State of California
AIR RESOURCES BOARD

STAFF REPORT: INITIAL STATEMENT OF REASONS FOR RULEMAKING

Technical Status and Proposed Revisions to On-Board Diagnostic System Requirements and Associated Enforcement Provisions for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines (OBD II)

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EXECUTIVE SUMMARY

Background

On-board diagnostic (OBD) systems are mainly comprised of software designed into the vehicle's on-board computer system to detect emission control system malfunctions as they occur by monitoring virtually every component and system that can cause increases in emissions. When the OBD system detects an emission-related malfunction, it alerts the vehicle owner by illuminating a malfunction indicator light (MIL) located on the vehicle's instrument panel, and additionally stores information that helps to identify the faulty component or system and the nature of the fault, which enables technicians to quickly and properly repair such faults. OBD systems therefore benefit vehicle owners by ensuring detected malfunctions are promptly and correctly repaired, and ensure that in-use motor vehicle and motor vehicle engine emissions are reduced through improvements in emission system durability and performance.

The California Air Resources Board (ARB or Board) initially adopted OBD regulations in 1989 that required all 1996 and subsequent 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 title 13, California Code of Regulations (CCR), 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 2005, the Board adopted regulations that required OBD systems in heavy-duty engines (HD OBD) beginning in the 2010 model year and that established HD OBD-specific enforcement requirements (title 13, CCR sections 1971.1 and 1971.5, respectively).

Since the initial adoption of the OBD II regulation, the Board has requested that staff biennially update it on motor vehicle manufacturers' progress in meeting the OBD II requirements and to propose such modifications as necessary to achieve maximum compliance with the regulation. In accordance with the Board's direction, ARB staff has regularly met with manufacturers and has proposed amendments to the OBD II regulation which the Board adopted in 1997, 2003, 2007, 2010, and 2012. The Board most recently adopted amendments to the OBD II regulation in 2013 to align the requirements for OBD II systems in medium-duty diesel engines and vehicles with concurrent amendments to the HD OBD regulation.

Staff Proposal

ARB staff has identified a number of proposed amendments to the OBD II regulation that it believes are warranted. Some of the proposed amendments address manufacturers' implementation concerns and provide clarification on existing requirements. Staff is also proposing amendments that it believes are needed to ensure the integrity of the OBD II systems. In addition, because certain requirements can result in lengthy discussion with manufacturers in order to determine the most appropriate monitoring solution or can delay certification due to the time required to examine and approve hardware designs, staff is proposing amendments that should streamline the certification process for both manufacturers and staff.

A summary of the main issues and technical amendments are provided below, while a detailed explanation of each issue is provided in section II of this report. Summaries and rationales of the proposed changes are provided in section VII of this report. Many of the proposed amendments to the OBD II regulation (section 1968.2) have been discussed with manufacturers and have raised little issue or have mostly been settled. They include:

- Adding definitions for “emissions neutral diagnostic,” “emissions neutral default action,” “safety-only component or system,” and “smart devices” for streamlining purposes, and revising the applicable monitoring requirements.
- Revising the gasoline misfire monitoring requirements for plug-in electric hybrid vehicles to no longer require emission threshold-based malfunction criteria.
- Relaxing the interim malfunction thresholds for gasoline air-fuel ratio cylinder imbalance monitoring.
- Revising the gasoline evaporative system purge flow monitoring requirements for purging on the high-load purge lines.
- Revising the gasoline and diesel crankcase ventilation system monitoring requirements.
- Revising the requirements for light-duty and medium-duty chassis-certified diesel vehicles, including revising the diesel misfire monitoring requirements to no longer require emission threshold-based malfunction criteria and to require expanded monitoring conditions.
- Specifying more detailed monitoring requirements for hybrid vehicles, including streamlining plug-in hybrid component test-out criteria that manufacturers would have to meet to be exempt from monitoring certain components.
- Revising the comprehensive component test-out criteria that manufacturers would have to meet to be exempt from monitoring certain components.
- Updating the SAE International (SAE) and International Organization for Standardization (ISO) document references.
- Adding data stream parameters required to be reported to assist with portable emission measurement systems (PEMS) testing.
- Revising the test data, including the emission data, required to be collected as part of the certification demonstration testing.
- Adding items required to be submitted as part of the certification application.

