.

(w) Safety Considerations. This new section adds clarifying language to address safety and the potential for catastrophic failure of an applicant's strategy while in use. Applicants have always been required to address any potential safety issues associated with their strategy. The Procedure already requires applicants to include a complete discussion of any potential safety issues in their preliminary application. The proposed amendments clarify that applicants must provide an analysis of all potential safety and catastrophic failure issues associated with the use of their DECS including an analysis of all potential failure modes and that the Executive Officer may require additional safety testing by an independent test facility and may require design modifications to a DECS both before and after receiving verification. The proposed changes are necessary to ensure the safe operation and maintenance of verified strategies.

(w)(1) This new subsection clarifies that the applicant must provide an analysis of all potential safety and catastrophic failure issues associated with the use of their DECS.

(w)(2) This new subsection clarifies that the Executive Officer may require additional safety testing both before and after verification of the DECS.

(w)(3) This new subsection stipulates that if the Executive Officer determines that the applicant has not made a satisfactory demonstration of safety of their DECS, the Executive officer may deny the applicant's request for verification or revoke an existing verification.

(x) Technical service bulletins. This new subsection clarifies that technical service bulletins or other service related information must be submitted concurrently to ARB along with each applicant's end-users, authorized installer or distributors. The proposed change is necessary to ensure that staff has the necessary information to assist applicants and conduct in-field investigations.

Amendments to Title 13, CCR, Section 2707. Warranty Requirements.

Verified applicants and installers of verified DECS are required to provide warranty protections to the end-users of these devices. This section clarifies the warranty requirements for both applicants and installers of verified DECS.

(a)(2)(B) This subsection has been updated to clarify that the requirements only pertain to the installation warranty.

(a)(2)(C) This subsection has been updated to clarify that the requirements only pertain to the installation warranty.

(b)(1) Product Warranty Statement. Clarifying language was added to specify that the manufacturer's warranty applies to parts replacements, sizing changes, or adjustments required to appropriately match DECS to the target engine. This clarification is necessary because coverage has been denied in the past due to misinterpretation of the extent of the warranty coverage requirements by applicants. If an applicant incorrectly sizes their DECS or makes a sizing change based on in-field issues at the time of installation, they must honor the full extent of their warranty responsibilities

(c) Diesel Emission Control Strategy Warranty Report. Modifications to this section include clarifications to the format and content of both the annual and supplemental warranty reports. Currently, applicants are required to submit an annual warranty report to the Executive Officer and a supplemental report within 30 days if warranty claims exceed four percent of the number of engines using an applicant's DECS. This section was modified to clarify that applicants must include all warranty claims in their annual report but should delineate valid claims from those claims where warranty service was denied.

A supplemental warranty report is also required of all applicants any time claims exceed the four percent threshold. However, the four percent threshold is not clearly defined. Therefore, this section was modified to clarify that the four percent threshold is defined as the cumulative number of valid warranty claims for the same part or component of the DECS divided by the cumulative sales or leases for the DECS family. Any time the cumulative number of valid warranty claims for the same part or component of an applicant's DECS exceed four percent of the cumulative sales or leases for the DECS family, they are required to submit an additional warranty report within 30 calendar days. The proposed changes are necessary to ensure adequate warranty protections for end-users of these devices and to support the proposed recall provisions. Additional changes to this section include the requirement that applicants submit their warranty reports in the format specified by the Executive Officer.

(c)(1) This subsection has been modified to clarify those annual sales and lease data must be submitted for the calendar year and not an applicant's fiscal year for all California verified DECS. This proposed change is necessary to ensure that all applicants are submitting sales data that corresponds with the preceding calendar year.
(c)(2) This subsection has been modified to clarify production data must be submitted for the calendar year and not the applicant's fiscal year for all California verified DECS. Again, this proposed change is necessary to ensure that all applicants are submitting production data that corresponds with the preceding calendar year.

(c)(3) This subsection has been modified to clarify that the annual summary of all warranty claims must cover the given calendar year for all California verified DECS.

(c)(3)(A) This subsection has been modified by including "parts" along with components and specifying that claims must be categorized by DECS family name to provide clarity to applicants.

(c)(3)(B) This subsection has been modified for clarity by replacing the word "model" with "family", as in "DECS family", and changing "systems" to "strategies".

(c)(3)(C) This subsection has been modified for clarity by replacing "system" with "strategy" and including "part" with components.

(c)(3)(D) This new subsection clarifies that applicants must provide information on the annual and cumulative replacements and repairs of each part or component to support the four percent calculation mentioned in 2707(c) above.

(c)(3)(E) This new subsection clarifies that applicants must provide contact information for each end-user that files a request for warranty service. The proposed change is necessary to validate each applicants annual or supplemental warranty report.

(c)(4) This subsection has been modified for clarity by replacing "system" with "strategy".

(c)(6) This new subsection clarifies that applicants must include a list of their authorized installers with their annual report to support the proposed changes to section 2706.

(c)(7) This new subsection stipulates penalties for any applicant that fails to submit the required annual or supplemental warranty reports within the specified time periods.

(c)(8) This new subsection clarifies that any warranty report that does not contain all required information will not be considered complete.

(d) Installation Warranty Report. This new section was added requiring authorized installers to also file an annual installation warranty report and to share this information with the manufacturer(s) for which they are authorized to install. The original intent of the Procedure was that this information would be forwarded to the applicants and included in their annual warranty reports. During the public process staff was made aware that this does not always happen. Several applicants stated that they are not receiving information from installers regarding warranty claims and have no authority to compel them to forward this information to them for inclusion in their required reports. The proposed change is necessary to assist applicants and to ensure that ARB is able to reasonably monitor the situation.

The installation warranty report, required by March 1 of each calendar year, is structured in the same format as the applicants product warranty report but is focused on warrantable events that pertain to the installation, which is largely an issue of workmanship. Clarifying language was added specifying that installers are only responsible for the installation warranty, not the product warranty, and must provide the same level and length of coverage for the installation that DECS manufacturers provide for their products.

(d)(1) – (d)(5) These new subsections specify the information that needs to be included in the annual installation warranty report.

(d)(6) This new subsection stipulates penalties for any applicant that fails to submit the required installation warranty reports within the specified time period.

(d)(7) This new subsection clarifies that any installation warranty report that does not contain all required information will not be considered complete.

Amendments to Title 13, CCR, Section 2708. Determination of Emissions Reductions.

This section provides the methodology used to calculate the percent emissions reduction from the applicants valid test results and categorization of the DECS by the Executive Officer. The proposed changes include minor clarifications to the methodology.

(a)(1)(B) Changes to this subsection include minor modification to clarify the requirements for applicants seeking verification of NO_x reductions.

(b) Categorization of the Diesel Emission Control Strategy. This section has been modified to clarify that the emissions reductions demonstrated by each test set must be greater than or equal to the minimum level the DECS is categorized to. The proposed change is necessary because the calculations for determining emissions reductions are based on the averages of several replicate test sets and applicants have requested categorization even though one or more test sets show performance below the requested categorization level. The proposed change makes it clear that all test sets must perform at or above the requested categorization level to validate the performance of an applicant's DECS.

(b)(1)(A), (b)(1)(B), (b)(1)(C), and (b)(1)(D) These subsections were updated to correct the numbering sequence.

(b)(2)(A), (b)(2)(B), (b)(2)(C), (b)(2)(D), and (b)(2)(E) These subsections were updated to correct the numbering sequence.

Amendments to Title 13, CCR, 2709. In-Use Compliance Requirements.

The Procedure currently requires applicants to demonstrate the continuing functionality and durability their DECS through in-use compliance testing. Applicants are required to identify and obtain actual in-use systems and perform testing that replicates the tests done to receive their initial verification. This section identifies the in-use compliance requirements. The proposed changes include a reduction in the amount of required in-use emissions testing, the introduction of in-field tests, an alternative test schedule, additional clarifications, proposed changes intended to streamline the process, and proposed recall provisions.

(a) Applicability. The section has been updated to clarify several subcategories of off-road and stationary applications to assist applicants. While these applications have always been subject to the in-use compliance requirements the proposed changes are intended to provide additional guidance to applicants. Applicability now specifically identifies those DECS for marine, Rubber-Tired Gantry (RTG) crane, Auxiliary Power Unit (APU), and Transport Refrigeration Unit (TRU) applications.

Additional modifications to this section include an increase in the sales trigger that determines when an applicant must begin the in-use testing process and a second sales trigger to align with the proposal to replace one set of in-use compliance emissions testing with field testing. Currently, applicants are required to begin in-use testing when 50 units of a DECS family have been sold or leased in the California market. The proposed amendments replace the first set of required in-use emissions tests with less expensive field tests. To support this proposed change this section has been modified to require applicants to begin their in-use field tests after selling or leasing 100 units in the California market. This change is necessary to provide economic relief to applicants.

Applicants are still required to perform the second set of in-use emissions tests. However, it is no longer appropriate to base the in-use test requirements with only one sales trigger. Therefore, the modifications to this section include a second sales trigger. The proposed changes require applicants to begin their in-use compliance emissions tests after selling or leasing 300 units in the California market. This change is necessary to align the sales trigger with the rest of the proposed changes and to provide additional economic relief to applicants.

(a)(1) This new subsection addresses a previous oversight in the in-use compliance requirements. For entirely fuel-based strategies, there are no components or parts that would constitute a sales unit so sales thresholds don't apply. Therefore, the proposed changes include a maximum volumetric threshold coupled with a time requirement that will trigger when in-use compliance testing must begin. The proposed changes require applicants of fuel-based DECS to begin the in-use compliance emissions testing when 6 million gallons of treated or alternative fuel are sold in the California market, or 3 years after receiving verification, whichever comes first.

(a)(2) This new subsection clarifies that the Executive Officer may specify an alternative trigger for fuel-based DECS at the time of verification based on economic or engineering justifications provided by the applicant. This proposed modification is necessary due to the unique nature of fuel-based DECS.

(b) Alternative Test Schedule. This new section provides an alternative test schedule that would allow applicants to forego field testing upon selling or leasing 100 units and move directly to emissions testing. This will reduce an applicant's current in-use testing requirements by half and provide significant economic relief.

(c) Age of Test Units. This section was updated to correct the numbering sequence and to accommodate the proposed field and emissions testing changes. Currently, in-use compliance testing is required in two separate phases, referred to as "Phase 1" and "Phase 2". The proposed changes replace "Phase 1" with field testing and "Phase 2" with emissions testing to align with the proposed changes.

(c)(1) This subsection was updated to clarify the proposed change to field testing and modified for clarity by replacing the word "obtain" with "identify" and changing "systems" to "strategies".

(c)(2) This subsection was updated to clarify the proposed change to emissions testing and modified to allow applicants to select test units that have been operated for at least 60 percent of their minimum warranty period or for three years, whichever comes first. The proposed changes will make it easier for applicants to locate test units and streamline the in-use testing process.

(d) In-Use Compliance Testing Proposals. This section was updated to correct the numbering sequence and to clarify the requirements for submitting in-use compliance testing proposals. After reaching the appropriate sales trigger each applicant begins the in-use testing process by submitting a testing proposal. The proposed changes clarify that test proposals must be submitted no later than 90 days after meeting the appropriate sales trigger and specify separate proposals for each DECS family for both field and emissions testing. In addition, the proposed changes require any applicant that fails to submit their in-use compliance field testing proposal within 90 days after selling or leasing the 100^{th} unit to follow the alternate test schedule. This last requirement has been added to provide an incentive to applicants to submit their testing proposals within the applicable timeframe.

Other modifications to the section include a detailed list of the minimum requirements and information required by applicants for both field and emissions testing proposals. These changes are necessary to align with the other proposed changes to the in-use compliance requirements and to streamline the process by providing applicants with the minimum requirements necessary to develop their testing proposals for submission and review by the Executive Officer.

(e) Selection of Diesel Emission Control Strategies for Testing. This section was updated to correct the numbering sequence and to clarify that applicants are required propose for each DECS family a representative sample of ten installed DECS for potential in-use testing for both field and emissions testing. Other modifications include a clarification that each applicant must provide an explanation of the methodology used to ensure that the ten installed DECS are representative of the engines or vehicles equipped with the strategy, and to provide information on each DECS cleaning history if available. These changes are necessary to align with the other proposed changes and to ensure that an applicant's in-use test results are sufficient to validate the continuing functionality and durability of their verified systems.

(f) Selection of Test Engines. This section was updated to correct the numbering sequence and to clarify the test engine selection requirements. These updates include replacing the word "candidate" with "proposed" and changing "systems" to "strategies" where appropriate. Other modifications include specifying the selection of test engines for "emissions" testing to avoid confusing this requirement with field testing, clarification that the Executive Officer may require in-use testing using the engine on which the DECS is installed if the DECS effects the performance on the engine as with some fuel-based strategies, and clarification regarding how applicants may determine if a selected test engine is in a proper state of maintenance. These proposed changes clarify the selection requirements, align with the other proposed changes, and streamline the in-use compliance process.

(g) Number of Diesel Emission Control Strategies to be Tested. This section was updated to correct the numbering sequence and to align the requirements with the other proposed changes. Currently, applicants are required to test a minimum of four candidate test units for each Phase of in-use compliance testing. The modifications to this section require applicants to test eight candidate test units for field testing and make no changes to the number of candidate test units for emissions testing. Other minor modifications to this section are proposed to align the language with the current proposal. These changes are necessary to ensure a sufficient number of candidate test units are examined by applicants performing field tests to ensure that the verified strategies continues to remain functional and durable while providing applicants with a cost effective alternative to the currently required emissions testing.

(g)(1) This subsection was updated to clarify that eight candidate test units are required for field testing and for each test unit that fails; two more test units from the same DECS family must be identified and tested.

(g)(2) This new subsection clarifies that four candidate test units are required for emissions testing and for each test unit that fails; two more test units from the same DECS family must be identified and tested.

(g)(3) This subsection was modified to correct the numbering sequence and clarify that for both field and emissions testing no more than ten candidate test units may be tested. This is the current requirement and the proposed changes are only necessary to align this subsection with the other proposed changes.

(g)(4) This subsection was modified to correct the numbering sequence and to align the subsection with the other proposed changes.

(h) In-Use Compliance Field Testing. This new section is necessary to identify the general requirements for field testing. The proposed changes clarify the field testing requirements by specifying that applicants must propose a test methodology that can be used in-field to determine if their DECS continues to successfully reduce emissions. For some types of DECS, the proposed testing may be qualitative, such as a smoke opacity test or may require more quantitative test, such as the use of a Portable Emissions Monitoring System (PEMS). For all types of DECS applicants are required to use good engineering judgment and propose a test methodology that shows that their verified strategy continues to effectively reduce emissions. Other proposed changes require applicants to propose visual and functional test that can be performed in-field to demonstrate that their strategies remain intact and fully functional. These proposed tests, submitted with an applicant's testing proposal, must include proposed criteria to determine compliance. These proposed changes are necessary to implement field test provisions and will provide significant economic relief to all applicants.

(i) In-Use Compliance Emissions Testing. This section was updated to correct the numbering sequence and to clarify that applicants must propose visual and functional tests, similar to those used for field testing, along with their emissions tests. Requiring functional tests will provide additional economic relief to applicants by allowing supporting components and systems of the DECS to be tested without the need to remove and replace them. As with field testing, applicants are required to use good engineering judgment and propose a test methodology to verify that all parts of the DECS are intact and functioning as originally verified.

(j) Alternative Test Cycles and Methods. This section was updated to correct the numbering sequence and to clarify that for in-use compliance field testing, any proposed alternate test plan must show that DECS continues to function properly and will indicate if the DECS is compromised in any way.

(k) In-Use Compliance Report. This section was updated to correct the numbering sequence and to align this section with the other proposed changes. These clarifications include the use of the proposed naming convention for field and emissions testing, the proposed sales triggers, and the information for each candidate test unit that must be included in the final report. The proposed changes provide applicants with 18 months to complete either field or emissions testing and submit the appropriate final report. The proposed changes are necessary to align with the other proposed changes and to streamline the in-use compliance process.

(l) This section was updated to correct the numbering sequence and to align the four percent warranty requirements that may trigger additional in-use testing with the changes previously discussed in section 2707(c).

(m) Conditions for passing In-Use Compliance Testing. This section was updated to correct the numbering sequence and to align the requirements for passing in-use compliance testing with the proposed changes to the field and emissions testing requirements. Currently, an individual DECS meets the requirements for passing in-use compliance for either Phase of testing if it reduces emissions by at least 90 percent of the lower bound of the emission reduction level it was originally verified to and meets the NO_2 requirements of the Procedure. In addition, for each DECS family name, if more than 4 units are tested, 70 percent of all units tested must meet these requirements. The proposed modifications include the addition of the visual and functional tests for passing in-use compliance field and emissions testing and the requirement to test eight candidate test units for in-use compliance field testing.

(m)(1) In-Use Compliance Field Testing. This new subsection specifies that each DECS subject to in-use compliance field testing passes in-use compliance testing if it meets the requirements specified in (m)(1)(A) and (m)(1)(B).

(m)(1)(A) This new subsection specifies that each test unit must meet the proposed opacity level or alternate criteria in the applicants approved in-use compliance test plan approval letter.

(m)(1)(B) This new subsection specifies that each test unit must meet the proposed visual and functional test criteria in the applicants approved in-use compliance test plan approval letter. If the first eight test units meet the criteria in (m)(1)(A) and (m)(1)(B), the DECS family passes in-use compliance field testing. If any of the first eight fail, and more than eight are tested, at least nine test units must meet these requirements for the DECS family to pass in-use compliance field testing.

(m)(2) This section was updated to correct the numbering sequence and to clarify that each DECS subject to in-use compliance emissions testing passes in-use compliance testing if it meets the requirements specified in (m)(2)(A), (m)(2)(B), and (m)(2)(C).

(m)(2)(A) This subsection was updated to correct the numbering sequence and to clarify that the emissions test results for each candidate test unit must reduce emissions by at least 90 percent of the lower bound of the emission reduction level it was originally verified to.

(m)(2)(B) This new subsection specifies that each test unit must meet the proposed visual and functional test criteria in the applicants approved in-use compliance test plan approval letter.

(m)(2)(C) This subsection was updated to correct the numbering sequence. This section continues to specify that each candidate test unit must meet the NO_2 requirements of the Procedure. Other minor modifications to the section are for clarity only and to align the existing requirements with the other proposed changes.

(n) Failure of In-Use Compliance Testing. This section was updated to correct the numbering sequence and other minor clarifications for consistency.

(n)(2) For consistency, "systems" was replaced with "strategies".

(n)(3) For consistency, "systems" was replaced with "strategies" and clarifying language included to identify "DECS family".

(o) This section was updated to correct the numbering sequence and clarifies that failing to adhere to the proposed recall provisions may lower the verification level or revoke the verification status of the verified DECS family.

(p) Recall Provisions. This new section identifies the requirements of the proposed recall provisions. The proposed recall provisions provide the Executive Officer with the authority to determine whether the recall of a DECS family is appropriate based on a review of an applicant's in-use compliance report, remedial report, warranty report, enforcement testing results, or any other information. The proposed provisions specify that a recall may be trigged by catastrophic failure or other safety related failure, failing to meet the conditions for passing in-use compliance testing, valid warranty claims in excess of the four percent threshold specified in section 2707(c), or if a substantial number of units of the DECS family experience the failure of an operational feature.

An operational feature failure is defined as the failure of one or more features of a DECS that by itself, may not lead directly to a warrantable event but renders the system unable to function properly. In essence, it's the failure of a control strategy that's an integral part of DECS that may not lead to the failure of a part or a component and therefore, may not directly trigger a warrantable event. For example, if an applicant's DECS employed a specific algorithm that due to its design doesn't adequately notify the end-user in a timely fashion of a high backpressure event, then that algorithm may be considered an operational feature failure.

The proposed changes specify that in the event of a recall the Executive Officer shall provide notification to the applicant that includes a description of the failure, the factual basis for the recall determination, and shall designate a date at least 60 days from the receipt of the notification for submission of a recall plan by the applicant. The proposed changes also specify that recalls must address all DECS of the affected DECS family including all DECS sold a California verified, and that the recall plan must be approved by the Executive Officer.

(q) Recall Plan. This new section identifies the minimum requirements for a recall plan. The proposed changes specify the minimum requirements and are provided to guide applicants in the development and submission of their recall plans. The minimum requirements include: a description of the DECS subject to recall, the number of units affected, information needed to identify recalled units, a description of the failure and the specific repairs or modifications that will be used to correct the deficiencies, the method of contact for the end-users of the affected units and a contact schedule, a copy of any notification letters planned, any planned incentives to induce compliance with the recall effort, repair or replacement instructions, and information on the potential impact the recall may have on the vehicle or equipment.

(r) Reporting Requirements. This new section requires any applicant subject to recall to report quarterly progress of their recall efforts for six consecutive quarters beginning with the quarter after the recall begins.

(s) This section was updated to correct the numbering sequence and to clarify that the provisions of the section also apply to the requirements of section 2709, including the proposed recall provisions. Other modifications include the identification of penalties for any applicant that fails submit a recall plan or to complete the requirements of an approved recall plan.

Amendments to Title 13, CCR, Section 2710. Verification of Emissions Reductions for Alternative Diesel Fuels and Fuel Additives.

This section identifies the test procedures and methods that are required for the verification of DECS that use alternative diesel fuels or fuels additives.

Table 6 Fuel Test Methods and Reference Fuel Specifications. This table was updated to correct several typographical errors and to update the test procedure for American Petroleum Institute (API) gravity. An additional American Society for Testing and Materials (ASTM) test procedure was included; ASTM test method D4052 was added for the determination of API gravity as it is this test method that most fuel testing laboratories, including ARB, are now using in place of the previous method.

(d)(3)(A)(1) The proposed change to this subsection amends the emissions test procedure from a minimum or five tests to nine tests to align with the other test procedures.

(d)(3)(A)(2) The proposed changes to this subsection amends the number of tests in the emissions test sequence from twenty to nine. The existing twenty test matrix was adopted based on ARB's Diesel Fuel regulations and is designed to show equivalency between a candidate fuel and reference fuel. This test matrix includes twenty replicate tests because this amount of replicate testing is needed to show fuel equivalency for determining differences in the measured pollutant parameters of as little as one to two percent. Because fuel equivalency testing requires this level of resolution, a significant number of replicate tests are necessary to eliminate test-to-test variability and provide statistical viability. However, unlike fuel equivalency testing, verification emissions tests are designed to show a percent reduction from a control strategy as compared to a set of baseline tests (i.e. baseline verses controlled). In addition, the health effects testing often required during the multimedia evaluation currently uses nine replicate tests to generate the statistically valid results from the composite tests for each fuel. Therefore, the proposed changes include reducing the number of replicate tests from twenty to nine.

Other modification include clarifying language requiring fuel additives that accumulate within the fuel system, engine, or exhaust system to use the same test engine or engines for both emissions and durability testing and requiring these types of additives to perform post-durability tests at higher dosage rates to determine any long term effects of the additive. These requirements are necessary in order to determine the effect of any accumulation of the additive or alternative fuel and to determine at what point these effects will stabilize.

(e)(1) This subsection was updated to correct the numbering sequence and to clarify which subsections are applicable to meet the durability requirements of section 2407.

(e)(2) This subsection was updated to correct the section reference.

(e)(3) This new subsection is proposed to clarify that the same test engine used for emissions testing must be used for durability testing for fuel additives that accumulate within the fuel system, engine, or exhaust system.

(g)(4)(A) This new subsection is proposed to include a labeling requirement for entirely fuel-based strategies. This requirement addresses an oversight in the labeling requirements found in Section 2706. The labeling requirements in Section 2706 require identification of the year and month of manufacture of the DECS or a unique serial number on each label. This portion of the requirement makes little sense for a strategy that is likely to be continuously replenished. Therefore, the proposal includes clarifying language exempting strategies that do not include exhaust aftertreatment (e.g. entirely fuel-based strategies) from providing the month and year of manufacture or a unique serial number.

(h) Conditional Verification. This section was removed as it conflicted with the other conditional verification requirements of section 2706. This option for conditional verification of an alternative diesel fuel or fuel additive for off-road or stationary applications was removed, as it requires the applicant to first obtain an on-road conditional verification. This conflicts with section 2706 as conditional verification is not offered as a path to verification for on-road applications.

(h) Extensions of an Existing Verification. This section was update to correct the numbering sequence and to correct the section reference.

Amendments to Title 13, CCR, Section 2711. Compliance.

This section identifies general compliance requirements that apply to all verified DECS.

(a) This new section provides clarification that all ARB verified DECS must be properly installed and maintained.

(b) This section was updated to correct the numbering sequence.

(c) This section was updated to correct the numbering sequence.

(d) This section was updated to correct the numbering sequence.

(e) This new section provides clarification that tampering with an installed ARB verified DECS is not allowed.

REFERENCES

ARB, 2000. California Air Resources Board. *Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles.* California Air Resources Board, October 2000. http://www.arb.ca.gov/diesel/documents/rrpFinal.pdf. Last accessed December 6, 2011.

Society of Automotive Engineers, 1996. *J1667: Snap Acceleration Smoke Test Procedure for Heavy-Duty Powered Vehicles, Society of Automotive Engineers Recommended Practice*, Issued February 1996. http://www.arb.ca.gov/enf/hdvip/saej1667.pdf. Last accessed January 6, 2012.

ASTM D4052-96(2002): Standard Test Method for Density, Relative Density, and API Gravity of Liquids by Digital Density Meter, American Society for Testing and Materials, reapproved January 1, 2002.

Appendix A: Proposed Regulation Order

California Code of Regulations, Title 13, Division 3

Chapter 14. Verification Procedure, Warranty and In-Use Compliance Requirements for In-Use Strategies to Control Emissions from Diesel Engines

Note: The pre-existing regulation text is set forth below in normal type. The amendments are shown in underline to indicate additions and ~~strikeout~~ to indicate deletions. ***** indicates sections of regulation not printed are not changed.

Amend sections 2700, 2701, 2702, 2703, 2704, 2705, 2706, 2707, 2708, 2709, 2710 and 2711 to read as follows:

§ 2700. Applicability.

These procedures apply to market-ready in-use strategies which, through the use of sound principles of science and engineering, control emissions of particulate matter (PM) and oxides of nitrogen (NOx) from diesel-fueled diesel engines. These strategies may include but are not limited to, diesel particulate filters, diesel oxidation catalysts, fuel additives, selective catalytic reduction systems, exhaust gas recirculation systems, and alternative diesel fuels. To be verified under these procedures, a strategy must either reduce emissions of PM or both PM and NOx. A strategy that reduces emissions of NOx alone may be verified only for use with on-road diesel engines certified to a PM emissions standard of 0.01 grams per brake-horsepower hour (g/bhp-hr) or less, or off-road diesel engines certified to a PM emissions standard of 0.03 g/bhp-hr or less. A strategy that reduces emissions of NOx alone may be verified for use with other diesel engines provided that they are not regulated by ARB in-use fleet regulations or Airborne Toxic Control Measures that require PM emissions control, or provided that they would otherwise potentially not be retrofit with PM emission control strategies.

NOTE: Authority cited: Sections 39002, 39003, 39500, 39600, 39601, 39650-39675, 40000, 43000, 43000.5, 43011, 43013, 43018, 43105, 43600 and 43700, Health and Safety Code. Reference: Sections 39650-39675, 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107 and 43204-43205.5, Health and Safety Code; and Title 17 California Code of Regulations Section 93000.

§ 2701. Definitions.

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(9) "Baseline" means the test of a vehicle or engine in its original equipment manufacturers configuration without the diesel emission control strategy implemented.

* * * * *

(13) "Days" when computing any period of time, means normal working days on which the Air Resources Board is open for business unless otherwise noted.

~~(13)~~(14) "Diesel ~~e~~Emission ~~c~~Control ~~s~~Strategy" or "Diesel ~~e~~Emission ~~c~~Control system" means any device, system, or strategy employed with an in-use diesel vehicle or piece of equipment that is intended to reduce emissions. Examples of diesel emission control strategies include, but are not limited to, particulate filters, diesel oxidation catalysts, selective catalytic reduction systems, fuel additives used in combination with particulate filters, alternative diesel fuels, and combinations of the above.

~~(14)~~(15) "Diesel Emission Control Strategy Family Name~~.~~" ~~See~~ As defined in ~~S~~section 2706(j)(2).

~~(15)~~(16) "Diesel Engine" means an internal combustion engine with operating characteristics significantly similar to the theoretical diesel combustion cycle. The primary means of controlling power output in a diesel cycle engine is by limiting the amount of fuel that is injected into the combustion chambers of the engine. A diesel cycle engine may be petroleum-fueled (i.e., diesel-fueled) or alternate-fueled.

~~(16)~~(17) "Diesel-~~f~~Fueled ~~a~~Auxiliary ~~p~~Power ~~s~~System" or "APU" means any device that is permanently dedicated to the vehicle on which it is installed and provides electrical, mechanical, or thermal energy to the primary diesel engine, truck cab, and/or sleeper berth, bus passenger compartment or any other commercial vehicle's cab, as an alternative to idling the primary diesel engine.

~~(17)~~(18) "Distributor" means any person or entity to whom a diesel emission control strategy is sold, leased or supplied for the purposes of resale or distribution in commerce.

~~(18)~~(19) "Donor Vehicle/~~e~~Engine" means any vehicle/engine whose installed diesel emission control strategy device has been removed for the purpose of re-designation or component swapping.

~~(19)~~(20) "Durability" means the ability of the applicant's diesel emission control strategy to maintain a level of emissions below the baseline and maintain its physical integrity over some period of time or distance determined by the Executive Officer pursuant to these regulations. The minimum durability testing periods contained herein are not necessarily meant to represent the entire useful life of the diesel emission control strategy in actual service.

~~(20)~~(21) "Emergency Standby Engine" means a diesel engine operated solely for emergency use, except as otherwise provided in airborne toxic control measures adopted by ARB.

~~(21)~~(22) "Emergency Use" means using a diesel engine to provide electrical power or mechanical work during any of the following events and subject to the following conditions:

(A) The failure or loss of all or part of normal electrical power service or normal natural gas supply to the facility,

(B) The failure of a facility's internal power distribution system,

(C) The pumping of flood water or sewage to prevent or mitigate a flood or sewage overflow,

(D) The pumping of water for fire suppression or protection,

(E) The powering of ALSF-1 and ALSF-2 airport runway lights under category II or III weather conditions,

(F) Other conditions as specified in airborne toxic control measures adopted by ARB.

~~(22)~~(23) "Emission control group" means a set of diesel engines and applications determined by parameters that affect the performance of a particular diesel emission control strategy. The exact parameters depend on the nature of the diesel emission control strategy and may include, but are not limited to, certification levels of engine emissions, combustion cycle, displacement, aspiration, horsepower rating, duty cycle, exhaust temperature profile, and fuel composition. Verification of a diesel emission control strategy and the extension of existing verifications are done on the basis of emission control groups.

~~(23)~~(24) "End user" means any individual or entity that owns or operates a vehicle or piece of equipment that has a verified diesel emission control ~~system~~ strategy installed.

~~(24)~~(25) "Executive Officer" means the Executive Officer of the Air Resources Board or the Executive Officer's designee.

~~(25)~~(26) "Executive Order" means the document signed by the Executive Officer that specifies the verification level of a diesel emission control strategy for an emission control group and includes any enforceable conditions and requirements necessary to support the designated verification.

~~(26)~~(27) "Fuel Additive" means any substance designed to be added to fuel or fuel systems or other engine-related systems such that it is present in-cylinder during combustion and has any of the following effects: decreased emissions, improved fuel economy, increased performance of the entire vehicle or one of its component parts, or any combination thereof; or assists diesel emission control strategies in decreasing emissions, or improving fuel economy or increasing performance of a vehicle or component part, or any combination thereof. Fuel additives used in conjunction with diesel fuel may be treated as an alternative diesel fuel. See ~~S~~section 2701 (a)(3) .

~~(27)~~(28) "Hot Start" means the start of an engine within four hours after the engine is last turned off. The first hot start test run should be initiated 20 minutes after the cold start for Federal Test Procedure testing following Section 86.1327-90 of the Code of Federal Regulations, Title 40, Part 86.

~~(28)~~(29) "Installer" or "Authorized Installer" means any individual or entity that equips any vehicle, engine or equipment with a diesel emission control strategy and has the authorization of the party that holds the verification for the diesel emission control strategy pursuant to section 2706(u).

~~(29)~~(30) "Locomotive" means a self-propelled piece of on-track equipment designed for moving or propelling cars that are designed to carry freight, passengers or other equipment, but which itself is not designed or intended to carry freight, passengers (other than those operating the locomotive) or other equipment.

~~(30)~~(31) "Marine Engine" means a compression ignition engine designed and used to provide propulsion or auxiliary power on water craft such as recreational boats, ocean going vessels, or commercial harbor craft.

(32) "Market-ready" means ready for introduction into commerce. A market-ready diesel emission control strategy is not a prototype and requires no design modifications, part changes, revisions to control logic, or other changes prior to being sold to end-users for commercial use. All components that are necessary for a market-ready diesel emission control strategy to function properly are also commercially available.

~~(31)~~(33) "Portable Engine" means an engine designed and capable of being carried or moved from one location to another, except as defined in section 2701(a)(~~33~~42). Engines used to propel mobile equipment or a motor vehicle of any kind are not portable. Indicators of portability include, but are not limited to, wheels, skids, carrying handles, dolly, trailer, or platform. A portable engine cannot remain at the same facility location for more than 12 consecutive rolling months or 365 rolling days, whichever occurs first, not including time spent in a storage facility. If it does remain at the facility for more than 12 months, it is considered to be a stationary engine. The definitions in Title 13 California Code of Regulations section 2452(g) and section 2452(x) are incorporated by reference herein.

(34) "Quarterly Reports" refer to the following calendar periods: January 1 – March 31; April 1 – June 30; July 1 – September 30; October 1 – December 31.

(35) "Recall" means an inspection, repair, adjustment, replacement, or modification program of a diesel emission control strategy family required by the Executive Officer and initiated and conducted by the manufacturer, applicant, or its agent or representative for which direct notification of the end-user is necessary to remedy: the potential for catastrophic failure or other safety related failure, failure to meet the conditions for passing in-use compliance testing as defined in section 2709(m) of this Procedure, valid warranty claims in excess of four percent as defined in section 2707(c) of this Procedure, or the failure of an operational feature (e.g. strategy used to signal high backpressure) of a substantial number of units. Recalls must address all diesel emission control strategies within a specific diesel emission control strategy family and may include all diesel emission control strategies sold as California verified.

~~(32)~~(36) "Re-designation" means the removal, within the same common ownership fleet, of a complete used verified diesel emission control strategy from an appropriate engine in a vehicle/application and installation to another appropriate engine in a vehicle/application that meets the terms and conditions of the diesel emission control strategy Executive Order.

~~(33)~~(37) "Regeneration" in the context of diesel particulate filters, means the periodic or continuous combustion of collected particulate matter that is trapped in a particulate filter through an active or passive mechanism. Active regeneration requires a source of heat other than the exhaust itself to regenerate the particulate filter. Examples of active regeneration strategies include, but are not limited to, the use of fuel burners and electrical heaters. Passive regeneration does not require a source of heat for regeneration other than the exhaust stream itself. Examples of passive regeneration strategies include, but are not limited to, the use of fuel additives and the catalyst-coated particulate filter. In the context of NOx reduction strategies, "regeneration" means the desorption and reduction of NOx from NOx adsorbers (or NOx traps) during rich operation conditions.

~~(34)~~<u>(38)</u> "Repower" means to replace the engine in a vehicle or piece of equipment with another engine that meets a subsequent engine emissions standard (e.g., replacing a Tier 1 engine with a Tier 3 or later engine).

~~(35)~~<u>(39)</u> "Revoke" means to cancel the verification status of a diesel emission control strategy. If a diesel emission control strategy's verification status is revoked by the Executive Officer, the applicant must immediately cease and desist selling the diesel emission control strategy to end-users.

<u>(40) "Rubber-tired Gantry Crane" or "RTG Crane" means an off-road overhead cargo container crane with the lifting mechanism mounted on a cross-beam supported on vertical legs which run on rubber tires.</u>

~~(36)~~<u>(41)</u> "Seller" means any person or entity that sells, leases or supplies a diesel emission control strategy.

~~(37)~~<u>(42)</u> "Stationary Engine" means an engine that is designed to stay in one location, or remains in one location. An engine is stationary if any of the following are true:

(A) The engine or its replacement is attached to a foundation, or if not so attached, will reside at the same location for more than 12 consecutive months. Any engine that replaces engine(s) at a location, and is intended to perform the same or similar function as the engine(s) being replaced, will be included in calculating the consecutive time period. In that case, the cumulative time of all engine(s), including the time between the removal of the original engine(s) and installation of the replacement engine(s), will be counted toward the consecutive time period; or

(B) The engine remains or will reside at a location for less than 12 consecutive months if the engine is located at a seasonal source and operates during the full annual operating period of the seasonal source, where a seasonal source is a stationary source that remains in a single location on a permanent basis (at least two years) and that operates at that single location at least three months each year; or

(C) The engine is moved from one location to another in an attempt to circumvent the residence time requirements [Note: The period during which the engine is maintained at a storage facility shall be excluded from the residency time determination.] The definitions in Title 13 California Code of Regulations section 2452(g) and section 2452(x) are incorporated by reference herein.

~~(38)~~(43) "Transport Refrigeration Unit (TRU)" means a refrigeration system powered by an integral internal combustion engine designed to control the environment of temperature sensitive products that are transported in trucks and refrigerated trailers. TRUs may be capable of both cooling and heating.

~~(39)~~(44) "Unidirectional Device Design and Installation" means that an emission control device must be appropriately designed, manufactured and labeled to prevent reverse flow installation.

~~(40)~~(45) "Used Verified Device" means any verified diesel emission control strategy which has been sold or leased to an end user and installed on an engine/application.

(46) "Valid Warranty Claim" means a request from an end user, installer, or distributor to the applicant for an inspection, repair, adjustment, replacement, or modification of a specific part or component of the diesel emission control strategy, vehicle, or engine for which the applicant is invoiced for compensation pursuant to the warranty provisions and compensation is actually provided, excluding warranty repairs made solely for customer satisfaction purposes (i.e., good faith repairs). The number of valid warranty claims will be used to determine the 4 percent failure rate pursuant to sections 2707 and 2709.

~~(41)~~(47) "Verification" means a determination by the Executive Officer that a diesel emission control strategy meets the requirements of this Procedure. This determination is based on both data submitted or otherwise known to the Executive Officer and engineering judgment.

(48) "Warranty Claim" means a request from an end user, installer, or distributor to the applicant for an inspection, repair, adjustment, replacement, or modification of a specific part or component of the diesel emission control strategy, vehicle, or engine.

~~(42)~~(49) "Warrantable Condition" means any condition of the diesel emission control strategy, vehicle, or engine which triggers the responsibility of the applicant to take corrective action pursuant to ~~S~~section 2707.

NOTE: Authority cited: Sections 39002, 39003, 39500, 39600, 39601, 39650-39675, 40000, 43000, 43000.5, 43011, 43013, 43018, 43105, 43600 and 43700, Health and Safety Code. Reference: Sections 39650-39675, 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107 and 43204-43205.5, Health and Safety Code; and Title 17 California Code of Regulations Section 93000.

§ 2702. Application Process.

(a) Overview. Before submitting a final application for the verification of a diesel emission control strategy for use with an emission control group, the applicant must submit a preliminary verification application (pursuant to ~~S~~section 2702(b))~~ at the Executive Officer's discretion~~ in the format shown in 2702(d). If the Executive Officer determines that an application includes more than one emission control group, the applicant must propose a test plan that includes test engines and testing conditions that are representative of the least favorable conditions within the requested emission control groups for the diesel emission control strategy to demonstrate compliance with the requirements of the Procedure. To obtain verification, the applicant must conduct emission reduction testing (pursuant to ~~S~~section 2703), durability testing (pursuant to ~~S~~section 2704), a field demonstration (pursuant to ~~S~~section 2705), and submit the results along with comments and other information (pursuant to ~~S~~sections 2706 and 2707) in a final verification application to the Executive Officer, in the format shown in ~~S~~section 2702(d). If the Executive Officer grants verification of a diesel emission control strategy, it will issue an Executive Order to the applicant identifying the verified emission reduction and any conditions that must be met for the diesel emission control strategy to function properly. After the Executive Officer grants verification of a diesel emission control strategy, the applicant must provide a warranty, conduct in-use compliance testing of the strategy after having sold or leased a specified number of units, and report the results to the Executive Officer (pursuant to ~~S~~section 2709). A diesel emission control strategy that employs two or more individual systems or components must be tested and submitted for evaluation as one system. A verified diesel emission control strategy may not be installed on an engine with another diesel emission control strategy that is not included in the Executive Order. Applicants seeking verification of an alternative diesel fuel must follow the procedure described in ~~S~~section 2710.

(b) Preliminary Verification Application. Before formally submitting a final application for the verification of a diesel emission control strategy, the applicant must submit a preliminary verification application~~ at the Executive Officer's discretion~~. The Executive Officer reserves the right to require that an applicant's preliminary application be submitted with a market-ready diesel emission control strategy that is identical in all material respects to the product that will be sold upon receiving verification. If such a request is made by the Executive Officer the applicant must submit the market-ready diesel emission control strategy within 30 calendar days or the preliminary application will be terminated. This product must also be identical in all respects to any products used to support the verification activity. The submitted diesel emission control strategy must include all parts including, but not limited to, the aftertreatment components, sensors, control logic and algorithms, and the backpressure monitor as well as a complete parts list. Any changes to any part of the strategy including, but not limited to, control logic and algorithms, functionality, materials, catalyst loadings and formulation, hardware, etc., will be deemed not identical and not appropriate for verification purposes. Different sizes of the same strategy will be determined to be identical at the Executive Officer's discretion. For strategies that include multiple sizes of the same part (e.g., the diesel particulate filter), the Executive Officer will specify which size of the part must be submitted.

The Executive Officer shall return, at the applicant's expense, the market-ready diesel emission control strategy after the request for verification is either granted, denied, or withdrawn. The Executive Officer shall use the information in the preliminary verification application to help determine whether the strategy relies on sound principles of science and engineering to control emissions, the need for additional analyses, and the appropriateness of allowing alternatives to the prescribed requirements. The preliminary verification application must follow the format shown in ~~S~~section 2702(d) and at a minimum provide the information required in sections 1. through 5., and section 8.A.5~~, where applicable~~. In addition, the preliminary verification application must include the following information:

* * * * *

(5) A brief statement that the applicant acknowledges and agrees to do the following:

(A) Provide a warranty pursuant to the requirements of section 2707.

(B) Submit in-use compliance information pursuant to the requirements of Section 2709.

(C) Keep records until the in-use compliance requirements are completed that contain information per ~~S~~section 2702(~~m~~n) including:

* * * * *

(c) ~~When an applicant submits a preliminary verification application, the Executive Officer shall, within 30 days of its receipt, determine whether the applicant has identified the information necessary to support an application for verification and notify the applicant in writing that it may submit an application for verification. The Executive Officer may suggest modifications to the proposed preliminary verification application to facilitate verification of the diesel emission control strategy.~~ All applications, correspondence, and reports, with the exception of applications based on the use of fuel additives or alternative diesel fuels, locomotive applications, stationary applications, transport refrigeration units, rubber-tired gantry cranes, and marine applications, must be submitted in writing to:

CHIEF, HEAVY-DUTY DIESEL IN-USE STRATEGIES BRANCH
AIR RESOURCES BOARD
9480 TELSTAR AVENUE, SUITE 4
EL MONTE, CA 91731

All applications, correspondence, and reports for systems utilizing any form of fuel additive or alternative diesel fuel or ~~intended for locomotives,~~ must be submitted in writing to:

CHIEF, ~~CRITERIA POLLUTANTS~~ <u>ALTERNATIVE FUELS</u> BRANCH
AIR RESOURCES BOARD
1001 I STREET
SACRAMENTO, CA 95814

<u>All applications, correspondence, and reports for systems intended for use with locomotive must be submitted in writing to:</u>

<u>CHIEF, FREIGHT TRANSPORT BRANCH</u>
<u>AIR RESOURCES BOARD</u>
<u>1001 I STREET</u>
<u>SACRAMENTO, CA 95814</u>

All applications, correspondence, and reports for systems intended for <u>use with stationary applications,</u> transport refrigeration units<u>, rubber-tired gantry cranes,</u> or marine applications must be submitted in writing to:

CHIEF, EMISSIONS ASSESSMENT BRANCH
AIR RESOURCES BOARD
1001 I STREET
SACRAMENTO, CA 95814

(d) Application Format. The preliminary and final verification applications must be submitted in writing to the address shown in subsection (c) above. Electronic mail and verbal submissions do not constitute acceptable application formats. Supporting data in electronic format may be accepted as part of the application at the discretion of the Executive Officer. The preliminary and final verification applications for a diesel emission control strategy must follow the format shown below. If a section asks for information that is not applicable to the diesel emission control strategy, the applicant must indicate "not applicable." If the Executive Officer concurs with the applicant's judgement that a section is not applicable, the Executive Officer may waive the requirement to provide the information requested in that section. Final verification applications must include all of the information provided in the preliminary verification application as described in ~~S~~<u>s</u>ection 2702(b), including any additional information, updates, or changes, and all additional information shown below.

1. *Introduction*

* * * * *

2. *Diesel Emission Control Strategy Information*

2.1 General description of the diesel emission control strategy
  2.1.1 Detailed discussion of principles of operation and system design
  2.1.2 Description of inducement method if applicable
  2.1.3 Schematics depicting operation (as appropriate)
  2.1.4 A list identifying all the parts of the diesel emission control strategy as described in ~~S~~section 2706(o)
  2.1.5 Detailed description of measures taken to prevent reverse flow installation
2.2 Description of regeneration method
  2.2.1 Operating condition requirements for regeneration
  2.2.2 Thresholds and control logic to activate regeneration
  2.2.3 Description of backpressure monitor including thresholds and control logic
2.3 Favorable operating conditions
2.4 Unfavorable operating conditions and associated reductions in performance
2.5 Fuel and lubricating oil requirements and misfueling considerations
2.6 Identification of failure modes and associated consequences
2.7 ~~Complete discussion~~ Analysis of potential safety and catastrophic failure issues per section 2706(w) *(e.g., uncontrolled regeneration, lack of proper maintenance, unfavorable operating conditions, use of inappropriate fuel, high exhaust temperatures, substrate failure, sensor failure, etc.)*, including a description of the mitigation strategies employed by the diesel emission control strategy for each potential safety and catastrophic failure issue
2.8 Complete discussion of the installation requirements *(e.g., appropriate system placement, space requirements, visibility, device orientation, engine oil consumption limits, etc.)*
2.9 Pre-installation compatibility assessment procedures
2.10 Maintenance requirements
  2.10.1 Detailed description of all normal maintenance requirements for the diesel emission control strategy
  2.10.2 An objective criteria for DECS ash removal (pressure drop across the filter, maximum clean filter weight, pre-installation filter weight comparison, etc.) for determination if a DECS is "cleaned" per section 2706(h)(2)(B)
  2.10.3 A copy of the language that will instruct the end user of proper handling of spent components and/or materials cleaned from the diesel emission control strategy, identify any hazardous materials, and provide procedures for resetting any backpressure monitors after maintenance procedures are completed~~.~~
2.11 Description of noise level control compliance

3. -Alternative Diesel Fuel and Fuel Additive Information~~.~~
(Use of an alternative diesel fuel/fuel additive requires a multimedia evaluation as required by Section 43830.8 California Health and Safety Code)

3.1 Alternative Diesel Fuel Information
3.~~1~~2 Additional information from ~~S~~section 2710(b), 2710(c), 2710(f), and 2710(g)
3.~~2~~3 Emission control group compatibility considerations
3.~~3~~4 Misfueling prevention strategies
3.~~4~~5 Multimedia evaluation
3.~~4~~5.1 Additional test data and information required for multimedia evaluation

* * * * *

5. *Testing Information*
5.1 Emission reduction testing
5.1.1 Test facility identification including capabilities and identification of all analytical instruments
5.1.2 Description of test vehicle and engine *(make, model year, engine family name, PM and NOx certification levels if applicable, etc.)*
5.1.3 Statement indicating whether the test engine is in a proper state of maintenance, and/or has been rebuilt or modified from the original engine manufacturer configuration
5.1.4 Description of test fuel
5.1.5 Discussion of effects of elevated NOx emissions on diesel emission control strategy (effects on emission reduction performance, durability, safety, and control strategy response)
5.1.6 Test procedure description *(pre-conditioning period, test cycle, etc.)*
5.1.7 Test results and comments
5.1.8 Incomplete and aborted test data and explanations

* * * * *

6. *Warranty and In-Use Compliance Requirements*
6.1 Statement that the applicant agrees to provide annual warranty reports and to follow the warranty requirements per ~~S~~section 2707
6.2 Statement that the applicant agrees to follow the in-use compliance requirements per ~~S~~section 2709
6.3 Statement that the applicant agrees to keep the required end user information per ~~S~~section 2702(~~m~~n)

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8. *Appendices*
A. ~~Laboratory~~Emissions test report information *(for all tests, including incomplete, aborted and failed tests)*
A.1 Actual ~~laboratory~~ emissions test data. Applicants must submit the raw, real-time data gathered by the laboratory's data acquisition system during emissions testing in electronic format on a compact

disc. These are the raw data from which emissions test results are derived. (e.g., analyzer voltage readings recorded at a frequency of 1 Hertz)

- A.2 Plots of engine backpressure and exhaust temperature
- A.3 Driving traces for chassis dynamometer tests
- A.4 Quality assurance and quality control information
- A.5 Testing equipment information and indication that testing equipment meets specifications and calibrations given in procedures required by sections 2703, 2704 and 2710 as appropriate.