Staff is also proposing amendments to the OBD II enforcement regulation (section 1968.5) to align with some of the proposed changes to the OBD II regulation. These include relaxations to the mandatory recall interim thresholds for the gasoline air-fuel ratio cylinder imbalance monitor, changes to the mandatory recall provisions for gasoline and diesel misfire monitors, and changes to the mandatory recall provisions for light-duty diesel vehicles.

Staff is also proposing amendments to title 13, CCR section 1900, specifically to the definition of "emissions-related part." The definition currently refers to the "Emissions-Related Parts List," adopted by the State Board on November 4, 1977, as last amended May 19, 1981. Staff is proposing to amend the definition of "Emissions-related part" in section 1900 to incorporate the most current version of the "Emissions-Related Parts" List," specifically the version updated on June 1, 1990.

In addition to the proposed amendments described above, there are a few issues where ARB staff and industry differed significantly as to the necessity or the stringency of a requirement. The requirements of concern to the affected manufacturers include:

Low Emission Vehicle III (LEV III) Emission Malfunction Thresholds

For emission threshold monitors (i.e., monitors that detect malfunctions before emissions exceed a specific required threshold), the OBD II regulation currently does not prescribe emission malfunction thresholds specific to LEV III applications since the OBD II regulation had not been comprehensively updated since the adoption of the LEV III program. Considering the changes that come with the LEV III standards, including the combined non-methane organic gases (NMOG) and oxides of nitrogen (NOx) tailpipe standards, new vehicle emission categories with lower emission levels (e.g., ULEV50, ULEV70, SULEV20), and the reduction of the particulate matter (PM) tailpipe standards starting with the 2017 model year, staff is proposing new emission malfunction thresholds for both gasoline and diesel LEV III vehicles. Manufacturers have argued that meeting some of these proposed thresholds are difficult or not feasible in the required timeframe.

Concerning the proposed NMOG+NOx threshold of 2.0 times the standards for ULEV70 and ULEV50 vehicles, manufacturers have indicated an interest in using currently-compliant SULEV30 engines from smaller passenger cars in future larger vehicles as a downsizing measure to meet the LEV III requirements, which may result in higher emissions when a malfunction occurs. Concerning the proposed NMOG+NOx threshold of 2.5 times the standards for SULEV20 vehicles, manufacturers have indicated that staff's proposed emission malfunction threshold is not feasible without changes to monitoring strategies and/or hardware changes. Accordingly, manufacturers proposed higher interim thresholds of 2.5 times the NMOG+NOx standards for ULEV70 and ULEV50 vehicles and higher thresholds of 3.75 times the NMOG+NOx standards that would apply indefinitely for SULEV20 vehicles. While staff believes that ARB's proposed thresholds are technically feasible, it does agree that some relaxation is necessary for near-term model years, although it disagrees with manufacturers about the extent of the relaxation needed. To provide manufacturers with some interim relief, staff is proposing a higher interim threshold (5.0 times the NMOG+NOx standards versus the current 4.0 times the NMOG+NOx standards) before mandatory recall is considered for LEV III ULEV70 and ULEV50 vehicles, while also proposing a higher interim threshold (3.25 times the NMOG+NOx standards) for monitors on SULEV20 vehicles.

Manufacturers have also expressed concern about staff's proposal to reduce the PM filtering performance monitor threshold from 1.75 times to 1.5 times the standard for 2019 and subsequent model year medium-duty chassis vehicles certified to a PM tailpipe standard of 120 milligram per mile (mg/mi) or 60 mg/mi. Manufacturers have indicated that a change in the threshold for the remaining two model years in which vehicles are allowed to certify to the higher PM tailpipe standards is unnecessarily burdensome, since re-calibration of the PM filter monitor would be required once the PM tailpipe standards drops to 10 mg/mi or 8 mg/mi. However, staff, believes that the PM standards of 120 or 60 mg/mi are already so large that the proposed threshold of 1.5 times the PM standard can easily be met using PM sensors or manufacturers' current PM filter delta pressure sensor based diagnostic strategies.