B. Field test information

- B.1 Engine backpressure and exhaust temperature data (as described in ~~S~~sections 2704(d)(2) and 2705(c)(1))
- B.2 Third-party letters or questionnaires describing in-field performance

~~C. Diesel emission control strategy label~~

~~D~~C. Copy of the Owner's Manual (as described in ~~S~~section 2706(l))

~~E~~D. Copy of the Installation Manual

~~F~~E. Sample scale drawings of the original and replacement diesel emission control strategy labels (See ~~S~~section 2706(j))

~~G~~F. Other supporting documentation

(e) ~~Within 30 days of receipt of the preliminary application, the Executive Officer shall notify the applicant whether the application is complete.~~ Preliminary Verification Application Review Process. A preliminary application for verification is reviewed as follows:

(1) Review for Completeness. Within 30 days of receipt of the preliminary application, the Executive Officer shall notify the applicant indicating whether the application is complete. If the preliminary application is not complete the Executive Officer shall request any missing information from the applicant.

(A) If, after requesting missing information three times, the Executive Officer determines that the preliminary application is still not complete, the application will be terminated.

(2) Engineering and Compliance Review. After determining that the preliminary application is complete, the Executive Officer shall conduct a technical review of the preliminary application to determine whether the preliminary application is adequate to support development of a test plan approval letter. If the preliminary application is not adequate to support development of a test plan approval letter, the Executive Officer shall request additional information from the applicant.

(A) If, after requesting additional information three times, the Executive Officer determines that the preliminary application is still not adequate to support development of a test plan approval letter, the application will be terminated.

(3) Test Plan Approval Letter. Following the Engineering and Compliance review and upon determining that the preliminary application is satisfactory, the Executive Officer shall issue a test plan approval letter to the applicant within 45 days.

(4) If the preliminary application is terminated by the Executive Officer and the applicant wishes to attempt verification again, the applicant must wait at least 30 calendar days before submitting a new, revised preliminary verification application.

(f) ~~Within 60 days after a final application has been deemed complete, the Executive Officer shall determine whether the diesel emission control strategy merits verification and shall classify it as shown in Table 1:~~Final Verification Application Review Process. A final application for verification is reviewed as follows:

(1) The Executive Officer shall not review a final application unless the applicant has first received a test plan approval letter.

(2) Review for Completeness. Following receipt of the final application, the Executive Officer shall notify the applicant indicating whether the final application is complete. If the final application is not complete the Executive Officer shall request any missing information from the applicant.

(A) If, after requesting missing information three times, the Executive Officer determines that the final application is still not complete, the application will be terminated.

(3) Test Results and Compliance Review. Within 60 days of determining that the final application is complete, the Executive Officer shall determine whether the diesel emission control strategy merits verification and shall classify it as shown in Table 1:

Table 1. Verification Classifications for Diesel Emission Control Strategies

Pollutant	Reduction	Classification
PM	< 25%	Not verified
		Level 0* (see note below)
	≥ 25%	Level 1
		Level 1 Plus**
	≥ 50%	Level 2
		Level 2 Plus**
	≥ 85%, or ≤ 0.01 g/bhp-hr	Level 3
		Level 3 Plus**
NOx	< 25%	Not verified
	≥ 25%	Mark 1
	≥ 40%	Mark 2
	≥ 55%	Mark 3
	≥ 70%	Mark 4
	≥ 85%	Mark 5

*A diesel emission control strategy that reduces emissions of PM by less than 25 percent may be verified as a Level 0 strategy if it reduces emissions of NOx by at least 25 percent and meets the other criteria in section 2700.
**The diesel emission control strategy complies with the 20 percent NO_2 limit before January 1, 2009 (and after January 1, 2007).

~~The applicant and the Executive Officer may mutually agree to a longer time period for reaching a decision, and additional supporting documentation may be submitted by the applicant before a decision has been reached.~~ The Executive Officer shall notify the applicant of the decision in writing and specify the verification level for the diesel emission control strategy and identify any terms and conditions that are necessary to support the verification.

(4) If the final application is terminated by the Executive Officer and the applicant wishes to attempt verification again, the applicant must wait at least 30 days before submitting a new, revised final application.

(g) Application Termination. If at any point during the review process an applicant's application is terminated, the Executive Officer will cease review of all materials regarding the diesel emission control strategy and associated application. The applicant may submit a new, revised application per section 2702 (e) – (f) after 30 days of the date of the termination notification. This time is intended to allow the applicant to correct any deficiencies in the application. If the preliminary application was terminated, a resubmitted preliminary application will be reviewed as a new application. The re-submission must address the concerns that caused the termination and must not be identical to the terminated application.

~~(g)~~(h) Extensions of an Existing Verification. If the applicant has verified a diesel emission control strategy with one emission control group and wishes to extend the verification to include additional emission control groups, it may apply to do so using the original test data, additional test data, engineering justification and analysis, or any other information deemed necessary by the Executive Officer to address the differences between the emission control group already verified and the additional emission control group(s). Processing time periods follow sections (e) and (f) above.

~~(h)~~(i) Conditional Extensions of an Existing Verification for On-Road Applications. If an applicant has an ARB verified diesel emission control strategy and wishes to extend the verification to include new on-road emission control groups, the applicant may apply to receive a conditional extension. If the Executive Officer determines that the diesel emission control strategy is technologically sound and appropriate for the intended application, the applicant may be granted conditional extension for up to one year. Upon receiving a conditional extension, the applicant may sell the diesel emission control strategy as a verified product for the duration of the conditional extension period. To obtain full verification, the applicant must complete the requirements set forth by the Executive Officer according to the requirements of the regulation. In granting a conditional extension, the Executive Officer may consider all relevant information including, but not limited to, the following: the design of the diesel emission control strategy, original test data, other relevant test data, the duty cycle of the prospective emission control group, and field experience. For the time period it is effective, a conditional extension is equivalent to a verification for the purposes of satisfying the in-use compliance requirements. Diesel emission control strategies that are conditionally verified for off-road and stationary applications are not eligible for conditional extensions (See ~~S~~section 2704(~~k~~l)).

~~(i)~~(j) Design Modifications. If an applicant modifies the design of a diesel emission control strategy during the review process, the Executive Officer will terminate the application. The applicant must re-submit an application per section 2702 (e) – (f) that includes details of the new design in order for the diesel emission control strategy to be considered for verification, a conditional verification, or a conditional extension. Re-submission must follow the requirements of section 2702(g). If an applicant modifies the design of a diesel emission control strategy that has already been verified ~~or is under~~

~~consideration for verification~~ by the Executive Officer, the modified version must be evaluated under this Procedure. The applicant must provide a detailed description of the design modification along with an explanation of how the modification will change the operation and performance of the diesel emission control strategy. To support its claims, the applicant must submit additional test data, engineering justification and analysis, or any other information deemed necessary by the Executive Officer to address the differences between the modified and original designs, to ensure that the verified emissions reductions are maintained, and to ensure that emissions of any pollutants remain compliant with the requirements per section 2706. Processing time periods follow sections 2702 (e) ~~and~~ (f) above. A design modification includes, but is not limited to:

(1) Any change of materials or specifications to the major parts of the diesel emission control strategy (e.g., the diesel particulate filter, the diesel oxidation catalyst, the canning components, etc.).
(2) Any change to the wash coat or catalyst formulas or composition.
(3) Any change to the catalyst loadings.
(4) Any change to the sensors, part sizes, or sizing methodology.
(5) Any change to the monitoring and notification system control logic or algorithms or parts.

~~(j)~~(k) Verification Transfers. If an applicant wishes to sell, lease, or supply another manufacturer's previously verified diesel emission control strategy, the applicant must do the following:

(1) Submit a letter of consent from the manufacturer that legally holds the original verification. The letter must give the applicant the right to hold a verification for the diesel emission control strategy and, if applicable, to use information that was previously submitted as support in the application for the original verification.
(2) Submit an application(s) per ~~S~~section 2702 of this Procedure. If previously submitted information is included, necessary additional information must be submitted that satisfies all applicable requirements of this Procedure (e.g. testing data, warranty statement, label, owner's manual, etc.).
(3) Submit a description of the diesel emission control strategy's principals of operation. The applicant must demonstrate understanding of how the product relies on sound principles of science and engineering to achieve emissions reductions.
(4) Submit a plan showing how the applicant will comply with the in-use compliance requirements of section 2709 of this Procedure.

~~(k)~~(l) Emission Control Strategies Approved under Other Verification Programs. Any applicant with a diesel emission control strategy that is verified under another diesel emission control verification program that wishes to receive ARB verification must submit an application that contains the information requested in part (d) above. Pre-existing data and information submitted in support of verification approval from other programs may be submitted, but the applicant must meet requirements that are unique to this Procedure including, but not limited to, a system label compliant with ~~S~~section 2706(j), a California owner's manual compliant with ~~S~~section 2706(l), a warranty compliant with ~~S~~section 2707, in-use compliance requirements per ~~S~~section 2709, and multimedia evaluation if applicable. The Executive Officer may evaluate all information submitted including additional information required by this Procedure to determine if a diesel emission control strategy merits ARB verification.

~~(l)~~(m) Treatment of Confidential Information. Information submitted to the Executive Officer by an applicant may be claimed as confidential, and such information shall be handled in accordance with the procedures specified in Title 17, California Code of Regulations, ~~S~~sections 91000-91022. The Executive Officer may consider such confidential information in reaching a decision on a verification application.

~~(m)~~(n) Recordkeeping Requirements. Both applicants and authorized diesel emission control strategy installers are responsible for keeping records as described below.

(1) Applicants that receive a verification, conditional verification, or a conditional extension must keep records that have valid end user contact information (name, address, phone number), a description of the vehicles or equipment the units are applied to (type of vehicle/equipment, make, model year, vehicle identification number), and a description of the engines the units are applied to (make, model, model year, engine serial number, engine family name). The applicant must keep these records for each diesel emission control strategy family until the in-use compliance requirements of the diesel emission control strategy family are completed. Applicants that receive a conditional extension of conditional verification must submit these records to the Executive Officer one year after receiving the conditional extension or conditional verification. Applicants that receive verifications must submit these records upon request by the Executive Officer to an agent or employee of ARB. The Executive Officer may request that such records be made available at any time. The applicant must provide these records within 30 days of the request by ARB. Failure to submit these records may result in revocation or suspension of the verification and/or any other remedy available under Part 5, Division 26 of the Health and Safety Code.

(2) Authorized ~~I~~installers must keep all pre-installation compatibility assessment records as described in ~~S~~section 2706(t)(~~3~~2) – (4).

~~(n)~~(o) The Executive Officer may at any time with respect to any diesel emission control strategy sold, leased, offered for sale, intended for sale, or manufactured for sale in California, order the applicant or manufacturer to submit records pertaining to the diesel emission control strategy, at the applicant's expense, to a location specified by the Executive Officer.

~~(o)~~(p) Applicants that receive a verification, a conditional verification, or a conditional extension must demonstrate sales or the active pursuit of sales of their diesel emission control strategies in California upon request of the Executive Officer. If an applicant fails to provide such proof, the Executive Officer will evaluate whether the verification should be revoked.

~~(p)~~(q) The Executive Officer may, with respect to any diesel emission control strategy sold, leased, offered for sale, intended for sale, or manufactured for sale in California, order the applicant or strategy manufacturer to make available for testing and/or inspection a reasonable number of diesel emission control ~~system~~ strategies including but not limited to new diesel emission control strategies selected by ARB staff that are in the possession of authorized dealers or distributors but not yet installed on candidate engines, and may direct that they be delivered at the applicant's expense to the state board at the Haagen-Smit Laboratory, 9528 Telstar Avenue, El Monte, California or where specified by the Executive Officer. The Executive Officer may also, with respect to any diesel emission control strategy being sold, leased, offered for sale, intended for sale, or manufactured for sale in California, have an applicant test and/or inspect under the supervision of the Executive Officer a reasonable number of units at the applicant's or manufacturer's facility or at any test laboratory accepted by the Executive Officer. All such testing and inspection is confirmatory in nature. If the Executive Officer finds performance that is not consistent with either an existing or requested verification, the applicant must address and resolve the inconsistency to the satisfaction of the Executive Officer in order to maintain or receive verification. Any testing and inspection done by ARB cannot be used as a substitute for emissions test data or other support required in an application for verification.

(r) For the purpose of selecting new diesel emission control strategies for testing and/or inspection to determine compliance with this regulation, an agent or employee of ARB, with prior notice and upon presentation of proper credentials, has the right to enter any facility (with any necessary safety clearances) where diesel emission control strategies verified under these Procedures are located or kept.

~~(q)~~(s) The Executive Officer may lower the verification level or revoke the verification status of a verified diesel emission control strategy family, a conditionally verified strategy, or a strategy with a conditional extension or suspend all review of pending verification applications if the Executive Officer determines that there are errors, omissions, inaccurate information, fraudulent submittals, or a deficiency of required submittals, in the application for verification, supporting information, warranty report, recall plan, or in-use compliance ~~testing~~ report. Any changes to the verified diesel emission control strategy family not approved by the ARB will subject the applicant to ARB enforcement actions. Additionally, penalties may be assessed under Part 5, Division 26 of the Health and Safety Code. The Executive officer may suspend the review of all other applications sent by an applicant if that applicant fails to submit warranty reports or any other requested information. The Executive Officer may also seek remedial action against the applicant if it is determined that the verified diesel emission control strategy does not comply with the requirements or provisions of the Executive Order.

NOTE: Authority cited: Sections 39002, 39003, 39500, 39600, 39601, 39650-39675, 40000, 43000, 43000.5, 43011, 43012, 43013, 43018, 43105, 43600 and 43700, Health and Safety Code. Reference: Sections 39650-39675, 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107 and 43204-43205.5, Health and Safety Code; and Title 17 California Code of Regulations Section 93000.

§ 2703. Emission Testing Requirements.

(a) Testing on an Emission Control Group Basis.

(1) The applicant must test the diesel emission control strategy on an emission control group basis and identify the emission control group. The applicant must identify the test engines and vehicles, if applicable, by providing the engine family name, make, model, model year, and PM and NOx certification levels if applicable. The applicant must also describe the applications for which the diesel emission control strategy is intended to be used by giving examples of in-use vehicles or equipment, characterizing typical duty cycles, indicating any fuel requirements, and/or providing other application-related information.

(2) If the Executive Officer determines that the applicant has requested more than one emission control group, the applicant must propose a test plan that includes one or more emission test engines that are representative of the least favorable conditions (e.g., PM levels, NOx-to-PM ratios, engine size) within the requested emission control groups for the diesel emission control strategy to demonstrate compliance with the requirements of the Procedure.

(3) The applicant must select an appropriate test engine or engines based on the proposed emission control group. Attributes of the emission control group which determine an appropriate test engine include, but are not limited to:

(A) Certification category (e.g., on-road or off-road)

(B) Certified emission levels (e.g., PM levels, NOx-to-PM ratios)

(C) Certified aftertreatment (e.g., diesel oxidation catalyst, diesel particulate filter)

(D) Exhaust gas recirculation (e.g., none, internal or external)

(E) Engine size (e.g., displacement, rated horsepower, exhaust flow rate)

(b) Test Engine Requirements and Pre-conditioning.

(1) For a diesel emission control strategy that has the potential to form NO_2 or other secondary emissions, the applicant must identify this potential to the Executive Officer and propose an emissions test engine accordingly. The applicant must provide detailed and comprehensive information showing how the proposed emissions test engine is an appropriate, representative test engine.

(2) The applicant may tune-up or rebuild test engines prior to, but not after, baseline testing unless rebuilding the engine is an integral part of the diesel emission control strategy. All testing should be performed with the test engine in a proper state of maintenance. Emissions of NO_2 from the test engine must not exceed 15 percent of the total baseline NOx emissions by mass. If there is a special category of engines with NO_2 emission levels that normally exceed 15 percent, this requirement may be adjusted for those engines at the discretion of the Executive Officer.

(c) Diesel Emission Control Strategy Requirements and Pre-conditioning.

(1) The diesel emission control strategy must be appropriately sized for the emissions test engine(s) based on the sizing information provided in the application and must be approved by the Executive Officer. If the sizing methodology or the test unit and engine combination indicated in the test plan approval letter changes during testing or during the application review process, the application will be re-evaluated and a new test plan approval letter, which may include additional testing, must be issued by the Executive Officer before any further testing commences. Any testing conducted prior to the sizing change may be rejected at the Executive Officer's discretion.

(2) If a diesel emission control strategy includes both single and multiple filter designs, the sizing of both designs is subject to the requirements and conditions in section 2703(c)(1). Both single and multiple configurations require complete emissions and durability testing (see section 2704) unless:

(A) The multiple-filter design has only one filter per exhaust manifold.

(B) The multiple filter design involves multiple filters housed within one can. Additional testing requirements for this configuration are at the discretion of the Executive Officer.

(C) The applicant demonstrates to the satisfaction of the Executive Officer that full testing of one configuration is worst case and therefore sufficient to support verification of the other configuration.

(3) The engine or vehicle installed with a diesel emission control strategy must be operated for a break-in period of between 25 and 125 hours before emission testing. Note that special pre-conditioning requirements may apply. See section 2706(a)(4) for details.

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NOTE: Authority cited: Sections 39002, 39003, 39500, 39600, 39601, 39650-39675, 40000, 43000, 43000.5, 43011, 43013, 43018, 43105, 43600 and 43700, Health and Safety Code. Reference: Sections 39650-39675, 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107 and 43204-43205.5, Health and Safety Code; and Title 17 California Code of Regulations Section 93000.

§ 2704. Durability Testing Requirements

(a) The applicant must demonstrate, to the satisfaction of the Executive Officer, the durability of the applicant's diesel emission control strategy through an actual field or laboratory-based demonstration combined with chassis or engine dynamometer-based emission tests.

(1) A laboratory-based durability demonstration is not acceptable as the primary durability data used to support verification with an emission control group that includes on-road, off-road, or APU applications. The applicant may request that the Executive Officer consider a laboratory-based durability demonstration as secondary supporting data. In evaluating such a request, the Executive Officer may consider all relevant information including, but not limited to, the degree to which the proposed laboratory-based demonstration simulates real-world conditions and subjects the diesel emission control strategy to operating conditions that are either favorable or unfavorable for proper operation based on its design.

(2) If the applicant chooses a laboratory-based durability demonstration, an additional field demonstration will be required to demonstrate in-field compatibility (pursuant to ~~S~~section 2705).

(3) If the applicant has demonstrated the durability of the identical strategy in a prior verification or has demonstrated durability through field experience, the applicant may request that the Executive Officer accept the previous demonstration in fulfillment of this requirement. In evaluating such a request, the Executive Officer may consider all relevant information including, but not limited to, the similarity of baseline emissions and application duty cycles, the relationship between the emission control group used in previous testing and the current emission control group, the number of engines tested, evidence of successful operation and user acceptance, and published reports.

(b) Demonstrating Durability on an Emission Control Group Basis.

(1) If the Executive Officer determines that the applicant has requested more than one emission control group, the applicant must propose a test plan that includes one or more durability test engines and applications that are representative of the least favorable conditions (e.g., PM levels, NOx-to-PM ratios, engine size) within the requested emission control groups for the diesel emission control strategy to demonstrate compliance with the requirements of the Procedure.

(2) The applicant must select an appropriate test engine and application based on the proposed emission control group. Attributes of the emission

control group which determine an appropriate test engine and application include, but are not limited to:
(A) Certification category (e.g., on-road or off-road)
(B) Certified emission levels (e.g., PM levels, NOx-to-PM ratios)
(C) Certified aftertreatment (e.g., diesel oxidation catalyst, diesel particulate filter)
(D) Exhaust gas recirculation (e.g., none, internal or external)
(E) Engine size (e.g., displacement, rated horsepower, exhaust flow rate)
(F) Exhaust temperature profile
(G) Vehicle or equipment usage
(H) Vehicle or equipment type (e.g., rubber-tired or crawler)

~~(b)~~(c) Engine Selection and Sizing.

(1) Subject to the approval of the Executive Officer, the applicant may choose the engine and application to be used in the durability demonstration. The engine and application must be representative of the emission control group for which verification is sought. The applicant must identify the test engine and vehicle, if applicable, by providing the engine family name, make, model, model year, PM and NOx certification levels if applicable, and vehicle identification number. The applicant must also describe the applications for which the diesel emission control strategy is intended to be used by giving examples of in-use vehicles or equipment, characterizing typical duty cycles, indicating any fuel requirements, and/or providing other application-related information.

(2) The selected engine need not be the same as the engine used for emission testing, but if the applicant does use the same engine, the emission testing may also be used for the initial durability tests.

(3) Emissions of NO_2 from the emissions test engine must not exceed 15 percent of the total baseline NOx emissions by mass. If there is a special category of engines with NO_2 emission levels that normally exceed 15 percent, this requirement may be adjusted for those engines at the discretion of the Executive Officer.

(4) The diesel emission control strategy must be appropriately sized for the durability test engine(s) and vehicle(s) based on the sizing information provided in the application and must be approved by the Executive Officer. If the sizing methodology or the test unit and engine combination indicated in the test plan approval letter changes during testing or during the application review process, the application will be re-evaluated and a new test plan approval letter, which may include additional testing, must be issued by ARB before any further testing commences. Any testing conducted prior to the sizing change may be rejected at the Executive Officer's discretion.

(5) If a diesel emission control strategy includes both single and multiple filter designs, the sizing of both designs is subject to the requirements and conditions in section 2703(c)(1). Both single and multiple configurations

require complete emissions and durability testing (see section 2704) unless:

(A) The multiple-filter design has only one filter per exhaust manifold,

(B) The multiple filter design involves multiple filters housed within one can. Additional testing requirements for this configuration are at the discretion of the Executive Officer.

(C) The applicant demonstrates to the satisfaction of the Executive Officer that full testing of one configuration is worst case and therefore sufficient to support verification of the other configuration.

~~(c)~~(d) Test Fuel.

(1) The test fuel must meet the specifications in the California Code of Regulations (~~S~~sections 2280 through 2283 of Title 13), with the exception of the sulfur content or other properties previously identified by the applicant and approved by the Executive Officer. The Executive Officer may approve test fuel(s) that do not comply with ~~S~~sections 2280 through 2283 of Title 13 of the California Code of Regulations if the fuel(s) are determined to be, based on sound science and engineering, representative of commercially available fuel typically used for the intended application(s).

(2) If operation or performance of a diesel emission control strategy is affected by fuel sulfur content, the sulfur content of the test fuel must be no less than 66 percent of the stated maximum sulfur content for the diesel emission control strategy, unless

(A) the testing is performed with fuel containing 15 ppmw or less sulfur for verification on 15 ppmw or less sulfur diesel fuel, or

(B) the testing is performed with diesel fuel commercially available in California for verification on CARB diesel fuel (i.e., fuel meeting the specifications in Title 13, California Code of Regulations, ~~S~~sections 2280 through 2283).

(3) Baseline testing may be conducted with commercially available diesel fuel or diesel fuel with 15 ppmw or less sulfur. Baseline and control tests must be performed using the same fuel unless the control fuel is specified as a component of the emission control strategy.