New Data Stream Parameters

As ARB and its partner federal agencies (U.S. EPA and the National Highway Traffic Safety Administration) have adopted increasingly stringent carbon dioxide (CO_2) and fuel economy standards, vehicle manufacturers have started to and will continue to introduce new engine and vehicle technologies to reduce CO_2 emissions. The reductions assigned to these technologies are based on a limited set of certification test cycles that will likely differ, by varying amounts, from actual reductions achieved in the real world. In addition, vehicle manufacturers are charging consumers higher incremental prices for these new technologies and consumers are choosing these technologies based on expectations that the fuel savings from the reduced CO_2 emissions/increased fuel economy will more than offset the higher incremental costs. If specific technologies or applications of technologies have real world benefits that are disproportionally less than represented by the results obtained during certification, California will not realize the intended greenhouse gas (GHG) emission reductions nor will consumers realize the expected fuel savings to recoup the additional money paid for the vehicle. As already evidenced by the increased number of instances in the last few years where federal agencies have required vehicle manufacturers to relabel specific vehicle models with lower fuel economy than originally claimed for certification, there will be a continued need for the agencies to be vigilant in verifying CO_2 (and fuel economy) performance. Staff is therefore proposing that future vehicles incorporate additional data stream parameters that would be used to characterize the vehicle's CO_2 emissions in the real world. These data, which would be required to be phased in on new vehicles starting in the 2019 model year, would help ARB verify that the advanced vehicle and powertrain technologies being deployed to meet the stringent GHG emission standards actually deliver expected benefits and consumer fuel savings in the real world. ARB also anticipates using such data for other purposes, including the development of future CO_2 tailpipe standards that would better ensure real world reductions are achieved, the evaluation of 'off-cycle' credits granted to vehicle manufacturers for specific engine and vehicle technologies that primarily work in conditions outside of those represented by the certification test cycles, the development of future plug-in hybrid electric vehicle regulations that more accurately represent the emission reductions these vehicles achieve, and improvement of GHG inventory models utilized by ARB to accurately project benefits from current and future regulatory measures being considered when planning for compliance with the State's GHG goals.

Specifically, the required data would identify the fuel consumption of the engine/vehicle, since fuel consumption is well correlated to CO_2 emission performance and can be readily measured on a vehicle without any additional hardware or cost. Because many of the new technologies being introduced by vehicle manufacturers target CO_2 reductions in specific engine operating conditions, the data would characterize the fuel consumption relative to these specific conditions. For example, some technologies target CO_2 reductions during engine idling conditions, so the data would help confirm that such technology is achieving the desired benefit during idle conditions. Other examples include technologies such as some hybrid systems that target the largest reductions during city-like driving or active aerodynamic components that target reductions during highway-like driving.

Concerns have been raised by several vehicle manufacturers and other interested parties that such data could have an unintended consequence of providing information about an individual driver's behavior or vehicle usage habits that otherwise would remain private. To address this, the proposal has been structured to provide the minimum needed data to achieve the goal and to have the data stored and accessed in a manner that virtually, if not completely, eliminates the ability for the data to be used to identify any specific driver behavior. First, these data parameters would solely be stored in a vehicle in an aggregate form— not second-by-second or even trip-specific data — such that ARB could quantify the overall CO_2 performance of vehicles, without providing access to any detailed information about driver behavior or how vehicles are being operated at any specific time or for any specific trip. Secondly, such data would specifically exclude any data that could be used, directly or indirectly, to identify a vehicle's current or past location or current or past vehicle operation in excess of speed limits or any other traffic law. Third, these data, by design, could only be accessed from the vehicle by physically plugging a specialized tool into the diagnostic port inside the vehicle while the vehicle is on thereby virtually ensuring that there is some level of participation by the vehicle operator in granting access to the data. Lastly, ARB is not proposing to require vehicle owners to submit these data or allow these data to be accessed. For ARB to access the data, vehicle owners would be contacted and asked to voluntarily participate. Those that choose to participate would allow ARB access to their vehicle and be informed of the data ARB was collecting and the intended usage of it. Those that chose not to participate would be free to decline participation. Likewise, vehicle owners would be free to choose to allow others to access their vehicle to collect the data or not. Any data retrieved by ARB from willing participants could also be readily stored without any identifiable information about the specific vehicle or vehicle owner as is consistent with ARB's data storage practices to store only the data that are needed and eliminate any ability for the data to be hacked or stolen and linked back to an individual vehicle or driver.

Environmental and Cost Impacts

The proposed amendments are not expected to have an adverse impact on the environment. The proposed revisions to the OBD II regulations primarily consist of updates to and clarifications of existing requirements. The only amendments that are expected to affect costs involve the addition of more stringent monitoring requirements for the crankcase ventilation systems on gasoline and diesel vehicles and the addition of new demonstration testing requirements for a few monitors (e.g., the air-fuel ratio cylinder imbalance monitor, cold start emission reduction strategy monitor) on gasoline vehicles. For the proposed changes, the incremental cost to light-duty and medium-duty manufacturers is estimated to be $5.11 per vehicle. These costs are expected to be passed on to the consumer. The overall incremental cost to a consumer is estimated to be $5.43 per vehicle, which when compared to the $34,367 average price of a typical new vehicle represents a price increase of less than 0.02 percent. Further details of the environmental impact, costs, and cost-effectiveness are included in section III. “Environmental Impact Analysis” and section V “Economic Impact.”

Staff Recommendations

Staff recommends that the Board adopt the amendments to the OBD II regulation, the associated OBD II enforcement regulation, and the definition of “emission-related part” as proposed in the Initial Statement of Reasons.

I. INTRODUCTION AND BACKGROUND

Staff is proposing amendments to the OBD II regulation and its associated OBD II enforcement regulation (title 13, CCR sections 1968.2 and 1968.5, respectively). A summary of the main amendments are provided below while detailed explanations of the issues are provided in section II. Summaries and rationales of the proposed changes are provided in section VII of this report. The amendments include:

- Adding LEV III emission malfunction thresholds for emission threshold monitors
- Revising the air-fuel ratio cylinder imbalance monitor monitoring requirements and standardization requirements
- Clarifying monitoring requirements for hybrid vehicles
- Revising the gasoline misfire monitoring requirements for plug-in hybrid electric vehicles
- Revising the evaporative system monitoring requirements for turbocharged vehicles with high load lines
- Revising the crankcase ventilation monitoring requirements
- Revising the light-duty diesel monitoring requirements to align with medium-duty diesel requirements, including full-range misfire monitoring
- Adding allowances for exemptions to selective catalytic reduction (SCR) system low reductant and wrong reductant monitoring for vehicles with inducement systems
- Revising the requirements to allow for exemption from illuminating the MIL for certain components that activate emissions-neutral default actions when they fail
- Revising the requirements to allow for exemption from monitoring for certain components used only for safety purposes
- Adding a definition for smart device and clarifying the monitoring requirements for smart devices
- Adding specific test-out requirements that would allow exemption from monitoring of components that do not have a significant impact on emissions and are not used as part of a diagnostic strategy
- Adding new data stream parameters required to be reported by the OBD II system for CO_2 technology performance, PEMS data collection, and other purposes
- Revising the mandatory recall provisions in the OBD II enforcement regulation, including changes related to the gasoline air-fuel ratio cylinder imbalance monitor and changes related to light-duty diesel vehicles

The following section details the proposed changes as well as staff's rationale for proposing them. All proposed amendments to sections 1968.2 and 1968.5 are included in Appendices A and B, respectively, with proposed additions to the regulation denoted by underline and proposed deletions denoted by ~~strikeout~~.