(4) The test fuel (or batch of fuel purchased) must be analyzed using American Society for Testing and Materials (ASTM) test methods listed in Table 6 (See ~~S~~section 2710), which are incorporated herein by reference. At a minimum, sulfur content, aromatic content, polycyclic aromatic hydrocarbons, nitrogen content, and cetane number must be reported. The Executive Officer may ask for additional properties to be reported if evidence suggests those properties may affect functioning of the diesel emission control strategy.

~~(d)~~(e) Service Accumulation. The durability demonstration consists of an extended service accumulation period in which the diesel emission control strategy is implemented in the field or in a laboratory accepted by the Executive Officer, with emission reduction testing before and after the service accumulation. Service accumulation begins after the first emission test and concludes before the final emission test. The pre-conditioning period required in ~~S~~section 2703 (c) cannot be used to meet the service accumulation requirements.

(1) Minimum Durability Demonstration Periods. The minimum durability demonstration periods are shown in Table 3, below.

Table 3. Minimum Durability Demonstration Periods

Engine Type	Minimum Durability Demonstration Period
On-Road	50,000 miles or 1000 hours
Off-Road (including portable engines) Stationary, Marine, ~~Locomotives,~~ TRUs, and APUs	1000 hours
Stationary Emergency Standby Engines	500 hours
Locomotives	3000 hours

(2) Temperature and Backpressure Measurement Requirements. For strategies that include exhaust aftertreatment, engine backpressure, exhaust temperature, and engine speed must be measured and recorded for 1000 hours or over the entire durability period (whichever is shorter). The applicant must propose a measurement and recording protocol for approval by the Executive Officer. The protocol may include, but is not limited to, measurement and recording of values once every few seconds, or higher frequency measurement with recording of averages, minima, and maxima over longer time intervals. The data must include an accurate date and time stamp that corresponds with periods of actual engine operation. Data must be submitted electronically in columns as a spreadsheet or text file or another format approved by the Executive Officer. Failure to submit in an approved format will terminate the application process.

(3) NOx Emissions Measurement Requirements. For strategies that include exhaust aftertreatment to reduce emissions of NOx, the mass emissions of NOx both upstream and downstream of the aftertreatment device must be measured and recorded for at least the first and last 100 hours of the durability period. The applicant must propose a measurement method for approval by the Executive Officer. The method may include, but is not limited to, the use of NOx sensors before and after the device. Measurements of NOx emissions must occur on at least a 1 Hertz basis. Data must be recorded as averages over time intervals no greater than 10

seconds. The data must include an accurate date and time stamp that corresponds with periods of actual engine operation. Data must be submitted electronically in columns as a text file or another format approved by the Executive Officer.

(4) Electronic System Codes. Error codes, fault codes, and high backpressure codes, as defined in the applicants test plan approval letter, that are generated by a diesel emission control strategy's electronic control system and/or operational monitoring system during the durability demonstration must be submitted with the date and time each code occurs.

~~(4)~~(5) Fuel for Durability Demonstrations. The fuel used during durability demonstrations should be equivalent to the test fuel, or a fuel with properties less favorable to the durability of the emission control strategy. Durability demonstrations may, at the applicant's option and with the Executive Officer's approval, include intentional misfueling events so that data on the effects of misfueling may be obtained.

~~(5)~~(6) Industrial Safety Requirements. The installation of a diesel emission control strategy on an off-road vehicle or piece of equipment used for a durability demonstration within California must conform to all applicable industrial safety regulations (California Code of Regulations, Title 8, Division 1, Chapter 4). If all off-road durability demonstrations are conducted outside California, at least one must conform to these regulations.

~~(6)~~(7) Photographic Documentation. For each durability demonstration, the applicant must submit digital photographs in electronic format of the following:

(A) The vehicle or piece of equipment before installation of the diesel emission control strategy. Photographs must show:
1. The entire vehicle or piece of equipment.
2. A close-up of the location in which the diesel emission control strategy will be installed.
3. All available engine identification including the make, model, and engine label.

(B) The vehicle or piece of equipment after installation of the diesel emission control strategy. Photographs must show:
1. The entire vehicle or piece of equipment showing the diesel emission control strategy installed, if possible.
2. A close-up of the installed diesel emission control strategy.
3. All available diesel emission control strategy identification including labels and logos.

(C) For a filter-based diesel emission control strategy, the outlet face of the filter after completing the durability demonstration.

~~(e)~~(f) Third-Party Statement for In-field Durability Demonstrations. For in-field durability demonstrations, the applicant must provide a written statement from an Executive Officer approved third party, such as the owner or operator of the vehicle or equipment used, at the end of the durability period. The statement must describe overall performance, maintenance required, problems encountered, and any other relevant comments. The results of a visual inspection conducted by the third party at the end of the demonstration period must also be described. The description should comment on whether the diesel emission control strategy is physically intact, securely mounted, leaking fluids, and should include any other evaluative observations. The third party statement must clearly identify the demonstration engine and vehicle or equipment using a unique identifier such as a vehicle identification number and engine serial number along with the engine family name, and must provide the name and contact information of the third party.

~~(f)~~(g) Test Cycle. Testing requirements are summarized in Table 4. Note that the same cycle(s) must be used for both the initial and final tests.

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~~(g)~~(h) Test Run. The requirements for emissions reduction testing are summarized in Table 4, below. Note that special pre-conditioning requirements may apply. See section 2706(a)(4) for details.

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~~(h)~~(i) Maintenance During Durability Demonstration. Except for emergency engine repair, only scheduled maintenance on the engine and diesel emission control strategy and re-fill of additives (if any) may be performed during the durability demonstration. If normal maintenance includes replacement of any component of the diesel emission control strategy, the time (miles, years, or hours) between component change or refill must be reported with the results of the demonstration.

~~(i)~~(j) Functional Testing of Monitoring and Notification Systems. The applicant must demonstrate the durability of all monitoring and notification systems employed by the diesel emission control strategy. Such systems include, but are not limited to, backpressure monitors, reductant level monitors, malfunction indicator systems, and mechanisms to de-rate an engine's maximum power output. The applicant must propose test procedures to demonstrate the durability of the monitoring and notification systems on a diesel emission control strategy that has completed the service accumulation period.

~~(j)~~(k) Performance Requirements. The diesel emission control strategy must meet the following requirements throughout the durability demonstration period:

(1) If the applicant claims a percent emission reduction, the percent emission reduction must meet or exceed the initial verified percent emission reduction level.
(2) If the applicant claims to achieve 0.01 g/bhp-hr for PM, the PM emission level must not exceed 0.01 g/bhp-hr.
(3) The diesel emission control strategy must maintain its physical integrity. Its physical structure and all of its components not specified for regular replacement during the durability demonstration period must remain intact and fully functional.
(4) The diesel emission control strategy must not cause any damage to the engine, vehicle, or equipment.
(5) The backpressure caused by the diesel emission control strategy should not exceed the engine manufacturer's specified limits, or must not result in any damage to the engine.
(6) No maintenance of the diesel emission control strategy beyond that specified in its owner's manual will be allowed without prior Executive Officer approval.

~~(k)~~(l) Conditional Verification for Off-road and Stationary Applications. If the Executive Officer determines that the diesel emission control strategy is technologically sound and appropriate for the intended application, he may grant a conditional verification for off-road and stationary applications upon completion of 33 percent of the minimum durability period. In making this determination, the Executive Officer may consider all relevant information including, but not limited to, the following: the design of the diesel emission control strategy, filter and catalyst substrates used, similarity of the strategy under consideration to verified strategies, the intended application of the diesel emission control strategy, other relevant testing data, and field experience. Where conditional verification is granted, full verification must be obtained by completing the durability testing and all other remaining requirements. For stationary, marine, RTG crane, and TRU applications, ~~T~~these requirements must be completed within a year after receiving conditional verification. For off-road applications, the requirements must be completed within two years after receiving conditional verification. For the aforementioned time periods, conditional verification is equivalent to verification for the purposes of satisfying the requirements of in-use emission control regulations except as otherwise provided in section 2709. For all applications, failure to complete the requirements within the specified time may result in revocation of the conditional verification and the recall provisions of section 2709 of this Procedure. Strategies that include the use of alternative diesel fuels or fuel additives are not eligible for conditional verification.

~~(l)~~(m) Failure During the Durability Demonstration Period. If the diesel emission control strategy fails to maintain its initial verified percent emission reduction or emission level for any reason, the Executive Officer may downgrade the strategy to the verification level which corresponds to the lowest degraded performance observed in the durability demonstration period. If the diesel emission control strategy fails to maintain at least 25 percent PM reduction or 25 percent NOx reduction at any time during the durability period, the diesel emission control strategy will not be verified. If the diesel emission control strategy fails, requires repair or maintenance, suffers any type of component failure, or the demonstration is aborted at any point in the course of the durability demonstration period, the applicant must submit a report explaining the circumstances within 45 days of the occurrence. The Executive Officer may then determine whether to deny verification or allow the applicant to correct the failed diesel emission control strategy and either continue the durability demonstration or begin a new durability demonstration.

NOTE: Authority cited: Sections 39002, 39003, 39500, 39600, 39601, 39650-39675, 40000, 43000, 43000.5, 43011, 43013, 43018, 43105, 43600 and 43700, Health and Safety Code. Reference: Sections 39650-39675, 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107 and 43204-43205.5, Health and Safety Code; and Title 17 California Code of Regulations Section 93000.

§ 2705. Field Demonstration Requirements.

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(c) Reporting Requirements.

(1) Temperature and Backpressure Measurement Requirements. For strategies that include exhaust aftertreatment, engine backpressure, exhaust temperature, and engine speed must be measured and recorded over the entire demonstration period. The applicant must propose a measurement and recording protocol for approval by the Executive Officer. The protocol may include, but is not limited to, measurement and recording of values once every few seconds, or higher frequency measurement with recording of averages, minima, and maxima over longer time intervals. The data must include an accurate date and time stamp that corresponds with periods of actual engine operation. Data must be submitted electronically in columns as a <u>spreadsheet or</u> text file or another format approved by the Executive Officer. <u>Failure to submit in an approved format will terminate the application process.</u>

(2) NOx emissions Measurement Requirements. For strategies that include exhaust aftertreatment to reduce emissions of NOx, the mass emissions of NOx both upstream and downstream of the aftertreatment device must be measured and recorded over the entire demonstration period. The applicant must propose a measurement method for approval by the Executive Officer. The method may include, but is not limited to, the use of NOx sensors before and after the device. Measurements of NOx emissions must occur on at least a 1 Hertz basis. Data must be recorded as averages over time intervals no greater than 10 seconds. The data must include an accurate date and time stamp that corresponds with

periods of actual engine operation. Data must be submitted electronically in columns as a text file or another format approved by the Executive Officer.

(3) Electronic System Codes. Error codes, fault codes, and high backpressure codes, as defined in the applicants test plan approval letter, that are generated by a diesel emission control strategy's electronic control system and/or operational monitoring system during the field demonstration must be submitted with the date and time each code occurs.

~~(3)~~(4) Third Party Statement. The applicant must provide a written statement from a third party approved by the Executive Officer, such as the owner or operator of the vehicle or equipment used in the field demonstration. The written statement must be provided at the end of the test period and must describe the following aspects of the field demonstration: overall performance of the test application and the diesel emission control strategy, maintenance performed, problems encountered, and any other relevant information. The results of a visual inspection conducted by the third party at the end of the demonstration period must also be described. The description should comment on whether the diesel emission control strategy is physically intact, securely mounted, leaking any fluids, and should include any other evaluative observations. The third party statement must clearly identify the demonstration engine and vehicle or equipment using a unique identifier such as a vehicle identification number and engine serial number along with the engine family name, and must provide the name and contact information of the third party.

~~(4)~~(5) Photographic Documentation. For each field demonstration, the applicant must submit digital photographs in electronic format of the following:

(A) The vehicle or piece of equipment before installation of the diesel emission control strategy. Photographs must show:

1. The entire vehicle or piece of equipment.
2. A close-up of the location in which the diesel emission control strategy will be installed.
3. All available vehicle or equipment identification including the make, model, license plate, and vehicle number.
4. All available engine identification including the make, model, and engine label.

(B) The vehicle or piece of equipment after installation of the diesel emission control strategy. Photographs must show:

1. The entire vehicle or piece of equipment showing the diesel emission control strategy installed, if possible.
2. A close-up of the installed diesel emission control strategy.
3. All available diesel emission control strategy identification including labels and logos.

(C) For a filter-based diesel emission control strategy, the outlet face of the filter after completing the field demonstration

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NOTE: Authority cited: Sections 39002, 39003, 39500, 39600, 39601, 39650-39675, 40000, 43000, 43000.5, 43011, 43013, 43018, 43105, 43600 and 43700, Health and Safety Code. Reference: Sections 39650-39675, 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107 and 43204-43205.5, Health and Safety Code; and Title 17 California Code of Regulations Section 93000.

§ 2706. Other Requirements.

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(4) Pre-conditioning requirements. If the Executive Officer determines that a diesel emission control strategy has a propensity to increase emissions of NO_2 and that the NO_2 emissions from a diesel emission control strategy could be affected by the presence of particulate matter or ash (as with a catalyzed diesel particulate filter), the strategy must be preconditioned according to the following procedure:

(A) Initial test (prior to service accumulation). Before conducting the initial emissions test, the unit being tested must be pre-conditioned as follows:

1. Install a new, unused unit on an engine that is an appropriate size for the unit, in a good state of maintenance, and certified to a PM standard equal to or more stringent than that of the engines in the emission control group for which the applicant seeks verification.
2. Operate the engine on one of the test cycles specified below for 25 to 30 hours. For on-road verifications, use either the FTP (hotstart) or UDDS cycle as identified in 2703(e), or the 13-mode Supplemental Emissions Test (SET) in the Code of Federal Regulations, Title 40, Part 86. For off-road and stationary verifications, use either the steady-state test cycle of the Nonroad Composite Transient Cycle (NRTC) (California Code of Regulations, Title 13, ~~S~~<u>s</u>ection 2423) from ARB off-road regulations. For up to 10 hours of the 25 to 30 hour period, beginning after at least the first three test cycle repetitions or ending before at least the last three test cycle repetitions, an applicant may alternatively:
   a. Run the engine at high load such that the exhaust temperature is between 350 and 450 degrees Celsius, or
   b. Alternate back and forth between high and low loads such that the exhaust temperature never exceeds 525 degrees Celsius and the low load operation does not result in significant soot accumulation at the end of the pre-conditioning period.

~~2~~<u>3</u>. Measure and record the backpressure<u>,</u> ~~and~~ exhaust temperature<u>, date, and time</u> on a second-by-second basis (1 Hertz) for the duration of the 25 to 30 hour pre-conditioning period. Determine the average backpressure for at least the first three and last three test cycle repetitions.

~~3~~4. Following the 25 to 30 hour period of operation, remove the unit from the pre-conditioning engine and install it on the emissions test engine, if applicable. Proceed with the initial emissions test and determine NO_2^i, as defined in section 2706(a)(5). Determine the average backpressure over each of the emissions test repetitions and then average those values. The resulting average backpressure is compared with that of the aged unit per subsection (B), below.

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(C) In-Use Compliance Testing. Before conducting ~~the first phase of~~ in-use compliance emissions testing, the test units may need to be pre-conditioned. Using the required test cycle, measure and record the backpressure on a second-by-second basis (1 Hertz) over one hot-start test with a cleaned (or pre-conditioned per subsection (A) above) reference unit installed on the engine to be used for in-use compliance testing. The reference unit must be identical to the test units. Measure and record the backpressure of the test units retrieved from the field using the same engine and test cycle (one hot-start) as used with the reference unit. If the backpressure of a given test unit is either within 30 percent of the average backpressure recorded for the reference unit or, for transient test cycles, the backpressure does not exceed 60 inches of water for more than two percent of the time, or, for steady-state test cycles, the backpressure never exceeds 60 inches of water, it does not require pre-conditioning. Otherwise, the test unit must be pre-conditioned following subsection (B) above. Other units may not be substituted for the selected test units.

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(b) Limits on Other Pollutants

(1) Limits on non-methane hydrocarbon (NMHC) and NOx. In order for a diesel emission control strategy to be verified, the applicant must comply with one of the following:

(A) The diesel emission control strategy must not increase the emissions of either NMHC or NOx by more than ten percent of the baseline emissions level as reported under section 2708 (a) except that NMHC emissions may be increased by up to 0.1 g/bhp-hr provided the increase does not cause the emissions to exceed the applicable NMHC emissions standard or 0.5 g/bhp-hr if no standard exists, or

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(c) Fuel Additives. Diesel emission control strategies that use fuel additives must comply with ~~S~~section 2710 and meet the following additional requirements for verification. Fuel additives must be used in combination with a level 3 diesel particulate filter unless they can be proven to the satisfaction of the Executive Officer to be safe for use alone. In addition, the applicant must meet the following requirements:

(1) The applicant must submit the exact chemical formulation of the fuel additive,

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(4) The applicant must conduct additional emission tests of fuel additives.

(A) Except as provided in (B) below, the additional emission tests must follow the same test procedures, test cycles, and number of test runs as indicated in ~~S~~section 2703, except that the concentration of the additive must be at least 50 ppm or 10 times higher than that specified for normal use, whichever is highest. In all other respects, the additive in the high concentration test solutions must be identical to that in the fuel additive submitted for verification.

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(5) Fuel additives must be in compliance with applicable federal, state, and local government requirements. This requirement includes, but is not limited to, registration of fuel additives with the U.S. EPA. Registration of fuel additives with U.S. EPA must be completed prior to submission of an applicant's preliminary verification application.

* * * * *

(d) Alternative Diesel Fuels. Alternative diesel fuels must be in compliance with applicable federal, state, and local government requirements. This requirement includes, but is not limited to, registration of the alternative diesel fuel with the U.S. EPA. Registration of alternative diesel fuels with U.S. EPA must be completed prior to submission of an applicant's preliminary verification application. The applicant must conduct additional emission tests of alternative diesel fuels if the Executive Officer determines that such tests are necessary. The Executive Officer may consider all factors including, but not limited to, fuel components that could adversely affect emissions reductions and/or the applications to which they are applied.

* * * * *

(f) Operational Data Monitoring and Storage Requirements. The following requirements apply to all diesel emission control strategies that include exhaust aftertreatment:

(1) During emissions and durability testing, the applicant must:

(A) Measure and record exhaust backpressure and temperature pursuant to sections 2703 and 2704.
(B) Demonstrate that the backpressure caused by its diesel emission control strategy is within the engine manufacturer's specified limits, or will not result in any damage to the engine.

(2) If operation of the engine with the diesel emission control strategy installed will result in a gradual build-up of backpressure exceeding the engine's specified limits over time (such as due to the accumulation of ash in a filter), the applicant must submit information describing how to reduce the backpressure.

(3) All ~~filter-based~~ diesel emission control strategies that include a diesel particulate filter or other device that can cause exhaust backpressure to increase over time must be installed with a backpressure monitor to notify the operator of high backpressure conditions. The monitor must have a minimum of two stages of notification: when the high backpressure limit, as specified by the engine manufacturer or included in the verification application, is approached and when the high backpressure limit is reached or exceeded. These notifications must occur and be clearly visible to the operator while the vehicle or equipment is in use. Vehicles or equipment that can be operated from multiple locations by end-users must include a secondary notification system on the vehicle or equipment to alert the operator of a high backpressure condition. The applicant must identify the proposed high backpressure limits ~~of~~ for the strategy in its application for verification. Each high backpressure notification event must be recorded pursuant to section 2706(f)(5).

(A) The final, maximum high backpressure notification must be non-resettable by the operator and must meet the following requirements:
1. If the notification is triggered, it must remain on until a qualified technician can examine the engine and filter to determine the cause of the high backpressure condition.
2. If the notification is triggered and the engine is subsequently turned off, it must immediately resume when the engine is turned back on.
3. If the notification is triggered and the notification system subsequently either loses power or otherwise becomes nonfunctional, the notification must immediately resume when the system becomes operational.

(4) The Executive Officer reserves the right to require monitors that identify low backpressure limits in those cases where failures leading to low backpressure are unlikely to be detected, or have the potential to cause environmental damage beyond that caused by the engine prior to being equipped with the emission control strategy (e.g., systems that introduce additives into the fuel).

(5) ~~If the Executive Order for a diesel emission control strategy includes an exhaust temperature requirement, the strategy~~ All backpressure monitors must include an electronic device that is able to do the following:

(A) Measure and record exhaust backpressure and exhaust gas temperature data. Each record must include the date and time of measurement.

(B) Have the capacity to record exhaust backpressure, ~~and~~ exhaust temperature, date, and time data as described in (A) above for a period of at least 200 hours of actual engine operation without overwriting any stored data. ~~Data~~Measurements must be recorded at least once every 30 seconds. Each record must consist of the instantaneous measured exhaust backpressure and exhaust gas temperature or an average of such measurements over no more than the preceding 30 seconds provided the maximum and minimum values are also recorded for the same averaging period.

(C) Have the capacity to record error codes and high backpressure codes for a period of at least 500 hours of actual engine operation without overwriting any stored data. Each record must include the code and the date and time it occurred.

(6) An applicant must submit to the Executive Officer at the time of application all software and hardware that are required to interface with the diesel emission control strategy and download and view all recorded data. All such software and hardware associated with a diesel emission control strategy that is already verified must be submitted to the Executive Officer by the applicant no later than six months following the effective date of this part of the regulation.

(i) Component Swapping and Re-Designation Practices

(1) Component Swapping Practices.

* * * * *

(2) Device Re-Designation Practices. Applicants may authorize the complete removal of a verified diesel emission control strategy from the original installation to another vehicle or equipment within the end user's commonly owned fleet, provided the following provisions are met:

(A) Applicants must receive written approval from the Executive Officer prior to approving a diesel emission control strategy re-designation.

* * * * *

(G) A diesel emission control strategy installed on a vehicle or piece of equipment that is repowered (see section 2701(a)(34~~8~~)) may remain installed provided:

* * * * *

(j) System Labeling

(1) The applicant must ensure that identical, legible, and durable labels are affixed on both the diesel emission control strategy and the engine (or an alternate location approved by the Executive Officer) on which the verified diesel emission control strategy is installed except as noted in (3) below. All labels must be constructed and affixed so that they resist tampering and remain legible for the duration of the diesel emission control strategy's minimum warranty period. One label shall be welded, riveted, or otherwise permanently attached to the diesel emission control strategy and the other affixed to the engine in such a manner that it cannot be easily removed (e.g., bolted). The required labels must identify the name, address, and phone number of the manufacturer, the diesel emission control strategy family name (defined in (2) below) of the installed system, a unique serial number, and the month and year of manufacture. The month and year of manufacture are not required on the label if this information can be readily obtained from the applicant by reference to the serial number. ~~The applicant and installer must ensure that the label is affixed such that it is resistant to tampering and degradation from the conditions of its environment.~~ The applicant and/or installer must ensure that the label is visible after installation. In the event that the original strategy label is damaged, ~~or~~ destroyed, or missing ~~by the end user~~, the device manufacture shall issue an ARB approved replacement. The replacement label must be identical to the original label with the exception of the words "REPLACEMENT LABEL" which must be included at the bottom line of information. A sample scale drawing of the original and replacement labels must be submitted with the verification application. The end user must notify the applicant in the event of a damaged, destroyed, or missing original strategy label. The applicant must issue a replacement label within 45 days of notification by an end user of a damaged, destroyed, or missing label. All labels must be approved by the Executive Officer and must only be used with an ARB verified diesel emission control strategy. Unless an alternative is approved by the Executive Officer, the label information must be in the following format:

Name, Address, and Phone Number of Manufacturer
Diesel Emission Control Strategy Family Name
Product Serial Number
ZZ-ZZ (Month and Year of manufacture, e.g., 06-02)
REPLACEMENT LABEL*

* "Replacement Label" to be used only when a replacement of the original label has been issued by the device manufacturer.

(2) Diesel Emission Control Strategy Family Name. Each diesel emission control strategy shall be assigned a family name defined as below:

CA/MMM/YYYY/PM#/N##/AP~~P~~/XXXXX

CA: Designates a diesel emission control strategy verified in California.

MMM: Manufacturer code (assigned by the Executive Officer).

YYYY: Year of verification.

PM#: PM verification level 0, 1, 1+, 2, 2+, 3, or 3+ (e.g., PM3 means a level 3 PM emission control system).

N##: NOx verified reduction level in percent, if any (e.g., N25 means NOx reduction of 25 percent).