Additionally, ARB staff is proposing a minor amendment to title 13, CCR section 1900, specifically updating the version of the "Emission-Related Parts List" referenced in the definition of "emissions-related part." The proposed amendments to section 1900 are included in Appendix C, with the proposed additions to the regulation denoted by underline and proposed deletions denoted by ~~strikeout.~~

A. FEDERAL OBD REQUIREMENTS

In 2014, U.S. EPA adopted regulations that establish more stringent emission standards for 2017 and subsequent model year light duty vehicles, light-duty trucks, MDPVs, and complete heavy-duty vehicles between 8,501 and 14,000 pounds (lbs.) gross vehicle weight rating (GVWR), and that additionally limit the sulfur content in gasoline. "Control of Air Pollution From Motor Vehicles: Tier 3 Motor Vehicle Emission and Fuel Standards; Final Rule." (EPA Tier 3 regulation), 79 Federal Register 23414 (April 28, 2014). The U.S. EPA Tier 3 regulation largely harmonizes federal emission standards for the regulated categories of vehicles with the corresponding California emission standards in California's LEV III program.[1]

The U.S. EPA Tier 3 regulation also includes provisions that generally align federal OBD requirements for 2017 and subsequent model year light duty vehicles, light-duty trucks, MDPVs, and complete heavy-duty vehicles between 8,501 and 14,000 lbs. GVWR with ARB's California OBD II regulation, as last amended in 2013.[2] Although the amended federal OBD requirements differ from corresponding California OBD requirements in several respects, as discussed below, they retain the provision that allows U.S. EPA to deem California-certified OBD II systems to comply with the federal OBD regulation.

Retention of Existing Federal-California OBD Requirements

The recently amended federal OBD requirements retain existing differences between the federal OBD and California OBD II regulation. Specifically, the federal OBD requirements do not incorporate the anti-tampering provisions of the OBD II regulation, (that prevent unauthorized modifications of the computer-coded engine operating parameters of the on-board computer), or the deficiency provisions of the OBD II regulation (which allow certification of vehicles with non-fully compliant OBD systems provided manufacturers demonstrate a good-faith effort to comply with OBD requirements as expeditiously as possible and pay fines, and provided the deficiency would not trigger an ordered recall for the OBD system). The federal OBD requirements also limit the requirement that OBD systems verify the alignment of the crankshaft and the camshaft to vehicles that are equipped with variable valve timing.

New Federal-California OBD Differences

The amended federal OBD requirements establish compliance dates for certain categories of vehicles and engines and monitoring requirements that are delayed from

[1] U.S. EPA issued California a waiver for the LEV III emission standards in 2013. 78 Fed. Reg. 2112 (Jan. 9, 2013).
[2] ARB most recently adopted amendments to the OBD II regulation on June 26, 2013, and those amendments became operative under state law on July 31, 2013.

the corresponding compliance dates in the OBD II regulation. Specifically, the federal OBD requirements for vehicles and engines defined as medium-duty vehicles under California law (heavy-duty vehicles between 8,501 and 14,000 lbs. GVWR) first apply to 2019 model year vehicles/engines whose Job 1 (first production date) is on or after March 4, 2018, and to all 2020 and subsequent model year vehicles and engines, while ARB's OBD II requirements generally require medium-duty vehicles and engines to comply with the same requirements no later than the 2015 model year.

The amended federal OBD requirements incorporate provisions of the OBD II regulation that require OBD systems to monitor evaporative systems for malfunctions and to detect leaks that cumulatively are greater than or equal to a leak caused by a 0.02 inch diameter orifice, but establish a limited phase-in period that is not present in ARB's OBD II regulation. Specifically, the federal requirements allow 2016 model year vehicles that do not meet the 0.02 inch leak detection requirement to phase-in compliance with this requirement by the 2018 model year, while ARB's OBD II regulation required OBD systems to comply with these requirements since the 2003 model year.

Federal-Only OBD Requirements

The amended federal OBD requirements additionally establish requirements that only apply to federally certified OBD systems. First, manufacturers must demonstrate the ability of OBD systems to detect 0.020 inch leaks in evaporative systems before obtaining certification. This requirement applies to vehicle test groups certified to the OBD 0.020 inch evaporative system leak monitoring requirement.