AP: Verified application that includes one of the following: On-road (ON), Off-road (OF), ~~or~~ Stationary (ST), Marine (MA), Locomotive (LO), Transport Refrigeration Unit (TR), or Auxiliary Power System (AP).

XXXXX: Five alphanumeric character code issued by the Executive Officer.

(3) The applicant may request that the Executive Officer approve an alternative label format. In reviewing this request, the Executive Officer may consider all relevant information including, but not limited to, the informational content of an alternative label as proposed by the applicant.

* * * * *

(l) Owner's Manual. The applicant must provide a copy of the diesel emission control strategy owner's manual to the Executive Officer and, upon delivery of the diesel emission control strategy, to the end-user, which must clearly specify at least the following information:

(1) A Table of Contents located at the beginning of the owner's manual identifying the location of subsections (2) through (18) identified below.

(2) A statement alerting the end-user of their responsibility for maintaining the candidate engine such that it continues to meet the pre-installation compatibility assessment conditions identified in section 2706(t).

~~(1)~~(3) Warranty statement including the warranty period over which the applicant is liable for any defects.

~~(2)~~(4) Installation procedure and maintenance requirements for the diesel emission control strategy.

(5) An objective criteria for DECS ash removal (pressure drop across the filter, maximum clean filter weight, pre-installation filter weight comparison, etc.) for determination if a DECS is "cleaned" pursuant to section 2706(h)(2)(B)

~~(3)~~(6) Possible backpressure range imposed on the engine.

~~(4)~~(7) Fuel consumption penalty, if any.

~~(5)~~(8) Fuel requirements including sulfur limit, if any.

~~(6)~~(9) Handling and supply of additives, if any.

~~(7)~~(10) Instructions for reading and resetting the backpressure monitor.

~~(8)~~(11) Requirements for lubrication oil quality and maximum lubrication oil consumption rate.

~~(9)~~(12) The following statements must be included verbatim in the owner's manual:

* * * * *

~~(10)~~(13) Contact information for replacement components and cleaning agents.

~~(11)~~(14) Contact information to assist an end-user to determine proper ways to dispose of waste generated by the diesel emission control strategy (e.g., ash accumulated in filter-based systems). At a minimum, the owner's manual should indicate that disposal must be in accordance with all applicable Federal, State, and local laws governing waste disposal.

~~(12)~~(15) Appropriate methods of removing the diesel emission control strategy from the original installed configuration and installing the strategy on a different vehicle or piece of equipment, if such practices are allowed. The applicant must state possible repercussions to the end-user if such practices are done in an inappropriate manner. (See section 2706(i)).

~~(13)~~(16) Appropriate methods of swapping identical components in strategies that share the same diesel emission control strategy family name.

~~(14)~~(17) Parts List. Those parts not covered by the warranty provision of section 2707 must be specifically identified by a common description and part number.

~~(15)~~(18) Notification of potential safety concerns associated with the operation of the diesel emission control strategy.

* * * * *

(n) Installation Manual. The applicant must provide ~~the Executive Officer,~~ a copy of the diesel emission control strategy installation manual that the applicant intends to provide to installers and/or owners. The installation manual must include sufficient detail to enable the installer to properly install the diesel emission control strategy such that the installation is free from defects in workmanship, materials, or operation which could cause any of the components of the diesel emission control strategy to fail and allow the installer to warrant the installation pursuant to section 2707(a)(2)(A).

(1) The installation manual must include the criteria that will be used by the applicant to authorize a person or company to install their verified diesel emission control strategy.

(2) The installation manual must also include the criteria that will be used by the applicant to revoke a person or company's authorization to install their diesel emission control strategy.

* * * * *

(t) Pre-Installation Compatibility Assessment. The applicant~~, distributor,~~ or authorized installer (i.e., the party conducting the pre-installation compatibility assessment) must be able to demonstrate, to the satisfaction of the Executive Officer, that a candidate engine being considered for retrofit is compatible with the verified diesel emission control strategy by ensuring that each candidate engine meets all the terms and conditions of the Executive Order prior to installation.

(1) Each applicant must establish specific criteria to determine the suitability of a candidate engine prior to installation and provide this information to their authorized installers. This must include but is not limited to: a smoke opacity limit, oil consumption limits, fuel inspection requirements, visual inspections, and other assessment criteria that may be used to determine that the candidate engine is appropriate for use with the diesel emission control strategy and that the candidate engine is in a proper state of maintenance and operating within the engine manufacturers specifications. Candidate engines that do not meet the suitability criteria or that have a smoke opacity measured in accordance with Society of Automotive Engineers J1667 test procedures that exceeds the limit established by the applicant must not be retrofit with the diesel emission control strategy.

(A) The applicant must select and define specific criteria (e.g., oil consumption limits, fuel inspection requirements, visual inspection requirements, ensure adherence to all the terms of the verification Executive Order, etc.) that can be used by the installer to ensure that the candidate engine is appropriate for use with the diesel emission control strategy.

(B) The applicant must select a smoke opacity limit measured in accordance with Society of Automotive Engineers J1667 test procedures that serves to prevent installation of a diesel emission control strategy on an engine that is not appropriate for use with the diesel emission control strategy.

(C) For a diesel emission control strategy that is already verified, the holder of the verification must establish and implement specific criteria, including a smoke opacity limit, which may be used to determine the suitability of a candidate engine no later than six months following the effective date of this part of the regulation.

(D) For engines that operate at a constant-speed or are otherwise designed such that they are unable to follow Society of Automotive Engineers J1667 test procedures, the applicant must propose an alternate criterion instead of a smoke opacity level to determine the suitability of a candidate engine prior to installation.

~~(1)~~(2) For diesel emission control strategies that have exhaust gas temperature requirements for successful operation, the applicant~~, distributor,~~ or authorized installer (i.e., the party conducting the pre-installation compatibility assessment) must measure and record the exhaust gas temperature for each candidate engine to determine if the temperature requirements are satisfied. These measurements must represent the most challenging duty cycle (i.e., pattern of use) of the candidate engine with respect to the temperature requirements. Notwithstanding, the applicant is responsible for ensuring that the candidate engine is properly assessed. In lieu of logging data for each candidate engine, only the applicant may choose to data-log a representative number of candidate engines, provided the following requirements are met:

(A) The diesel emission control strategy is verified to reduce emissions of diesel particulate matter only,

(B) At least 5 representative engines must be data-logged from within each group of similar engines, or 10 percent of each group, whichever is larger. All engines in a group of 5 or fewer engines must be data-logged. Data from engines outside the group cannot be used to support retrofit of engines within the group. A group of engines is similar if:

1. All engines belong to the same common ownership fleet.
2. All engines have the same make and model.
3. All engines are certified to the same PM emissions standard.
4. The maximum power ratings of all engines fall within a range that does not exceed 100 horsepower. For example, all engines are rated to between 250 and 350 horsepower.
5. None of the engines have exhaust gas recirculation, or all of the engines have external exhaust gas recirculation, or all of the engines have internal exhaust gas recirculation.
6. All engines are installed in similar vehicles or equipment that perform a like function and have similar duty cycles. Examples of vehicle or equipment groups considered similar include solid waste collection vehicles, transit buses, class 8 tractors, excavators, wheel loaders, and back-up emergency generators.

(C) If the diesel emission control strategy is determined to be compatible with the candidate engine in its current application, the applicant~~,~~ ~~distributor,~~ or authorized installer (i.e., the party conducting the pre-installation compatibility assessment) must provide a written statement to the end user ~~no later than the date~~ at the time of installation and, upon request, to the Executive Officer within 30 calendar days of the request, that includes:

1. A statement that the exhaust gas temperature profile of the candidate engine was found to satisfy the requirements of the diesel emission control strategy's Executive Order,
2. The date of this determination,
3. The name and contact information of the owner of the common ownership fleet,
4. The Executive Order number and the diesel emission control strategy family name,
5. The engine family name, engine make and model, and power rating of each candidate engine along with a unique identifier such as a vehicle identification number or an engine serial number,

6. A description of the vehicle or equipment type for each candidate engine,
7. Identification of which candidate engines were data-logged and the groups they represent,
8. Identification of the parameters used to define each group of similar engines, ~~and~~
9. The name of the authorized installer and the date of installation, ~~if applicable.~~ and
10. A statement that any change in the duty cycle (i.e., pattern of use) used to measure the exhaust gas temperature profile of the candidate engine may cause the diesel emission control strategy to fail to meet the requirements of the strategy's Executive Order and information regarding how such a change will affect the performance of the strategy.

(D) In cases where representative sampling is selected, the party conducting the pre-installation compatibility assessment is still responsible for ensuring that all diesel emission control strategy installs comply with all the terms and conditions of the Executive Order.

~~(2)~~ (E) Data must be measured and recorded using a stand-alone data logging system that is independent of the diesel emission control strategy and must adhere to the following criteria:

~~(A)~~1. The measured and recorded data must be representative of the actual duty cycle and operation of the candidate engine as best it can be anticipated at the time.

~~(B)~~2. The exhaust gas temperature of the candidate engine must be measured at a point in the exhaust system that is within 6 inches of the proposed location of the inlet of the diesel emission control strategy.

~~(C)~~3. The recorded exhaust gas temperature must have an accuracy of at least ±4 degrees Celsius. The temperature sensor must have a range sufficient to accommodate the highest exhaust gas temperature measured plus 10 percent without exceeding the sensor's full scale rating while ensuring that 90 percent of the measured values fall between 10 and 90 percent of the sensor's full scale rating.

~~(D)~~4. The exhaust gas temperature of the candidate engine must be measured and recorded for a period that is long enough to determine the exhaust gas temperature profile associated with the candidate engine's duty cycle, but not less than 24 hours of representative, actual engine run time, unless the candidate engine is an Emergency Standby Engine permitted under the authority of a California Air District, as defined in section 39025 of the Health and Safety Code. Emergency standby engines with restricted use requirements may propose a period of less than 24 hours at the Executive Officer's discretion. The data logging strategy must include a means to accurately determine when the engine is actually running. This may include use of a data logging system that starts automatically when the engine starts and stops automatically when the engine stops, or a means to identify and remove data that correspond to the engine being off such as by simultaneously logging data from an engine RPM sensor or applying a temperature threshold that corresponds to a temperature just below the idle temperature of the engine.

~~(E)~~5. The memory of the data logging system must be of sufficient size to ensure that data are not overwritten prior to retrieval.

~~(F)~~6. All data must be recorded at a frequency of at least once every 5 seconds (0.2 Hertz)

~~(G)~~7. At a minimum, the following parameters must be measured and recorded:

~~1.~~a. Exhaust gas temperature in degrees Celsius

~~2.~~b. Time and date for each data point

~~3.~~c. Other parameters deemed necessary by the Executive Officer to meet the terms and conditions of the Executive Order.

(3) At the Executive Officer's request, the applicant must submit all data used to determine the suitability of a candidate engine with a verified diesel emission control strategy. All logged data must be submitted electronically in Microsoft Excel or Microsoft Access or another format approved by the Executive Officer. The ~~installer~~ party conducting the pre-installation compatibility assessment must keep a record of the data used to determine the suitability of the candidate engine for the duration of the warranty period of the diesel emission control strategy and make the data available to the applicant and the Executive Officer upon request. These data must include all logged data, the date of the determination, the name and contact information of the end user, the date of installation, the name and contact information of the installer, the Executive Order number, the diesel emission control strategy family name, and clearly identify the candidate engine and vehicle or equipment using a unique identifier such as a vehicle identification number and an engine serial number along with the engine family name.

(4) Prior to installation of a diesel emission control strategy, the applicant or authorized installer (i.e., the party performing the installation of the diesel emission control strategy) must conduct a basic assessment of each candidate engine~~'s state of maintenance~~ to ensure that it is appropriate for use with the diesel emission control strategy using the applicant criteria identified in section 2706(t)(1). The assessment must be performed no more than 15 days prior to installation. The ~~installer~~ party performing the installation of the diesel emission control strategy must maintain a record of all documentation used to make the determination that the candidate engine was appropriate for use with the diesel emission control strategy. All such records maintained by the ~~installer~~ party performing the installation of the diesel emission control strategy must be made available to the Executive Officer within thirty days upon written request. ~~For this basic assessment, the installer must at a minimum do the following:~~

~~(A) Review oil consumption and engine maintenance records if available,~~
~~(B) Obtain a fuel sample from the fuel tank and visually inspect the sample for contamination,~~
~~(C) Inspect the engine for signs of poor maintenance including oil leaks,~~
~~(D) Inspect the tailpipe for signs of oil contamination, and~~
~~(E) Inspect the exhaust plume for signs of high PM emissions and oil burning.~~

(u) Requirements for Installers of Diesel Emissions Control Strategies

(1) Any party that installs a diesel emission control strategy must be authorized and trained by the party that holds the verification for the diesel emission control strategy.

(2) Any party that installs a diesel emission control strategy must comply with the pre-installation assessment requirements in section 2706(t).

(3) All installations must strictly adhere to the requirements of the party that holds the verification for the diesel emissions control strategy and must not relocate the original equipment manufacturers exhaust system:

(A) Over any occupied space (e.g., driver or passenger compartments); or

(B) That would result in any noncompliance with any applicable safety standards such as but not limited to Federal Motor Carrier Safety Administration, Subpart G, Miscellaneous parts and accessories, section 393.83 Exhaust systems; or

(C) Any other location deemed unacceptable by the applicant.

(4) Any party that installs a diesel emission control strategy must offer a warranty pursuant to section 2707(a)(2).

(v) Training Requirements. The applicant is responsible for developing training to ensure end-users can safely operate and maintain their diesel emission control strategy. This training must include, at a minimum: a review of the pre-installation compatibility assessment criteria results, the effects of engine maintenance on the strategy's performance, identification of all warning and/or fault alarms and appropriate end-user responses, and cleaning and maintenance information for the strategy. The applicant or their authorized installer is responsible for ensuring that this training is presented to the end-user before the vehicle, equipment, or engine is put back into service following the installation of the strategy and must be available to the end-user on an on-going basis (e.g., online training materials).

(w) Safety Considerations. The applicant must give consideration to safety and catastrophic failure in the design of the diesel emission control strategy. The Executive Officer addresses safety as follows:

(1) The applicant must provide an analysis of all potential safety and catastrophic failure issues associated with the use of the diesel emission control strategy including an analysis of all potential failure modes. This analysis must include, but is not limited to, the effects of: uncontrolled regeneration, improper maintenance, unfavorable operating conditions,

use of inappropriate fuel, high exhaust temperatures, substrate failure, and sensor failures. For any potential safety or catastrophic failure issues identified, the applicant must provide a detailed description of the safety risk mitigation strategies that it employs.

(2) The Executive Officer may require additional safety testing and design modifications to the diesel emission control strategy both before and after verification of the diesel emission control strategy. In making these determinations, the Executive Officer may consider all relevant information including, but not limited to, the safety and catastrophic failure analysis provided by the applicant, system design, properties of the materials used by the diesel emission control strategy, field experience, and warranty report data. The Executive Officer may require that safety testing be conducted by an independent test facility that has appropriate safety testing experience.

(3) If the Executive Officer determines that an applicant has not made a satisfactory demonstration of the safety of its diesel emission control strategy, the Executive Officer may deny the applicant's request for verification or revoke an existing verification.

(x) Technical service bulletins, pre-installation compatibility assessment criteria, other service related information, or any other documentation that effects the proper operation and maintenance of the diesel emission control strategy provided to end-users, authorized installers, or distributors must be submitted concurrently to ARB. Submission of such information does not relieve applicants from the design modification requirements of section 2702(j) nor does it constitute ARB approval.

NOTE: Authority cited: Sections 39002, 39003, 39500, 39600, 39601, 39650-39675, 40000, 43000, 43000.5, 43011, 43013, 43018, 43105, 43600, 43700 and 43830.8, Health and Safety Code. Reference: Sections 39650-39675, 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107, 43204-43205.5, Health and Safety Code; and Title 17 California Code of Regulations Section 93000.

§ 2707. Warranty Requirements.

* * * * *

(2) Installation Warranty

(A) A person or company who installs a verified diesel emission control strategy must warrant that the installation is free from defects in workmanship or materials which cause the diesel emission control strategy to fail to conform to the emission control performance level it was verified to or the other requirements of sections 2700-2706 for the minimum time periods shown in Table 5.

(B) For each engine type and size listed in Table 5, the ~~minimum defects~~ installation warranty period is terminated by that listed event whichever occurs first. The installation warranty must cover the full repair or replacement cost of the diesel emission control strategy, including parts and labor.

(C) The installation warranty coverage provided by installers must ~~be~~ meet the same requirements as the warranty coverage provided by the applicant as established in subsection (a)(1) (C)-(E) and the same exclusions apply.

* * * * *

(b)(1) Product Warranty Statement. The applicant must furnish a copy of the following statement in the owner's manual, a copy of which must be provided to each owner upon delivery of the diesel emission control strategy. The applicant may include descriptions of circumstances that may result in a denial of warranty coverage, but these descriptions shall not limit warranty coverage in any way.

YOUR WARRANTY RIGHTS AND OBLIGATIONS

(Applicant's name) must warrant the diesel emission control system in the application for which it is sold or leased to be free from defects in design, materials, workmanship, or operation of the diesel emission control system which cause the diesel emission control system to fail to conform to the emission control performance level it was verified to, or to the requirements in the California Code of Regulations, Title 13, ~~S~~sections 2700 to 2706, and 2710, for the periods of time listed below, provided there has been no abuse, neglect, or improper maintenance of your diesel emission control system, vehicle or equipment, as specified in the owner's manuals. Where a warrantable condition exists, this warranty also covers the engine from damage caused by the diesel emission control system, subject to the same exclusions for abuse, neglect or improper maintenance of your vehicle or equipment. Please review your owner's manual for other warranty information. Your diesel emission control system may include a core part (e.g., particulate filter, diesel oxidation catalyst, selective catalytic reduction converter) as well as hoses, connectors, a back pressure monitor (if applicable), and other emission-related assemblies. Where a warrantable condition exists, (applicant's name) will repair or replace your diesel emission control system at no cost to you including diagnosis, parts, and labor.

WARRANTY COVERAGE:

For a (engine size) engine used in a(n) (type of application) application, the warranty period will be (years or hours or mile of operation) whichever occurs first. If any emission-related part of your diesel emission control system is defective in design, materials, workmanship, or operation of the diesel emission control system thus causing the diesel emission control system to fail to conform to the emission control performance level it was verified to, or to the requirements in the California Code of Regulations, Title 13, ~~S~~sections 2700 to 2706, and 2710, within the warranty period, as defined above, (Applicant's name) will repair or replace the diesel emission control system, including parts and labor. This coverage also applies to any parts replacements, sizing changes, or adjustments that are required to appropriately match the diesel emission control system to the engine on which it is installed.

* * * * *

(c) Diesel Emission Control Strategy Warranty Report. The applicant must submit a warranty report to the Executive Officer annually by April 1 of each calendar year for each verified ~~system~~ strategy with a unique diesel emission control strategy family name. The warranty report must include all warranty claims, even those that did not result in warranty service, and must delineate claims that resulted in warranty service (i.e., valid claims) from those that did not result in warranty service. The applicant must also submit a warranty report within 30 calendar days if, at any time, the cumulative number of valid warranty claims for the same part or component of the diesel emission control strategy exceed four percent of the ~~number of diesel engines using the~~ cumulative sales or leases for the diesel emission control strategy family. Where valid warranty claims exceed four percent, the Executive Officer may modify, revoke or suspend the existing verification or order a recall per the requirements of section 2709 of this Procedure. The warranty report must include the following information and shall be submitted in the format specified by the Executive Officer:

(1) ~~Annual~~The manufacturers corporate name, sales for the given calendar year and cumulative sales, and ~~annual~~ leases for the given calendar year and cumulative leases of diesel emission control ~~systems~~ strategies (California ~~only~~ verified).

(2) ~~Annual~~Production for the given calendar year and cumulative production of diesel emission control ~~systems~~ strategies (California ~~only~~ verified).

(3) Annual summary of warranty claims for the given calendar year (California ~~only~~ verified). The summary must include:

(A) A description of the nature of the claims and of the warranty replacements or repairs. The applicant must categorize warranty claims for each diesel emission control strategy family name by the part(s) or component(s) replaced or repaired.

(B) The number and percentage of diesel emission control ~~systems~~ strategies of each ~~model~~ family for which a warranty replacement or repair was identified.

(C) A short description of the diesel emission control ~~system~~ strategy part or component that was replaced or repaired under warranty and the most likely reason for its failure.

(D) For each part or component replaced or repaired under warranty, the number of annual and cumulative replacements or repairs of each part or component.

(E) Name and contact information of the end-user that filed the warranty claim and, if applicable, company name.

(4) Date the warranty claims were filed and the engine family and application the diesel emission control ~~systems~~ strategy were used with.

(5) Delineate the reason(s) for any instances in which warranty service is not provided to end-users that file warranty claims.

(6) A current list of authorized installers for the diesel emission control strategy family name.

(7) An applicant that fails to submit a complete diesel emission control strategy warranty report by April 1, or if required, within 30 calendar days for valid warranty claims in excess of four percent for the same part or component, may be subject to civil penalties as specified in state law and regulations, including, but not limited to, Health and Safety Code Sections 39600, 39660, and 39674.

(8) A diesel emission control strategy warranty report that does not contain all required information will not be considered complete. A diesel emission control strategy warranty report will be considered to be complete as of the date that all required information is submitted.

(d) Installation Warranty Report. Authorized installers of diesel emission control strategies must submit an installation warranty report to the Executive Officer annually by March 1 of each calendar year. The installation warranty report must include all installation warranty claims, even those that did not result in warranty service, for each verified strategy with a unique diesel emission control strategy family name for which they are authorized. Authorized installers must delineate all installation warranty claims by manufacturer and diesel emission control strategy family name and identify claims that resulted in warranty service (i.e., valid claims) and those that did not result in warranty service. The required information may be included in one annual report to the Executive Officer. An authorized installer must also provide each applicant a copy of the information that pertains to the applicant's products at least annually by March 1. The installation warranty report must include the following information submitted electronically as a spreadsheet or text file or another format approved by the Executive Officer:

(1) Name of the person or company installing verified diesel emission control strategies including contact information (business phone number, mailing address, and physical address if different from mailing address).

(2) Name and contact information of the person responsible of submitting the installation warranty report.

(3) Identification of each unique diesel emission control strategy family name the installer is authorized to install.

(4) Annual and cumulative installations for each diesel emission control strategy family name.

(5) For each installation warranty claim the following information must be provided:

(A) Name and contact information (business phone number and mailing address) of the end user.
(B) Diesel emission control strategy family name and serial number.
(C) Engine family name of the vehicle or equipment upon which the strategy is installed.
(D) Date of installation of the strategy.
(E) Mileage or engine hours at time of installation.
(F) Date of installation warranty claim.
(G) Hours of use or mileage at the time of installation warranty claim.
(H) Location of vehicle or equipment at the time of installation.
(I) Indication that the pre-installation assessment records per section 2706(t) are available for Executive Officer review upon request.
(J) A detailed description of the reason for the claim.
(K) Date of resolution of the claim.
(L) Identification if the installation warranty claim was honored (i.e., valid warranty claim) or denied.
(M) If the installation warranty claim was denied, a detailed explanation for the denial.

(6) An authorized installer of a verified diesel emission control strategy that fails to submit a complete installation warranty report by March 1 may be subject civil penalties as specified in state law and regulations, including, but not limited to, Health and Safety Code Sections 39600, 39660, and 39674.

(7) An installation warranty report that does not contain all required information will not be considered complete. An installation warranty report will be considered to be complete as of the date that all required information is submitted.

NOTE: Authority cited: Sections 39002, 39003, 39500, 39600, 39601, 39650-39675, 40000, 43000, 43000.5, 43011, 43013, 43018, 43105, 43600, 43700, Health and Safety Code. Reference: Sections 39650-39675, 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107, 43204-43205.5, Health and Safety Code; and Title 17 California Code of Regulations Section 93000.

§ 2708. Determination of Emissions Reduction.

(a) Calculation of Emissions Reduction. The emissions reduction verified for a diesel emission control strategy is based on the average of all valid test results before (baseline) and after (control) implementation of the diesel emission control strategy. Test results from both emission testing and durability testing are to be used. If the applicant chooses to perform either the initial or the final durability baseline test, but not both, it must use those results to calculate the reductions obtained in both the initial and final control tests.

(1) Percentage Reduction. The percentage reduction for a given pair of baseline and control test sets (where a "set" consists of all test cycle repetitions, e.g., the test set of 3 hot-start UDDS tests) is the difference between the average baseline and average control emissions divided by

the average baseline emissions, multiplied by 100 percent. The average of all such reductions, as shown in the equation below, is used in the verification of a diesel emission control strategy.

$$\text{Percentage Reduction} = 100\% \times \frac{\Sigma\,[(\text{baseline}_{AVG} - \text{control}_{AVG})/\text{baseline}_{AVG}]}{\text{Number of control test sets}}$$

Where:

Σ = sum over all control test sets

baseline_{AVG} or control_{AVG} = average of emissions from all baseline or control test repetitions within a given set

(A) For any test set involving cold and hot starts, the time weighted emission result is to be calculated by weighting the cold-start emissions by one-seventh (1/7) and the hot-start emissions by six-sevenths (6/7) as shown below.

Weighted Emission Result = 1/7* average cold-start emissions + 6/7* average hot-start emissions

(B) For applicants that request ~~seeking~~ verification of NOx reductions from on-road applications and submit additional test data pursuant to section 2703(e)(1)(C), weighted test results from the additional test set ~~described in subsection 2703(e)1(C)~~ are included in the percentage reduction equation above. The Executive Officer shall determine an appropriate weighting factor in consultation with the applicant based on factors including, but not limited to, the amount of time that vehicles within the selected emission control group have elevated NOx emissions and the breadth of engines and applications encompassed by the emission control group.

(2) The absolute emission level is the average control emission level, as defined in the following equation:

$$\text{Absolute Emission Level} = \frac{\Sigma\,(\text{control}_{AVG})}{\text{Number of control test sets}}$$

(b) Categorization of the Diesel Emission Control Strategy. The Executive Officer shall categorize diesel emission control strategies to reduce PM and NOx emissions based on their verified emission reductions according to Table 1 in section 2702. For a diesel emission control strategy to be verified at a given Level or Mark, the emission reductions demonstrated by each test set submitted with the application must be greater than or equal to the minimum reduction that defines the Level or Mark. It is not sufficient for the average reduction to exceed the minimum value of the Level or Mark if one of the reductions in the average is below the minimum. ~~Diesel emission control strategies that reduce NOx will be assigned their verified emission reduction (Mark 1, 2, 3, 4, or 5) in 15 percent increments starting at 25 percent (See Table 1 in section 2702).~~

(1) Diesel emission control strategies are categorized by their PM reductions as follows:

~~(1)~~(A) Level zero: the system has been demonstrated under these procedures to reduce PM emissions by less than 25 percent from the baseline emission level and to reduce NOx emissions by at least 25 percent from the baseline emission level.

~~(2)~~(B) Level one: the system has been demonstrated under these procedures to reduce PM emissions by at least 25 percent from the baseline emission level.

~~(3)~~(C) Level two: the system has been demonstrated under these procedures to reduce PM emissions by at least 50 percent from the baseline emission level.

~~(4)~~(D) Level three: the system has been demonstrated under these procedures to reduce PM emissions by at least 85 percent from the baseline emission level, or to achieve PM emission levels of 0.01 grams per brake-horsepower-hour (g/bhp-hr) or less.

(2) Diesel emission control strategies are categorized by their NOx reductions as follows:

~~(1)~~(A) Mark 1: the system has been demonstrated under these procedures to reduce NOx emissions by at least 25 percent from the baseline emission level.

~~(2)~~(B) Mark 2: the system has been demonstrated under these procedures to reduce NOx emissions by at least 40 percent from the baseline emission level.

~~(3)~~(C) Mark 3: the system has been demonstrated under these procedures to reduce NOx emissions by at least 55 percent from the baseline emission level.

~~(4)~~(D) Mark 4: the system has been demonstrated under these procedures to reduce NOx emissions by at least 70 percent from the baseline emission level.

~~(5)~~(E) Mark 5: the system has been demonstrated under these procedures to reduce NOx emissions by at least 85 percent from the baseline emission level.

NOTE: Authority cited: Sections 39002, 39003, 39500, 39600, 39601, 39650-39675, 40000, 43000, 43000.5, 43011, 43013, 43018, 43105, 43600, 43700 and 43830.8, Health and Safety Code. Reference: Sections 39650-39675, 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107, 43204-43205.5, Health and Safety Code; and Title 17 California Code of Regulations Section 93000.

§ 2709. In-Use Compliance Requirements.

(a) Applicability. These in-use compliance requirements apply to all diesel emission control strategies for on-road, off-road, ~~and~~ stationary, marine, RTG crane, APU, and TRU applications. It is the responsibility of the applicant to perform in-use compliance testing for each verified diesel emission control strategy family (see ~~S~~section 2706~~-~~(j)(2)). Field ~~T~~testing is required when ~~50~~ 100 units within a given diesel emission control strategy family have been sold or leased in the California market and emissions testing when 300 units have been sold or leased in the California market. Diesel emission control strategies that consist solely of a fuel additive or an alternative diesel fuel are only required to perform in-use compliance emissions testing or comply with other tests and conditions approved by the Executive Officer at the time of verification. For entirely fuel-based strategies, in-use compliance emissions testing is required, if not specified in the Executive Order, when:

(1) 6 million gallons of treated or alternative fuel are sold in the California market or 3 years after receiving verification, whichever comes first, or;

(2) The Executive Officer determines an alternative strategy is necessary based upon economic and engineering justifications provided by the applicant at the time of verification.

Applicants must submit an in-use compliance testing proposal for approval by the Executive Officer prior to performing either ~~the~~ in-use compliance field or emissions testing. ~~Applicants who have sold 50 units or more but have less than 50 units installed may submit a request for the Executive Officer to delay the in-use compliance deadlines specified in this section.~~

(b) Alternative Test Schedule. Applicants may elect to skip field testing and perform only in-use compliance emissions testing when 100 units within a given diesel emission control strategy family name have been sold or leased in the California market. Applicants selecting this option must test a minimum of 4 diesel emission control strategies for each family name per the Emissions Testing requirements of section 2709(c)(2) and the In-Use Compliance Emissions Testing procedures of section 2709(i).

~~(b)~~(c) ~~Test Phases.~~ Age of Test Units. ~~In-use compliance testing, as described below in subsections (d), (e), (f), and (g), must be conducted per an approved in-use compliance testing proposal at two different phases~~ For both field and emissions testing, applicants must select test units for each diesel emission control strategy family based on the following:

(1) ~~Phase 1~~ Field Testing. For field testing, ~~A~~applicants must ~~obtain~~ identify and test diesel emission control ~~systems~~ strategies once they have been operated for at least 25 percent of their minimum warranty period or for one year, whichever comes first.

(2) ~~Phase 2~~ Emissions Testing. For emissions testing, ~~A~~applicants must obtain and test diesel emission control ~~systems~~ strategies once they have been operated ~~between~~ for at least 60 ~~and 80~~ percent of their minimum

warranty period or for three years, whichever comes first. For all systems used with heavy heavy-duty vehicles, ~~the 60 to 80 percent window must be applied to the~~ only test units that adhere to the 5 year or 150,000 mile minimum warranty period may be selected.

~~(c)~~(d) In-Use Compliance Testing Proposals. Applicants with entirely fuel-based strategies must submit to the Executive Officer an in-use compliance emissions testing proposal no later than 90 days after meeting the requirements specified in section 2709(a). All other ~~The~~ applicants must submit to the Executive Officer a ~~Phase 1~~ separate in-use compliance testing proposal for both field and emissions testing for each family name. The in-use compliance field testing proposal must be submitted to the Executive Officer no later than 90 days after selling or leasing in the California market the ~~50~~100th unit. Applicants that fail to submit their field testing proposal within 90 days after selling or leasing the 100th unit will be required to follow the Alternate Test Schedule. The in-use compliance emissions testing proposal must be submitted to the Executive Officer within 90 days after selling or leasing in the California market the 300th unit. ~~The applicant must submit a Phase 2 in-use compliance testing proposal to the Executive Officer no later than 3 years after the 50th unit is sold. The following information must be included in both~~ Each in-use compliance testing proposal~~s~~ shall be submitted in the format specified by the Executive Officer and at a minimum include:

1. *In-Use Compliance Field Testing Proposal*

1.1 A cover letter signed by the applicant that includes the following information:

1.1.1 Diesel emission control strategy family name.

1.1.2 A statement that the author of the cover letter has the authority to represent the applicant with their in-use compliance field testing for this diesel emission control strategy family name.

1.1.3 A statement that the applicant agrees to adhere to the in-use compliance requirements of this Procedure.

1.1.4 Anticipated dates of in-use compliance field tests and final test report submittal.

1.2~~(1)~~ Applicant identification information including:~~.~~

1.2.1 Primary contact responsible for in-use compliance field testing information including contact information (e.g. name, mailing address, email address, telephone numbers).

1.2.2 Brief description of the contact's association to the verification holder.

1.3~~(2)~~ Diesel emission control strategy family name.

1.4~~(3)~~ Parties to be involved in conducting in-use compliance field tests.

1.5~~(4) Test facility i~~Identification and description of all test equipment, test personnel, and qualifications or certifications.

1.6~~(5)~~ Quality control and quality assurance procedures for the test equipment.

1.7~~(6)~~ List of 10 candidate test units ~~(at least 10 choices per phase)~~ for Executive Officer review with the following information for each: ~~vehicle/equipment information on which the unit is installed (make, model, model/year), location, engine information (family name, make, series, model year, displacement), date of manufacture, date of installation, and cleaning/repair history.~~

1.7.1 Vehicle or equipment make, model, and model year upon which the proposed test unit is installed.

1.7.2 Statement that the applicant has access to and has reviewed each vehicles' or equipments' maintenance records.

1.7.3 Vehicle or equipment location of operation and description (e.g. route delivery, trash collection, front-end loader, etc.).

1.7.4 Engine information including engine family name, make, model, series, displacement, model year, and horsepower upon which the proposed test unit is installed.

1.7.5 Proposed test unit serial number and serial number of each component of the diesel emission control strategy.

1.7.6 Date of manufacture of the proposed test unit.

1.7.7 Date of installation of the proposed test unit and name of installer.

1.7.8 Proposed test unit size information, if applicable.

1.7.9 Proposed test unit cleaning/repair history, if available.

1.8 A description and explanation of the methodology used to ensure that the proposed test units are representative of the engines or vehicles equipped with the applicant's diesel emission control strategy (e.g. statistical analysis, sales data, etc.).

1.9~~(7)~~ Cumulative sales of the diesel emission control strategy family name ~~in each application~~.

1.10~~(8)~~ Current and p~~P~~redicted mileage or hours of use each ~~diesel emission control system~~ proposed test unit will have accrued by the time it is ~~obtained~~ tested by the applicant ~~of diesel emission control strategy~~.

1.11~~(9) Description of test vehicles and engines (engine family name, make, model, model year, displacement).~~ Information regarding warranty claims for the diesel emission control strategy family and a statement that these claims for the same properly maintained and used part or component of the diesel emission control strategy have not exceeded the four percent threshold of section 2707(c), if accurate. If not, additional information as required.

1.12~~(10) Testing plan for meeting the requirements of part (g) below.~~ Identification of the specific test methodology that will be used to assess the in-field diesel emission control strategies.

1.13 Identification of the additional functional and visual tests that will be performed by the applicant to demonstrate the continuing functionality and durability of their diesel emission control strategy, including the criteria that will be used to analyze the results and determine compliance.

2. *In-Use Compliance Emissions Testing Proposal*

2.1 A cover letter signed by the applicant that includes the following information:
   2.1.1 Diesel emission control strategy family name.
   2.1.2 A statement that the author of the cover letter has the authority to represent the applicant with their in-use compliance testing for this diesel emission control strategy family name.
   2.1.3 A statement that the applicant agrees to adhere to the in-use compliance requirements of this Procedure.
   2.1.4 Anticipated dates of in-use compliance tests and final test report submittal.

2.2 Applicant identification information including:
   2.2.1 Primary contact responsible for in-use compliance testing information including contact information (e.g. name, mailing address, email address, telephone numbers).
   2.2.2 Brief description of the contact's association to the verification holder.

2.3 Diesel emission control strategy family name.

2.4 Parties to be involved in conducting in-use compliance emissions tests including: contact person for the selected emissions test facility or on-site testing company and identification of person or company responsible for removing test units.

2.5 Emissions test facility or on-site testing company identification and description of capabilities.

2.6 Quality control and quality assurance procedures for the test equipment, test procedures, and test facility.

2.7 List of 10 candidate test units for Executive Officer review with the following information for each:
   2.7.1 Vehicle or equipment make, model, and model year upon which the proposed test unit is installed.
   2.7.2 Statement that the applicant has access to and has reviewed each vehicles' or equipment's' maintenance records.
   2.7.3 Vehicle or equipment location of operation and description (e.g. route delivery, trash collection, front-end loader, etc.).
   2.7.4 Engine information including engine family name, make, model, series, displacement, model year, and horsepower upon which the proposed test unit is installed.
   2.7.5 Proposed test unit serial number and serial number of each component of the diesel emission control strategy.
   2.7.6 Date of manufacture of the proposed test unit.
   2.7.7 Date of installation of the proposed test unit and name of installer.
   2.7.8 Proposed test unit size information, if applicable.
   2.7.9 Proposed test unit cleaning/repair history.

2.8 A description and explanation of the methodology used to ensure that the proposed test units are representative of the engines or vehicles equipped with the applicant's diesel emission control strategy (e.g. statistical analysis, sales data, etc.). If an applicant's representative sample would require multiple test engines to comply with the requirements of the this section, the applicant may propose an alternative selection strategy but must provide a detailed engineering argument that clearly shows that the alternative selections represent test units from the representative group that provide the greatest challenge in meeting the requirements of section 2709(m). All such requests require the approval of the Executive Officer.

2.9 Cumulative sales of the diesel emission control strategy family name.

2.10 Current and predicted mileage or hours of use each proposed test unit will have accrued by the time it is obtained by the applicant for in-use compliance emissions testing.

2.11 Information regarding warranty claims for the diesel emission control strategy family and a statement that these claims for the same properly maintained and used part or component of the diesel emission control strategy have not exceeded the four percent threshold of section 2707(c), if accurate. If not, additional information as required.

2.12 Description of the emissions test vehicles and/or engines (engine family name, make, model, series, model year, displacement, horsepower, verification that the test engine(s) are California exhaust emissions certified, verification that the test engine is listed in the applicants emission control group, identification of any maintenance, repairs, or reflash).

2.13 A testing plan for meeting the requirements of part (h) below including:

2.13.1 Identification of the procedures and equipment that will be used by the applicant, the applicant's emissions test facility or on-site testing company.

2.13.2 For strategies that were determined to have a propensity to increase emissions of NO_2 during the initial verification process, identification of the reference test units specified in section 2706, the preconditioning procedures that will be used, and the determination of backpressure procedures that will be used during emissions testing.

2.13.3 For strategies that have a distinct regeneration event, identification of the procedures that will be used to quantify the regeneration emissions.

2.13.4 Identification of all test cycles and how many repetitions of each cycle will be performed.

2.13.5 Identification of the type of dynamometer testing that will be performed or the use of any load banks or other such devices.

2.13.6 Identification of the procedures that will be used to validate the test engine(s).

2.13.7 Identification of the specific sequence of events that will be followed during emissions testing.

2.13.8 Identification of the test fuel that will be used during emissions testing and any analytical procedures that will be used to validate the test fuel.

2.14 Identification of the additional functional and visual tests that will be performed by the applicant to demonstrate the continuing functionality and durability of their diesel emission control strategy, including the criteria that will be used to analyze the results and determine compliance.

Within 45 days of receipt of ~~the~~ any completed testing proposal, the Executive Officer shall determine whether the applicant has an appropriate testing proposal to support in-use compliance testing. The in-use testing proposal will not be considered approved until the Executive Officer issues the applicant an in-use compliance test plan approval letter ~~of approval~~. If the Executive Officer determines that the testing proposal is insufficient or inappropriate, the applicant must, within 30 days, submit a revised testing proposal.

~~(d)~~(e) Selection of Diesel Emission Control ~~Systems~~ Strategies for Testing. For each diesel emission control strategy family and for both ~~test phases~~ field and emissions testing, the applicant must propose a representative sample of ten installed diesel emission control ~~systems~~ strategies for in-use compliance testing based on information provided per ~~S~~section 2709~~(c)~~(d) ~~to be approved~~ for review and approval by the Executive Officer. The selected diesel emission control ~~systems~~ strategies should come from a representative sample of engines or vehicles equipped with the control ~~systems~~ strategies. The applicant must provide an explanation of the methodology used to ensure that the proposed test units are representative of the engines or vehicles equipped with the applicant's diesel emission control strategy. This methodology must be based on relevant data (e.g. cumulative sales information, size distribution, operating conditions, etc.) and these data must be provided with a detailed explanation for Executive Officer review and approval. The engines or vehicles equipped with the selected diesel emission control ~~systems~~ strategies ~~must have good maintenance records and~~ may receive a tune-up or normal maintenance prior to the applicant obtaining the diesel emission control ~~systems~~ strategies for testing. The applicant must obtain information from the end users regarding the diesel emission control ~~systems'~~ strategies' accumulated mileage or hours of usage, maintenance records (to the extent practicable), operating conditions, cleaning history (if available), and a description of any unscheduled maintenance that may affect the emission results.

~~(e)~~(f) Selection of Test Engines. The Executive Officer must approve the appropriate emissions test engines or vehicles for in-use compliance emissions testing. The applicant must provide ~~candidate~~ proposed test vehicles/engines for the Executive Officer's review in their in-use compliance emissions testing proposal. If the Executive Officer determines that a diesel emission control ~~system~~ strategy affects the performance of the engine, the Executive Officer may require the applicant to test the selected diesel emission control ~~system~~ strategy with the engine on which it is installed (e.g. fuel-based strategies). The applicant may tune-up or rebuild test engines prior to, but not after, baseline testing unless rebuilding the engine is an integral part of the diesel emission control strategy. All testing should be performed with the test engine in a proper state of maintenance. A test engine is generally determined to be in a proper state of maintenance if its emissions levels are within 10 percent of its original certification values. Emissions of NO_2 from the test engine must not exceed 15 percent of the total baseline NOx emissions by mass. If there is a special category of engines with NO_2 emission levels that normally exceed 15 percent, this requirement may be adjusted for those engines at the discretion of the Executive Officer.

~~(f)~~(g) Number of Diesel Emission Control ~~Systems~~ Strategies to be Tested. The number of diesel emission control ~~systems~~ strategies an applicant must test ~~in each of the two test phases~~ will be determined as follows:

(1) ~~A minimum of four diesel emission control systems in each diesel emission control strategy family must be tested. For every system tested that does not reduce emissions by at least 90 percent of the lower bound of its initial verification level (or does not achieve an emission level less than or equal to 0.011 g/bhp-hr of PM) or does not meet the NO_2 requirement in section 2709(k), two more diesel emission control systems from the same family must be obtained and tested.~~ For in-use compliance field testing, applicants must test a minimum of eight diesel emission control strategies per family name. For each diesel emission control strategy tested that fails to meet the requirements of section 2709(m), two more diesel emission control strategies from the same family must be identified and tested.

(2) For in-use compliance emissions testing, applicants must test a minimum of four diesel emission control strategies per family name. For each diesel emission control strategy that fails to meet the requirements of section 2709(m), two more diesel emission control strategies from the same family must be obtained and tested.

(3) The total number of ~~systems~~ strategies tested for either field or emissions testing shall not exceed ten per diesel emission control strategy family.

~~(2)~~(4) At the discretion of the Executive Officer, applicants may begin testing more than the minimum ~~four~~ number of diesel emission control ~~systems~~ strategies. Applicants may concede failure of their in-use compliance requirements for their diesel emission control strategy family ~~an emission control system~~ before testing a total of ten diesel emission control ~~systems~~ strategies.

(h) In-Use Compliance Field Testing. Applicants must propose a test methodology that can be used in-field to determine if the applicant's diesel emission control strategy continues to successfully reduce emissions such as a smoke opacity test that meets the requirements of the Society of Automotive Engineers J1667 test procedures or similar (i.e., portable emissions monitoring system). Applicants must also perform tests to demonstrate the continuing functionality and durability of their diesel emission control strategy. Applicants must identify specific test procedures and inspections that will be used to verify that all parts of the diesel emission control strategy are intact and functioning as originally verified (e.g. electronic control units, backpressure monitors, temperature sensors, hoses, brackets, etc.). These test procedures and inspections, including proposed criteria that will be used to analyze the results to determine compliance, must be defined in the applicant's in-use compliance field testing proposal and receive Executive Officer approval prior to performing in-use compliance field testing.

~~(g)~~(i) In-use Compliance Emissions Testing. Applicants must follow the test~~ing~~ procedures used for emission reduction verification as described in ~~S~~section 2703 (both baseline and control tests are required). Applicants must also perform tests to demonstrate the continuing functionality and durability of their diesel emission control strategy. Applicants must identify specific test procedures and inspections that will be used to verify that all parts of the diesel emission control strategy are intact and functioning as originally verified (e.g. electronic control units, backpressure monitors, temperature sensors, hoses, brackets, etc.). These test procedures and inspections, including proposed criteria that will be used to analyze the results to determine compliance, must be defined in the applicant's in-use compliance testing proposal and receive Executive Officer approval prior to performing in-use compliance emissions testing. As provided in ~~S~~section 2709~~(h)~~(j), the applicant may request the Executive Officer to review and approve an alternate testing procedure. If a diesel emission control strategy verified by U.S. EPA must perform engine dynamometer testing with the Heavy-duty Transient FTP cycle to fulfill the in-use compliance requirements of that program, but was verified by the Executive Officer with chassis dynamometer testing, the Executive Officer will also accept testing with the Heavy-duty Transient FTP cycle for the in-use compliance requirements of this Procedure.

~~(h)~~(j) Alternative Test Cycles and Methods. The Executive Officer may consider, on a case by case basis, an alternative test plan or method for applicants to satisfy the in-use compliance requirements of this section. For in-use compliance emissions testing, ~~T~~the proposed alternative test plan must be as scientifically sound as the testing described in ~~S~~section 2709~~(g)~~(i) of the Procedure and it must produce accurate results that will indicate if the emission control ~~system~~ strategy reduces emissions to the level for which it was verified. For in-use compliance field testing, the proposed alternative test plan must show that the diesel emission control strategy continues to function properly and indicate if the strategy is damaged or compromised in any way. Use of an alternative test procedure must be approved by the Executive Officer.

~~(i)~~(k) In-Use Compliance Report. The applicant must submit an in-use compliance report to the Executive Officer after ~~each phase of~~ either field or emissions in-use compliance testing. The applicant must submit the ~~phase 1~~

in-use compliance field testing report no later than ~~within~~ 18 months after selling or leasing ~~from when~~ the ~~50~~100th unit ~~is sold~~ in the California market, or for entirely fuel-based strategies, no later than 18 months after meeting the requirements specified in section 2709(a). ~~is sold~~. The ~~phase 2~~ applicant must submit the in-use compliance emissions testing report ~~must be submitted within 4 years~~ no later than 18 months ~~from when~~ after selling or leasing the ~~50th~~ 300th unit ~~is sold~~ in the California market. The following information must be reported for each of the ~~minimum of four~~ diesel emission control ~~systems~~ strategies tested:

(1) Diesel emission control strategy family name.

~~(1)~~(2) Parties involved in conducting the in-use compliance tests.

~~(2) Quality control and quality assurance information for the test equipment.~~

(3) ~~Diesel emission control strategy family name~~ Test unit serial number and serial number of each component of the diesel emission control strategy, installation date, and manufacture date.

(4) Vehicle or equipment and type of engine (engine family name, make, model year, model, displacement, etc.) the diesel emission control ~~system~~ strategy was applied to.

(5) Mileage or hours the diesel emission control ~~system~~ strategy was in use.

(6) Results of all emissions testing or field testing, documentation of any inspections, and results of all additional tests defined in the applicant's approved in-use compliance testing proposal.

(7) Summary of all maintenance, adjustments, modifications, and repairs performed on the diesel emission control ~~system~~ strategy.

(8) Results of any quality control and quality assurance procedures for the test equipment, test procedures, and test facility and identification of all test equipment.