Second, the OBD systems in vehicles that are subject to the 0.020 inch evaporative leak standard (see 40 Code of Federal Regulations (CFR) § 86.1813)[3] must store in computer memory and transmit to scan tools the distance that the vehicle traveled since the OBD evaporative leak diagnostic was most recently conducted. This requirement is phased-in between the 2018 and the 2022 model years.

Finally, the amended federal OBD requirements establish a provision allowing manufacturers of emergency vehicles[4] to request a deficiency or a temporary or permanent exemption from otherwise applicable OBD requirements provided manufacturers demonstrate significant vehicle engineering or performance issues associated with compliance with OBD requirements.

[3] The evaporative leak standard limits the cumulative equivalent diameter of any leak in the fuel or evaporative control emission system to a 0.02 inch diameter leak.

[4] Emergency vehicles are defined as motor vehicles manufactured primarily for use in medical response or for use by the U.S. Government or a State or local government for law enforcement or fire protection.

Discussion of Differences

Although the federal OBD regulation is now generally harmonized with California's OBD II regulation as last amended in 2013, the OBD II regulation still establishes more comprehensive and stringent requirements than the amended federal regulation. First, the OBD II regulation requires California OBD systems to comply with monitoring requirements earlier than federal OBD systems must comply with the federal OBD regulation. California's current OBD II regulation establishes requirements applicable to 2013 and subsequent model year vehicles and engines while the amended federal OBD regulation first applies to 2017 and subsequent model year vehicles and engines. For example, California's OBD II regulation requires OBD systems in medium-duty diesel vehicles and engines to detect PM filter performance faults before emissions exceed 0.03 grams per brake-horsepower hour (g/bhp-hr) beginning in the 2013 model year, and allows exclusions of specific failure modes until the 2015 model year.[5] The federal OBD regulation requires federal OBD systems to detect PM filter performance faults at these same levels beginning in the 2019 model year, so California OBD systems must comply with this requirement (without excluding specific failure modes) at least three model years earlier than federal OBD systems.

The 2015 amendments to the OBD II requirements will further establish the stringency of the California OBD II requirements to applicable federal requirements. For example, the 2015 amendments continue California's efforts to require more comprehensive and robust monitoring of emission related systems and components than required by federal OBD regulations. The amendments also incorporate some new requirements that were adopted in EPA's Tier 3 regulation, including requiring demonstration testing of the evaporative system 0.020-inch leak monitor and storing a data stream parameter related to the distance traveled since the last successful completion of the monitor. More details about the other proposed amendments are described under section II. below. 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.

II. TECHNICAL STATUS UPDATE AND PROPOSED AMENDMENTS

A. EMISSION MALFUNCTION THRESHOLDS FOR LOW EMISSION VEHICLE III (LEV III) APPLICATIONS

The OBD II regulation has not been comprehensively updated since the Board adopted California's LEV III program in 2012, and consequently does not prescribe emission malfunction thresholds for vehicles certified to LEV III emission standards. Emission malfunction thresholds are the maximum allowable emissions limits before OBD II systems must detect malfunctions in specified emission components or systems.

California's LEV III program establishes emissions standards that are significantly more stringent than the LEV II emissions standards, and primarily reduce the fleet average

[5] 13 CCR 1968.2(f)(9.2.1)

emissions of new light-duty vehicles to SULEV levels by 2025, an approximate 75 percent reduction from 2010 levels; establishes additional emission standard categories, such as ULEV70, ULEV50, and SULEV20 in order to provide additional options for compliance with the SULEV fleet average; and increases full useful life durability requirements from 120,000 miles to 150,000 miles. The LEV III program also establishes more stringent exhaust and evaporative emission requirements for medium-duty vehicles, requires all medium-duty vehicles between 8,501-10,000 lbs. GVWR to certify on a chassis dynamometer, and requires, for the first time, medium-duty vehicles to comply with supplemental federal test procedure (SFTP) standards.

Considering the new requirements associated with the LEV III standards, including the combined NMOG and NOx tailpipe standards, new vehicle emission categories, and the reduction of the PM tailpipe standards starting with the 2017 model year, staff is proposing to amend the emission malfunction threshold requirements of the OBD II regulation to reflect the recently adopted LEV III standards.