(9) For in-use compliance emissions testing, the raw, real-time data for all baseline and control tests and, if required, the backpressure check specified in section 2706(a)(4)(C). These are the raw data from which emissions test results are derived. (e.g., analyzer voltage readings recorded at a frequency of 1 Hertz).

~~(j)~~(l) The Executive Officer may request the applicant to perform additional in-use testing if, at any time, the cumulative number of valid warranty claims for the same part or component of the diesel emission control strategy exceed four percent of the ~~number of diesel engines using the~~ cumulative sales or leases for the diesel emission control strategy family, or based on other relevant information. As noted in ~~S~~section 2707(c), if the cumulative number of valid warranty claims for the same part or component of a diesel emission control strategy exceed four percent of the ~~number of diesel engines using the~~ cumulative sales or leases of the diesel emission control strategy family, the applicant must notify the Executive Officer and submit a warranty report within 30 calendar days of that time.

~~(k)~~(m) Conditions for Passing In-Use Compliance Testing.

(1) In-Use Compliance Field Testing. Each diesel emission control strategy subject to the in-use compliance field testing requirements of section 2709(h) passes in-use compliance field testing if:

(A) The strategy meets the average opacity level or meets the alternative test criteria defined in the applicants in-use compliance test plan approval letter issued by the Executive Officer, and

(B) The strategy meets the additional functional and visual test requirements defined in the applicant's in-use compliance test plan approval letter issued by the Executive officer.

If the first eight diesel emission control strategies tested within a diesel emission control strategy family meet these standards, the diesel emission control strategy family passes in-use compliance field testing. If any of the first eight diesel emission control strategies tested within a diesel emission control strategy family fail to meet these standards, and more than eight units are tested, at least nine units tested must meet these standards for the diesel emission control strategy family to pass in-use compliance field testing.

(2) In-Use Compliance Emissions Testing. Each ~~For a~~ diesel emission control strategy subject to the in-use compliance emissions testing requirements of section 2709(i) ~~to~~ passes in-use compliance emissions testing if:~~,~~

(A) ~~e~~Emission test results ~~must~~ indicate that the strategy reduced emissions by at least 90 percent of the lower bound of the emission reduction level the Executive Officer originally verified it to, and~~.~~

(B) If required, the strategy meets the additional functional and visual test requirements defined in the applicant's in-use compliance test plan approval letter issued by the Executive officer, and

(C) If required ~~In addition~~, the strategy ~~must~~ meets the requirements of section 2706(a) with the exception that the strategy does ~~must~~ not increase emissions of NO_2 by more than an increment equivalent in mass to 33 or 22 percent of the baseline NOx emission level for systems verified under the 30 or 20 percent NO_2 limits, respectively.

If the first four diesel emission control ~~systems~~ strategies tested within a diesel emission control strategy family meet ~~both of~~ these standards, the diesel emission control strategy family passes in-use compliance emissions testing. If any of the first four diesel emission control ~~systems~~ strategies tested within a diesel emission control strategy family fail to meet ~~either of~~ these standards, and more than four units are tested, at least 70 percent of all units tested must meet ~~both~~ these standards for the diesel emission control strategy family to pass in-use compliance emissions testing. ~~For each failed test, for which the cause of the failure can be attributed to the product and not to maintenance or other engine-related problems, two additional units must be tested, up to a total of ten units per diesel emission control strategy family.~~ Within 30 days of a test unit failing to meet the requirements of section 2709(m)(1) or section 2709(m)(2), the applicant must submit to the Executive Officer ~~for approval a testing proposal for the additional test units that is~~

~~compliant with part (c) above. The testing proposal must include~~ an investigative report detailing the causes of the failure~~.~~ and if necessary, a new in-use compliance testing proposal compliant with section 2709(d) for approval requesting additional test units. The Executive Officer shall, within 45 days of its receipt, determine whether the in-use compliance testing ~~plan~~ proposal is acceptable. After receiving approval from the Executive Officer, the applicant must complete testing.

~~(l)~~(n) Failure of In-Use Compliance Testing. If a diesel emission control strategy family does not meet the minimum in-use compliance requirements of this section, the applicant must submit a remedial report within 90 days after the in-use compliance report is submitted. The remedial report must include:

(1) Summary of the in-use compliance report

(2) Detailed analysis of the failed diesel emission control ~~systems~~ strategies and possible reasons for failure.

(3) Remedial measures to correct or replace failed diesel emission control ~~systems~~ strategies as well as the rest of the ~~in-use diesel emission control~~ strategies ~~systems~~ in the diesel emission control strategy family.

~~(m)~~(o) The Executive Officer shall evaluate the remedial report, annual warranty report, and all other relevant information to determine if the diesel emission control strategy family satisfies the in-use compliance requirements. The Executive Officer may request additional information from the applicant. Based on this review, the Executive Officer may lower the verification level or revoke the verification status of a verified diesel emission control strategy family. The Executive Officer may also lower the verification level or revoke the verification status of a verified diesel emission control strategy family, if the applicant does not conduct in-use compliance testing or fails to adhere to the recall provisions in accordance with this section, or if the Executive Officer conducts in-use compliance testing in accordance with this section (including alternative testing) and the diesel emission control strategy family does not pass the standards in this section.

(p) Recall Provisions. If the Executive Officer determines after a review of an applicant's in-use compliance report, remedial report, warranty report, enforcement testing results, or any other information that a diesel emission control strategy family: has the potential to experience catastrophic failure or other safety related failure, fails to meet the conditions for passing in-use compliance testing as defined in section 2709(m), has valid warranty claims in excess of four percent as defined in section 2707(c), or a substantial number of units experience a failure of an operational feature, the Executive Officer may require a recall. In the event of a recall the Executive Officer shall provide notification to the applicant that includes a description of the nature of the failure or warrantable condition, the factual basis for the determination, and shall designate a date at least 60 days from the date of receipt of such notification by which the applicant shall submit a recall plan for review and approval to address the failures or warrantable condition. Recalls must address all diesel emission control strategies within a specific diesel emission control strategy family and may include all diesel emission control strategies sold as California verified. Each recall plan must be approved by the Executive Officer in writing.

(q) Recall Plan. At a minimum, an applicant's recall plan shall contain the following information unless otherwise specified in the notification:

(1) A description of each diesel emission control strategy subject to the recall including the number of units to be recalled, the emission control group(s) affected, and any information required to identify the recalled units.

(2) A description of the type and nature of the failure or warrantable condition and the specific modifications, design changes, alterations, repairs, adjustments, or other changes to be made to correct the failures or warrantable condition with a description of the technical studies, data, or other information which support the applicant's decision regarding specific corrections to be made. If any modification requires a design change per section 2702(j) the recall plan must include a complete preliminary verification application per the requirements of section 2702(b).

(3) A description of the method by which the applicant will determine the names and addresses of the end users and the applicant's methods and schedule for notifying the end users, service facilities, and distributors.

(4) A description of the procedure to be followed by the end users to correct the failures or warrantable condition. This shall include the date on or after which the end user can have the failures or warrantable condition remedied, the time necessary to perform the remedy, and the designation of facilities at which the remedy can be performed.

(5) The plan may specify the maximum incentives (such as device cleaning or specified quantity of diesel fuel), if any, the applicant will offer to induce vehicle or equipment owners to present their diesel emission control strategies for repair, as evidence that the manufacturer has made a good faith effort to repair or replace all the diesel emission control strategies in the plan. The plan shall include a schedule for implementing actions to be taken including identified increments of progress towards implementation and deadlines for completing each such increment.

(6) A copy of the letter of notification to be sent to the end users.

(7) A description of the system by which the applicant will assure that an adequate supply of parts will be available to perform any repairs under the recall plan, including the date by which an adequate supply of parts will be available to initiate the repair or replacement campaign, and the method to be used to assure that the supply remains both adequate and responsive to end user demand.

(8) A copy of all necessary instructions to be sent to those persons who perform the replacement or repair.

(9) A description of the impact the proposed replacement or repairs will have on the vehicle, equipment, or engine including: exhaust backpressure,

exhaust temperature, durability, regeneration, maintenance, fuel economy, drivability, performance, safety, warranty, and a summary of the data and technical studies used to support such determinations.

(r) Reporting Requirements. Unless otherwise specified by the Executive Officer, the manufacturer shall report on the progress of a recall campaign by submitting subsequent reports for six consecutive quarters commencing with the quarter after the recall campaign begins. Such reports shall be submitted no later than 25 days after the close of each calendar quarter to: Chief, Mobile Source Control Division, 9528 Telstar Avenue, El Monte, CA 91731.

~~(n)~~(s)The Executive Officer may lower the verification level or revoke the verification status of a verified diesel emission control strategy family if the applicant fails to observe the requirements of ~~S~~sections 2706, ~~or~~ 2707, or 2709. The Executive Officer must allow the applicant an opportunity to address the possible lowering or revocation of the verification level in a remedial report to the Executive Officer and the Executive Officer may make this determination based on all relevant information. In addition, an applicant that fails to submit a recall plan as requested by the Executive Officer or to complete the requirements of an approved recall plan, including the reporting requirements, may be subject to civil penalties as specified in state law and regulations, including, but not limited to, Health and Safety Code Sections 39600, 39660, and 39674.

NOTE: Authority cited: Sections 39002, 39003, 39500, 39600, 39601, 39650-39675, 40000, 43000, 43000.5, 43011, 43013, 43018, 43105, 43600, and 43700, Health and Safety Code. Reference: Sections 39650-39675, 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107, and 43204-43205.5, Health and Safety Code; and Title 17 California Code of Regulations Section 93000

§ 2710. Verification of Emission Reductions for Alternative Diesel Fuels and Fuel Additives

* * * * *

Table 6. Fuel Test Methods and Reference Fuel Specifications

Property	General Reference Fuel Specifications	ASTM Test Method
Sulfur Content	15 ppm max	D5453-93
Aromatic Hydrocarbon content, Vol. %	10% max	D5186-96
Polycyclic Aromatic Hydrocarbon Content, Wt. %	1.4% max	D5186-96
Nitrogen Content	10 ppm max	D4629-96
Natural Cetane Number	48 min	D613-84
Gravity, API	33-39	D287-82 or

		D4052-96
Viscosity at 40°C, cSt	2.0-4.1	D445-83
Flash point, °F	130 min	D93-80
Distillation, °F IBP 10%REC 50%REC 90%REC EP	 340-420 400-490 470-560 550-610 580-660	D86-96

* * * * *

(d) Emissions Test Procedures for Particulates, Nitrogen Oxides, Soluble Organic Fraction, Hydrocarbons, and Toxics.

* * * * *

(3) Emission test requirements and test sequence for emissions test program.

(A) The applicant must follow the emission test requirements from Section 2703 subsections (a), (b), (k), (l), and (m). For all on-road diesel vehicles and equipment, the applicant must conduct engine dynamometer testing using the Federal Test Procedure (FTP) Heavy-duty Transient Cycle, in accordance with the provisions in the Code of Federal Regulations, Title 40, Part 86, Subpart N. For all off-road and stationary diesel vehicles and equipment, the applicant must conduct engine dynamometer testing in accordance with ~~S~~section 2703(e)(2) and 2703(e)(3). The applicant must use the following test sequences:

1. If both cold start and hot start exhaust emission tests are conducted, a minimum of ~~five~~ nine exhaust emission tests must be performed on the engine with each fuel, using either of the following sequences, where "R" is the reference fuel and "C" is the candidate alternative diesel fuel or fuel additive: RC CR RC CR RC (and continuing in the same order) or RC RC RC RC RC (and continuing in the same order). The engine mapping procedures and a conditioning transient cycle must be conducted with the reference fuel before each cold start procedure using the reference fuel. The reference cycle used for the candidate alternative diesel fuel or fuel additive must be the same as determined for the reference fuel.

2. If only hot start exhaust emission tests are conducted, one of the following test sequences must be used throughout the testing, where "R" is the reference fuel and "C" is the candidate alternative diesel fuel or fuel additive~~.~~:

Alternative 1: RC CR RC CR (continuing in the same order for a given calendar day; a minimum of ~~twenty-~~nine individual exhaust emission tests must be completed with each fuel)

Alternative 2: RR CC RR CC (continuing in the same order for a given calendar day; a minimum of ~~twenty-~~nine individual exhaust emission tests must be completed with each fuel)

Alternative 3: RRR CCC RRR CCC (continuing in the same order for a given calendar day: a minimum of ~~twenty one-~~nine individual exhaust emission tests must be completed with each fuel)

For all alternatives, an equal number of tests must be conducted using the reference fuel and the candidate alternative diesel fuel or fuel additive on any given calendar day. At the beginning of each calendar day, the sequence of testing must begin with the fuel that was tested at the end of the preceding day. The engine mapping procedures and a conditioning transient cycle must be conducted at the beginning of each day for the reference fuel. The reference cycle used for the candidate alternative diesel fuel or fuel additive must be the same as determined for the reference fuel. For fuel additives that accumulate within the fuel system, engine, or exhaust system, a test or tests using a multiple of the normal dosage rate will be required in post durability testing to determine any long term effects if accumulation is not shown to stabilize during the required durability time frame.

3. Alternative test sequence. The applicant may request the Executive Officer to approve an alternative test sequence in place of the above test sequences. In reviewing this request, the Executive Officer may consider all relevant information including, but not limited to, the following:
   a. Statistical and scientific equivalence to 1. or 2., and
   b. Body of existing test data using the alternative test sequence.

* * * * *

(e) Durability.
   (1) The applicant must meet the durability demonstration requirements in ~~S~~section 2704 subsections (a), (b), (c), ~~(d)~~, ~~(e)~~(f), and ~~(h)~~(i) with the exceptions of emissions testing an fuel requirements. If the applicant's diesel emission control strategy includes hardware components in addition to the alternative diesel fuel or fuel additive, then the emissions testing requirements in Section 2704 apply.
   (2) The applicant must provide test data obtained after completion of the service accumulation, described in ~~S~~section 2704~~(d)~~(e), showing that the candidate alternative diesel fuel or fuel additive does not adversely affect the

performance and operation of diesel engines or cause premature wear or cause damage to diesel engines. This must include but is not limited to lubricity, corrosion, and damage to engine parts such as fuel injector tips. The applicant must provide data showing under what temperature and conditions the candidate alternative diesel fuel or fuel additive remains stable and usable in California.

(3) For additives that accumulate within the fuel system, engine, or exhaust system, the same test engine used for emissions testing must be used for the durability demonstration.

* * * * *

(g) Other Requirements.

(1) The candidate alternative diesel fuel or fuel additive must be in compliance with applicable federal, state, and local government requirements.

(2) Applicants planning to market fuel in California must contact and register with the U.S. EPA and the California Dept. of Food and Agriculture. Contacts are listed below.

Office of Transportation and Air Quality
U.S. EPA Head Quarters
Ariel Rios Blvd.
1200 Pennsylvania Ave, N.W.
Washington DC 20468
Phone (202) 564-9303

Petroleum Products/Weighmaster Enforcement Branch
Division of Measurement Standards
Dept. of Food and Agriculture
8500 Fruitridge Road, Sacramento CA 95826
Phone (916) 229-3000

(3) Additional government agencies such as the California Energy Commission, Area Council of Governments, and Local Air Quality Management Districts may be contacted to facilitate the marketing of alternative diesel fuel in California.

(4) Labeling

(A) For strategies that do not include exhaust aftertreatment, labeling is required pursuant to section 2706(j) on the engine and the storage container for the alternative diesel fuel or fuel additive. This storage container may be either the fuel tank or a separate tank that is used to deliver the additive to the engine. Strategies that do not include exhaust aftertreatment are not required to identify the month and year of manufacturer or a unique serial number on their label.

* * * * *

(h) ~~Conditional Verification~~

~~(1) The Executive Officer may grant a conditional verification for an alternative diesel fuel or fuel additive for off-road or stationary applications only after the conditional verification for on-road application is granted. The Executive Officer may grant a conditional verification for on-road application if the applicant meets the following conditions:~~

~~(A) The applicant has applied for U.S. EPA registration of the alternative diesel fuel or fuel additive;~~

~~(B) The U.S. EPA has granted a research and development exemption or otherwise granted permission for the alternative diesel fuel or fuel additive to be used, and;~~

~~(C) All relevant requirements of Sections 2700-2710 have been met with the exception that registration with the U.S. EPA has not been completed.~~

~~(D) Multimedia Assessment as specified in Section 2710 (f).~~

~~(2) Where conditional verification is granted, full verification must be obtained by completing the U.S. EPA registration process within a year after receiving conditional verification. During that year, conditional verification is equivalent to verification for the purposes of satisfying the requirements of in-use emission control regulations.~~

~~(i)~~ Extensions of an Existing Verification. See ~~S~~section 2702-(~~g~~h).

* * * * *

NOTE: Authority cited: Sections 39002, 39003, 39500, 39600, 39601, 39650-39675, 40000, 43000, 43000.5, 43011, 43013, 43018, 43105, 43600, 43700 and 43830.8, Health and Safety Code. Reference: Sections 39650-39675, 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107, 43204-43205.5 and 43830.8, Health and Safety Code; Section 71017, Public Resources Code, and Title 17 California Code of Regulations Section 93000.

§ 2711. Compliance.

(a) Any ARB verified diesel emission control strategy shall be properly installed and maintained.

(~~a~~b) No person shall sell, offer to sell, or introduce into commerce an ARB verified diesel emission control strategy unless all of the conditions of the governing Executive Order and this Chapter are met.

(~~b~~c) The Executive Officer may modify, revoke or suspend an existing verification for any violation of the governing Executive Order or the procedures of this Chapter and seek any other remedy available under Part 5, Division 26 of the Health and Safety Code.

(~~c~~d) No person shall represent a device as being an ARB verified diesel emission control strategy unless it has received verification pursuant to this article.

(e) No person shall alter, physically disable, disconnect, bypass, or tamper with an installed ARB verified diesel emission control strategy.

NOTE: Authority cited: Sections 39002, 39003, 39500, 39600, 39601, 39650-39675, 40000, 43000, 43000.5, 43011, 43013, 43018, 43105, 43600 and 43700, Health and Safety Code. Reference: Sections 39650-39675, 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107 and 43204-43205.5, Health and Safety Code; and Title 17 California Code of Regulations Section 93000.

Appendix B: Sales Trigger Analysis and Methodology

This appendix explains the analysis performed and the methodology used by the Air Resources Board (ARB) staff to select the proposed sales triggers that determine when an applicant to ARB's verification program must begin the in-use compliance process. Section A below explains the current sales triggers and why the sales triggers used by the U.S. EPA voluntary retrofit program are different than staff's proposal. Section B outlines the analysis used to develop staff's proposal and Section C lists references used.

A. Current Sales Triggers

The current regulation requires applicants to ARB's verification program to begin the in-use compliance process when they have sold or leased 50 units of a given diesel emission control strategy (DECS) family in the California market. In the original staff report for the verification program, staff stated that they based the 50 unit sales number on U.S. EPA's Voluntary Retrofit Program (ARB, 2002). To be consistent with U.S. EPA's sales trigger of 500 units nationwide, 50 units were originally selected since California possessed approximately 10 percent of the nation's population at that time.

During the public process industry requested that staff adopt the higher sales trigger currently used by U.S. EPA. The voluntary retrofit program administered by U.S. EPA currently requires in-use compliance testing after the sale of 500 units nationwide. Staff evaluated this request but determined that the vast differences in market sizes between the 2 programs makes adopting this larger sales trigger unreasonable. U.S. EPA's voluntary retrofit program is administered in all 50 states and ARB's in only 1, California. Simply aligning the sales thresholds of both verification programs does not address the vast difference in market sizes. While staff believes that the sales trigger could be increased, simply adopting U.S. EPA's trigger would result in some DECS families substantially delaying their in-use testing.

B. Sales Trigger Analysis and Methodology

During the public process, applicants stated that the current sales trigger of 50 units is too low to justify the testing costs associated with the in-use compliance requirements. In an effort to determine a reasonable increase in the sales triggers, staff reviewed the purpose of the required testing. In-use testing is necessary to validate the effectiveness of ARB verified strategies and to provide credible data that can be used to resolve any performance or durability issues. ARB's verification program requires 2 sets of in-use testing: one designed to be performed shortly after initial verification to identify and resolve any performance issues with an applicant's strategy before widespread application occurs, and the second after the strategies have been significantly aged to validate their effectiveness and continuing durability. This testing provides valuable protections to the end-users of these devices by providing staff with the data necessary identify potential performance or durability issues.

Another important factor that was considered before proposing any increase to the existing sales trigger is the required product warranty. ARB's verification program requires applicants to provide end-users of these devices with a product warranty, and specifies minimum warranty periods for all DECS. Since the purpose of the in-use tests are to identify potential performance or durability issues it is imperative that this testing is performed before an applicant's initial "post-verification" sales have exceeded their minimum warranty periods. If a performance issue is identified during in-use compliance testing, providing a resolution for an end-user whose system is no longer under warranty would be difficult. Therefore, increasing the sales trigger to a level that results in the delivery of in-use test data to staff long after an applicant's initial sales have exceeded their minimum warranty period must be avoided.

However, performing in-use testing shortly after an applicant's initial verification testing should also be avoided as it is costly and may be largely unnecessary. In-use testing that begins too soon after initial verification merely replicates testing already done to support the verification effort and places an unnecessary burden on applicants. Therefore, to determine if an increase in the sales trigger is feasible, analyzing when applicants are meeting the existing 50 unit trigger is a necessary first step. If applicants are currently meeting the sales trigger relatively quickly after receiving either full or conditional verification, then the trigger could be increased to ensure that in-use compliance testing does not begin too soon after an applicant enters the marketplace. Also, this analysis must provide information that allows staff to balance any proposed increase so that it will not significantly delay an applicants in-use testing.

To accomplish this, staff reviewed both currently and formerly verified applicants' confidential annual warranty reports. These reports include annual sales data by DECS family name. Staff only used on-road and off-road sales data because sales data for other applications, such as stationary, were incomplete. Staff selected only those DECS family names that had total sales in excess of 75 units for on-road and 50 units for off-road. This was done to ensure that only DECS family names that had a significant market presence were used in the analysis. Staff then reviewed the data for the first 2 years of sales after receiving initial verification or conditional verification. The first full year of sales was defined to be at least 8 months to avoid skewing the data by selecting family names verified late in a calendar year. In addition, both currently and formerly verified systems were used in the analysis to increase the size of the data set. The analysis included sales data from calendar years 2003 through 2010 and is shown in Figure B1.

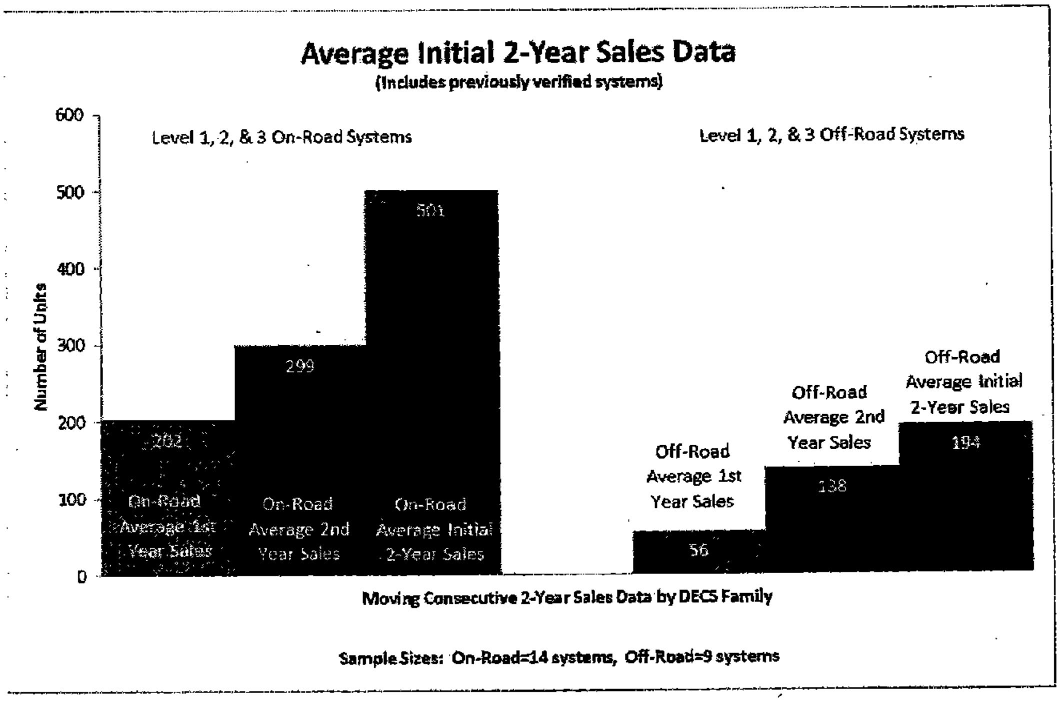

Figure B1. Average Initial 2 Year Sales Data from Currently and Previously ARB Verified On and Off Road DECS

Based on this analysis, it appears that applicants of on-road verified systems are reaching the 50 unit sales trigger shortly after receiving their initial verification and off-road verified systems within the first year. Therefore, ARB staff believes that the sales trigger for the first set of required in-use testing can be increased without sacrificing the protections built into the current requirements. Based on this analysis, ARB proposes increasing the sales trigger for the first set of in-use compliance testing to 100 units. Setting the sales trigger at 100 units ensures that ARB receives in-use data from the first set of tests before widespread in-field application of an applicant's strategy without resulting in a significant delay.

This analysis also shows that the second sales trigger could also be increased, but not to the levels initially requested by industry. As previously stated, this second set of in-use testing must be completed such that data are available before the end of the minimum warranty period of an applicant's initial sales. Since the majority of both on-road and off-road systems have a minimum warranty period of 5 years, to meet this requirement these data are currently required within this time frame. Since applicants have 18 months to submit their final in-use test report after reaching the sales trigger, this second set of in-use testing must take place approximately 2 to 3 years after receiving initial verification, thus ensuring that the required data are available to staff within this 5 year window.

As shown in Figure B1, on-road sales of DECS appear to meet the 500 unit trigger within 2 years which would fulfill the requirements to meet the 5 year window. However, off-road sales fall far short of this level. Also, as stated by industry, sales of DECS in all categories are slowing due to the global recession and much of the data used in the analysis was pre-recession data. Increasing the sales trigger to 500 units as requested by industry would delay ARB's access to in-use testing data well past the useful life of an applicant's initial sales.

Based on this analysis, ARB proposes increasing the sales trigger for the second set of in-use compliance testing to 300 units. This significant increase in the sales trigger will allow additional sales for all applicants before starting the required testing but will ensure that all categories can provide staff with the necessary in-use data before their initial sales exceed the minimum warranty period. These new triggers will provide applicants with additional time and added unit sales to help defer the costs of the mandatory testing.

C. References

ARB, 2002. California Air Resources Board. *Staff Report: Initial Statement of Reasons – Proposed Regulation for the Verification Procedure for In-Use Strategies to Control Emissions from Diesel Engines*. California Air Resources Board, March 2002. http://www.arb.ca.gov/regact/dieselrv/isor.PDF. Last accessed December 6, 2011.

Appendix C: Cost Methodology

This appendix explains methodology used by the Air Resources Board (ARB) staff to estimate the costs and savings of the proposed amendments to the *Verification Procedure, Warranty and In-Use Compliance Requirements for In-Use Strategies to Control Emissions from Diesel Engines* (the Procedure). Section A below provides an overview of the estimated costs and savings of the proposed amendments. Section B outlines the methodology used to quantify the potential savings of the proposed changes to the Procedure's in-use compliance requirements. Section C outlines the cost methodology of the proposed recall provisions. Section D outlines the cost methodology for the remaining proposed amendments and Section E lists references used.

A. Estimated Costs of the Proposed Amendments.

The proposed amendments are intended to provide financial flexibility to diesel emissions control strategy's (DECS) manufacturers, referred to as applicants in the Procedure and throughout this Appendix, while maintaining the integrity of the verification program. The proposed amendments provide short-term financial savings to all applicants by reducing the amount of required in-use compliance testing by up to one-half and allowing additional sales before this testing is required. The addition of functional in-field tests and the alternative test schedule further reduces the costs associated with the in-use compliance requirements. Streamlining the in-use compliance process and providing additional time for applicants to complete their conditional verifications provides even greater financial flexibility. The addition of recall provisions and clarifications to the warranty reporting requirements are necessary to maintain the stringency of the Procedure and ensure the in-use performance of DECS, but may offset some of the cost savings provided above. Staff has analyzed each proposed amendment to determine potential economic impacts.

Overall, staff's proposal is estimated to provide a net savings to industry of approximately $2.1 million to $5.6 million. A summary of the estimated costs and savings of staff's proposal are shown below in Table C1. Sections B through D of this Appendix provide a detailed discussion of the methodology used to develop the estimates of the economic impacts of staff's proposal. Where practicable, several of the proposed amendments contained in staff's proposal have been grouped together for brevity.

Table C1- Summary of the Costs or Savings to Industry of the Proposed Amendments

Item	Amendment Description	Scenario 1 (costs) vs savings	Scenario 2 (costs) vs savings
1	Replace one phase of in-use compliance emissions testing with field testing	$4.6 million	NA
2	Alternative test schedule (assumes all applicants select this option for their in-use testing)	NA	$5.3 million
3	Allow only one test engine for in-use compliance emissions testing	$381,000	$381,000
Subtotal – Cost savings from the proposed changes to the in-use compliance requirements		$5 million	$5.7 million
4	Recall provisions	($2.8 million)	($0)
5	Installation warranty reporting requirements	($73,000)	($73,000)
Net Savings		**$2.1 million**	**$5.6 million**

B. In-Use Compliance Requirements.

The proposed amendments to the Procedures in-use compliance requirements would reduce an applicant's in-use testing costs by up to one-half. Currently, the Procedure stipulates that all applicants must perform 2 phases of in-use emissions testing that are identical in size and scope. Staff's proposal replaces one phase of emissions testing with a less expensive field testing option. Details of the estimates for the various types of exhaust emissions testing from independent test facilities are shown below in Table C2. As shown in Table C2, staff estimates applicants spend an average of $82,525 per phase of exhaust emissions testing: this includes triplicate baseline testing of the test engine and triplicate control tests of a minimum of 4 candidate test units performed in an emissions testing facility, or in-situ where required.

Table C2- In-Use Compliance Exhaust Emissions Testing Costs
Triplicate Baseline tests and triplicate Control tests of 4 Test Units

Test Facility	Engine Dynamometer Testing Costs FTP Test Cycle	Engine Dynamometer Testing Costs NRTC Test Cycle	Chassis Dynamometer Testing Costs UDDS test Cycle	Stationary Testing Costs Steady-State Test Cycle	Small Engine Dynamometer Testing Costs Steady-State Test Cycle
Facility 1*	$86,055.00	$86,055.00	$98,480.00	$73,215.00	NA
Facility 2*	$85,000.00	$70,000.00	NA	NA	NA
Facility 3*	$72,500.00	$54,500.00	NA	NA	NA
Facility 4*	NA	NA	NA	NA	$98,646.00
Facility 5*	$94,500.00	$58,500.00	$79,500.00	NA	NA
Averages	$84,513.75	$67,263.75	$88,990.00	$73,215.00	$98,646.00
	Overall Average	**$82,525.70**			

*Note: Facilities currently providing emissions testing services to verification applicants provided these estimates to staff but asked that they not be directly identified in staff's report. As shown in Table 1, not all facilities are able to provide every type of required in-use testing.

Conversely, the proposed field testing option requires relatively inexpensive opacity testing, or for applicants that must also quantify NOx reductions, Portable Emission Measurement Systems (PEMS) testing. Several service companies are available to perform opacity tests and generally charge between $50 and $100 per test. However, many applicants and most heavy-duty diesel fleets have the capability to perform their own opacity testing and already own a smoke meter since these meters are currently used for compliance with the California Periodic Smoke Inspection Program and as a maintenance tool by the fleets. For applicants required to use the proposed PEMS testing, staff is aware of at least one service company that will perform in-situ PEMS testing for gaseous emissions at the rate of $5,000 per day. Since staff's proposal requires a minimum of 8 candidate test units to satisfy the field testing requirements, staff estimates that this would require 6 days of PEMS testing and $2,000 in travel expenses. Therefore, the additional costs of the proposed PEMS tests are estimated to be approximately $32,000 per DECS family.

Overall, replacing one phase of in-use testing with field testing is estimated to reduce an applicant's in-use compliance testing costs by approximately $50,000 to $82,000 for each DECS family. However, most applicants hold verifications for multiple DECS families. To determine the overall savings to industry, staff applied the estimated savings from the proposed changes to the in-use testing requirements to all currently verified DECS families. As shown below in Table C3, there are 59 DECS families currently verified by ARB[1].

Table C3- Currently Verified DECS Families by Application and Emission Reduction Type

Currently Verified DECS Families by Application							**Totals**
On-Road	Off-Road	TRU	Stationary	APU	RTG Crane	Marine	
22	13	5	12	4	2	1	59
Currently Verified PM DECS Families by Application							
On-Road	Off-Road	TRU	Stationary	APU	RTG Crane	Marine	
19	10	5	12	4	1	1	52
Currently Verified PM & NO_x DECS Families by Application							
On-Road	Off-Road	TRU	Stationary	APU	RTG Crane	Marine	
3	3	0	0	0	1	0	7

[1] ARB, 2012a, ARB Verification Procedure-Currently Verified. http://www.arb.ca.gov/diesel/verdev/vt/cvt.htm. Accessed April 18, 2012

Of the currently verified strategies, only 7 DECS families provide reductions of both particulate matter (PM) and Oxides of Nitrogen (NO_x). Based on staff's proposed changes, these strategies would be required to validate continuing NO_x reductions and would likely utilize PEMS testing in-field. As previously stated, compared to the current in-use testing requirements, staff estimates a savings of approximately $50,000 per DECS family for these strategies which represents total savings to industry of approximately $350,000. Staff estimates the remaining 52 strategies would realize the full savings of $82,000 per DECS family which represents total savings to industry of approximately $4.3 million. Therefore, replacing one phase of emissions testing with proposed field testing is estimated to save industry over $4.6 million for currently verified DECS families.

Staff's proposed alternative test schedule represents an even greater savings to DECS industry. As identified in Chapter II of the staff report, the proposed amendments contain a provision that would allow an applicant to move directly to emissions testing bypassing field testing entirely, thus cutting their in-use testing costs in half. While it is not clear how many applicants may select this option, staff used the best available data to quantify the cost savings to industry. Assuming all 59 currently verified DECS families selected the alternative test schedule option which would reduce their in-use testing costs by one-half, based on the average testing costs shown in Table C2, this represents a savings to industry of approximately $4.9 million. Also, since the alternative test schedule eliminates one phase of testing entirely, applicants would have no need to conduct field visits to select and identify the required 10 candidate test units. Based on verbal discussions with industry, staff estimates that this work costs applicants between $5,000 and $10,000 in labor and travel costs for each DECS family. Assuming an average savings of $7,500 per DECS family by eliminating the need to select and identify 10 candidate test units, this represents an additional savings to industry of over $440,000. Therefore, the total savings to industry of the proposed alternative test schedule is over $5.3 million. While it is unlikely that all applicants would select this option, this does provide an upper bound estimate of the potential savings of the proposed provision.

Staff's proposed change allowing applicants to use only one emissions test engine would also provide savings for some applicants. Because the emission control groups associated with Truck Refrigeration Unit (TRU), Stationary, Auxiliary Power Unit (APU), RTG Crane, and Marine verifications are generally narrow, staff does not anticipate that these strategies would require more than one test engine for their required in-use emissions testing. However, strategies verified for use with on-road and off-road engines usually have broad emission control groups which results in applicants offering products in multiple sizes and configurations. These generally require multiple test engines to fulfill their in-use emissions testing obligations. In developing the estimates shown in Table C2, several emissions testing facilities provided cost estimates for engine rental and set-up. While applicants could elect to purchase an additional test engine, renting a "house" engine from a test facility is by far the most cost-effective way to accomplish this. Based on the information provided to staff, the average cost for test engine rental and set up is approximately $15,250 per DECS family. Staff estimates that this would likely apply to the 25 currently verified on-road and off-road DECS family names shown in Table C3. Therefore, the proposed change represents an additional savings to industry of over $381,000.

In addition to these estimated savings, the proposed amendments to increase the sales triggers will allow all applicants to sell additional units before beginning their in-use testing. This will significantly lower the current fixed per-unit overhead costs associated with the Procedure's in-use compliance requirements and allow applicants to realize additional profits to better enable them to prepare for the mandatory testing. Though this is difficult to quantify, it will result in additional economic benefits and financial flexibility for all applicants.

Finally, staff's proposal includes functional testing that would allow applicants to test "in-field" various parts of their systems, thus eliminating the need to remove and replace the entire system for emissions testing. While these potential savings are also not quantifiable due to the range of costs associated with verified DECS and the unique make-up of each verified product, for most applicants this will result in additional economic benefits and financial flexibility.

In summary, the proposed changes to the Procedures in-use compliance testing requirements will result in reduced testing costs and added financial flexibility for all applicants while maintaining the stringency provided by the current in-use testing requirements. While the flexibility provided by staff's proposal makes quantifying the individual savings realized by each applicant difficult, staff estimates the savings to DECS industry from the proposed changes to the in-use compliance requirements will be approximately $5 million to $5.7 million for the currently verified DECS families.

In addition, once verified, all applicants are subject to the in-use compliance requirements. In conversations with applicants, staff estimates that the cost of verification is approximately $500,000 to $1 million per DECS family. Therefore, the changes to the in-use compliance requirements are estimated to provide a 10 percent savings to future applicants over the current cost of verification.

C. Recall Provisions.

The proposed recall provisions could potentially increase long-term costs for all applicants and have the potential to create a significant economic impact for any applicant subject to a recall action. However, because of the uncertainty of a recall event and the diversity of systems currently verified it is not possible to quantify the potential costs to an individual applicant. However, by using the best available data and some general assumptions staff was able to quantify a range of costs to DECS industry due to a potential recall event.

As discussed in the staff report in Chapter II, applicants are required to submit annual warranty reports to the Executive Officer which include confidential sales data. While this sales data is not complete for all categories, credible data exist for on-road, off-road, and TRU DECS sales. Based on best available data staff selected these categories as they represent approximately 70 percent of all currently verified DECS families and are therefore representative of the majority of currently deployed systems. Staff analyzed the data to determine average annual sales for each category as shown in Table C4.

Table C4- Average Annual Sales of On-Road, Off-Road, and TRU DECS

Sales Year	On-Road Units (Total Sales by Year)	Off-Road Units (Total Sales by Year)	TRU (Total Sales by Year)
2010	5452	752	2577
2009	3557	1660	2575
Average Annual Sales	4505	1206	2576

Only 2 years of data were analyzed due to the recent changes in the Procedure's Nitrogen Oxide (NO_2) requirements. Because of the required changes, most applicants verified new products in advance of the January 1, 2009 implementation date, leaving only 2 full years of sales data for currently verified systems available for analysis. This provides average total annual sales in each category that could potentially be affected by a recall.

Staff's analysis uses a conservative but reasonable approach by assuming that a potential recall would affect only part of each verified system. This is a reasonable assumption as a potential recall event is unlikely to result in replacement of the entire DECS. Therefore, staff selected the diesel particulate filter (DPF) core as the part of each verified system that would require replacement due to recall as this is generally the most expensive part of DECS. Staff contacted retrofit manufacturers and reviewed grant expenditures to collect average DPF core replacement costs and grouped them according to substrate type for on-road, off-road, and TRU systems. The average costs are shown below in Table C5 (Haas, 2012b, Brown, 2012c, Machado, 2012d, Luksik, 2012e, Simons, 2012f, Sem, 2012g, Babineau, 2012h, Swenson, 2012i, Lassen, 2012j, Grylls, 2012k, Jennings, 2012l).

Table C5- Average DPF Core Replacement Costs for On-Road, Off-Road, and TRU DECS

Substrate Type	On-Road DPF Core (average replacement costs)	Off-Road DPF Core (average replacement costs)	TRU DPF Core (average replacement costs)
Silicon Carbide - Uncatalyzed	$2,948	$6,231	$1,310
Silicon Carbide - Catalyzed	$6,349	$5,984	NA
Cordierite - Uncatalyzed	$3,000	NA	NA
Cordierite - Catalyzed	$5,500	$9,559	NA
Metal - Uncatalyzed	$4,191	$4,204	$1,600

Metal - Catalyzed	NA	NA	$2,300
Average Replacement DPF Core Costs	$4,398	$6,494	$1,737

However, since this represents the costs to end-users and not applicants, staff reduced the average replacement DPF core price for each category by 30 percent to represent each manufacturers assumed profit margin. Staff then used this adjusted cost and the average annual sales for each category to calculate the average annual costs to DECS industry for the replacement of DPF cores of deployed systems.

Staff assumed that a recall event could potentially occur every 5 years. Based on this assumption, the costs for DPF core replacement would be 5 times the average annual costs to DECS industry for the replacement of DPF cores of deployed systems in each category. This provides an estimate of the costs to replace all DPF cores due to a potential recall event in each category.

However, a potential recall would not require replacement of all DPF cores in each category. Based on the implementation history of the Procedure, staff believes that a recall event is unlikely to affect more than 2 DECS families during the 5 year period. Based on 59 currently verified DECS families, 2 DECS families represent approximately 4 percent of all currently verified families. Therefore, to estimate the costs of a potential recall event to DECS industry in each category, staff assumed that 4 percent of the total DPF core replacement costs would be representative of the cost of a potential recall event. Again, staff believes that this represents a reasonable estimate and the results of this analysis are shown in Table C6.

Table C6- Estimated Potential Recall Costs for On-Road, Off-Road, and TRU DECS

Category	On-Road	Off-Road	TRU
Average Annual Sales (DECS Units)	4505	1206	2576
Average DPF Core Replacement Costs to End-Users	$4,398	$6,494	$1,737
Adjusted DPF Core Replacement Costs (average costs less 30%)	$3,079	$4,546	$1,216
Average Annual Costs of DPF Core Replacement (average annual sales x adjusted DPF Core Replacement costs)	$13,867,544	$5,482,235	$3,132,158
Total Costs of DPF Core Replacement to DECS Industry (average annual costs x 5 years)	$69,337,769	$27,411,174	$15,660,792
Potential Recall Costs by Category (4% of Total Costs of DPF Core Replacement)	$2,773,510	$1,096,447	$626,432
Total Potential Recall Costs	**$2,773,510**	**$1,096,447**	**$626,432**

As shown in Table C6, the estimated potential recall costs to DECS industry for these categories range from $2.8 million for an on-road system to $626,000 for TRU systems. It is important to note that the proposed recall provisions, along with the warranty reporting requirements, represent possible tools that may be used by the Executive Officer in the event that an applicant fails to meet their warranty obligations or deploys a product that fails to perform either as verified or at its verified level. To stay competitive in the marketplace, most applicants seek to develop equitable relationships with their customers and have verified robust products that perform as verified. Therefore, for most applicants, the additional costs associated with a recall may not represent an additional economic impact as they may never be subject to the proposed provisions.

The Procedure currently includes provisions that provide for remedial measures in the event of a failure associated with an applicant's DECS family, so even without the addition of the proposed recall provisions it is assumed that applicants have made appropriate financial preparations and that such costs are already being incurred. In addition, in talking with applicants, staff understands that most "set aside" a portion of each sale to accommodate potential warranty claims. Eventually, if these monies are not used to reimburse end-users for valid warranty claims or to address remedial actions, this money becomes profit.

Since the proposed recall provisions are not imposing direct costs on industry, staff questioned applicants to determine if the level currently set aside for potential warranty claims would be increased to offset the potential financial liability of staff's proposed recall provisions. Only one manufacturer stated that they would hold-back additional sales revenue to offset any potential financial liability associated with the proposed recall provisions. Therefore, staff estimates that the economic impact from the proposed recall provisions to DECS industry ranges from $0 to $2.8 million.

D. Other Proposed Amendments

Installation Warranty Reporting. Staff's proposal requiring authorized installers to submit an annual installation warranty report will result in an additional cost for each installer. Applicants have stated that their annual product warranty reports generally take approximately one to three days to prepare annually and require some level of management oversight. Since each installer is required to warrant the installation of a DECS and not the product itself, staff anticipates that there will be fewer valid warranty claims for installers. Therefore, compiling an annual report should be significantly less time intensive for installers when compared to applicants. Assuming a management level employee is required to compile the report and is paid $60 per hour[2], and this work takes 2 full days, this would cost each installer approximately $960 per year. Staff has identified 76 businesses[3] (on-road, off-road, TRU installers) that are currently installing ARB verified retrofits. Staff estimates an additional $73,000 in statewide reporting costs from the addition of the proposed installer warranty reporting requirements. However, better and earlier identification of remedial actions may offset the costs and actually provide cost savings to DECS installers.

Pre-Installation Compatibility Assessment, Installer Requirements, and End-User training. The proposal requiring applicants to specify a smoke opacity limit, or alternate criterion, to help determine the state of maintenance of the candidate engine prior to retrofit should not result in any significant economic impacts. Several installers have informed staff that they are already performing this additional assessment of their own accord. The smoke meters necessary to determine opacity are readily available to most fleets and are already required by other regulatory programs. A determination of the state of maintenance of the candidate engine prior to retrofit will reduce the number of in-field problems for both applicants and installers, likely lowering on-going costs for remedial actions.

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[2] State of California Employment Development Department, OES Employment and Wages by Occupation, State of California, 2011 1st Quarter, Sales Manager Mean Hourly Wage, SOC Code 11-2021, http://www.labormarketinfo.edd.ca.gov/Content.asp?pageid=152

[3] ARB, 2012m, *Frequently Asked Questions - Heavy-Duty DECS Installation and Maintenance*, List of Verified DECS Installers, on-road, off-road, and TRU. http://www.arb.ca.gov/msprog/decsinstall/faq.htm#8. Accessed March 3, 2012

The proposed changes to the pre-installation compatibility requirements for temperature dependent DECS are simply clarifications of the existing requirements and as such, will not result in any economic impacts. Likewise, the additional requirements for installers, such as performing a smoke test prior to DECS installation, are already in use by several applicants and will not result in any economic impacts. The development of on-line or other electronic training materials for end-users will represent a cost to all applicants if not already planned or provided. Some applicants are already planning on-line training to provide better availability of training classes and help cut the costs of some of the currently provided in-house training. Overall, staff believes that this initial expense will be offset by reduced personnel costs and savings in travel expenses in ongoing training as applicants or their representatives may no longer need to provide in-person training to affected fleets.

The requirement that applicants develop criteria that will be used to authorize their installers may lead to economic impacts for all applicants. However, these costs should be short-term and minimal as they represent only an initial one-time expenditure of staff time. Also, most of the proposed installation training is included in an applicant's Installation Manual which is already required as part of the verification process. Overall, staff believes that the economic impact of these proposed changes will not be significant.

Application and Review Process. The proposed changes to the application and review process should have no economic impact. Staff's proposal merely defines the application and review process to better define the requirements for verification and the process used by staff in reviewing verification applications. In the event that an applicant is required by the Executive Officer to submit a market-ready DECS, a minor cost may be incurred with respect to shipping or transportation as the system will be returned to the applicant upon completion, rejection, or withdrawal from the review process. However, this cost is not expected to be significant.

Impacts of Other Clarifications. None of the remaining proposed clarifications to the Procedure are expected to result in any additional costs or savings, because they implement the original intent of the regulation.

E. References.

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Haas, 2012b. Personal communication between Frank Haas of ESW Canada, and Dean Bloudoff, ARB; April 24, 2012.

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Machado, 2012d. Personal communication between Crystal Machado of HUSS Inc., and Dean Bloudoff, ARB; April 25, 2012.

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Swenson, 2012i. Personal communication between Tom Swenson of Cleaire Advanced Emissions Controls, LLC., and Paul Henderick, ARB; April 24, 2012.

Lassen, 2012j. Personal communication between Marty Lassen of Johnson Matthey Inc., and Dean Bloudoff, ARB; April 25, 2012.

Grylls, 2012k. Personal communication between Paul Grylls of DCL International Inc., and Yong Yu, ARB; April 24, 2012.

Jennings, 2012l. Personal communication between Lisa Jennings, ARB, and Dean Bloudoff, ARB; April 24, 2012.

State of California Employment Development Department, OES Employment and Wages by Occupation, State of California, 2011 1st Quarter, Sales Manager Mean Hourly Wage, SOC Code 11-2021. California Employment Development Department. http://www.labormarketinfo.edd.ca.gov/Content.asp?pageid=152. Last accessed March 3, 2012.

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