1. PROPOSED EMISSION MALFUNCTION THRESHOLDS FOR LEV III GASOLINE APPLICATIONS

Staff is proposing the following emission malfunction thresholds (in terms of multiplier of the tailpipe standards) for LEV III gasoline applications:

Table 1: LEV III OBD II Gasoline Emission Malfunction Thresholds						
Exhaust Standards		Monitor Thresholds (except catalyst)				Catalyst Monitor Threshold
Vehicle Type	**Vehicle Emission Category**	**NMOG+NOx Mult.**	**CO Mult.**	**PM Mult.**	**PM THD (mg/mi)**	**NMOG+NOx Mult.**
Passenger Cars, Light-Duty Trucks, and Chassis Certified MDPVs	LEV160	1.50	1.50	N/A	17.50[1]	1.75
	ULEV125					
	ULEV70	2.00				2.00
	ULEV50					
	SULEV30	2.50	2.50			2.50
	SULEV20[4]					
Chassis Certified Medium-Duty Vehicles (except MDPVs)	All Medium-Duty Vehicle Emission Categories	1.50	1.50	1.50[2]	17.50[3]	1.75

1. Applies to 2019 and subsequent model year vehicles
2. Applies to 2019 and subsequent model year vehicles not included in the phase-in of the PM standards set forth in Table 3 below
3. Applies to 2019 and subsequent model year vehicles included in the phase-in of the PM standards set forth in Table 3 below
4. For SULEV20 vehicles, in lieu of the 2.50 NMOG+NOx multiplier set forth in Table 1, manufacturers shall use an NMOG+NOx multiplier of 3.25 for the first three model years a vehicle is certified, but no later than the 2025 model year

CO = carbon monoxide; MDPV = medium-duty passenger vehicle; THD = Threshold; Mult. = Multiplier to be used with the applicable standard (e.g., 2.0 times the NMOG+NOx standard)

Light-Duty Gasoline Vehicle Thresholds

Gasoline LEV III LEV160, ULEV125, and SULEV30 thresholds

The light-duty vehicle NMOG, NOx, and CO tailpipe standards for the LEV II LEV, ULEV, and SULEV applications are equivalent to the NMOG+NOx and CO tailpipe standards for the LEV III LEV160, ULEV125, and SULEV30 applications, respectively. As such, staff is proposing that these LEV III applications use the same multipliers (e.g., 1.50 for LEV160 and ULEV125) as those currently required for the corresponding LEV II applications. It should be noted that even though the proposed LEV III multipliers are the same for these vehicles, due to the combined LEV III NMOG+NOx tailpipe standards, the proposal actually allows for more deterioration of a single emission constituent (i.e., either NMOG or NOx) on these LEV III applications before a fault is required to be detected.

Gasoline LEV III ULEV70 and ULEV50 thresholds
Staff is proposing different emission thresholds for LEV III emission categories with no corresponding LEV II emission categories. For vehicles certified to the LEV III ULEV70 and ULEV50 emission categories, staff is proposing an emission threshold of 2.0 times the NMOG+NOx standard. Staff derived this proposed 2.0 multiplier by using a linear interpolation between the proposed LEV III LEV160, ULEV125, and SULEV30 malfunction criteria mentioned above. Further, staff is proposing an emission threshold of 1.5 times the CO standard for LEV III ULEV70 and ULEV50 vehicles. Staff derived this proposed 1.5 CO multiplier by analyzing LEV II ULEV emission demonstration data and finding that faults were detected before CO emissions exceeded the proposed LEV III ULEV70 and ULEV50 threshold.

Manufacturers have indicated an interest in using currently compliant SULEV30 engines from smaller passenger cars in future larger sport utility vehicles (SUVs) and light-duty trucks as a downsizing measure to meet the LEV III requirements. Additionally, manufacturers have indicated an interest in reclassifying ULEV125 vehicles as ULEV50 and ULEV70 vehicles using varying amounts of vehicle optimization. To support these efforts, manufactures requested an interim ULEV50 and ULEV70 multiplier of 2.5 times the standards. Manufacturers provided engineering data illustrating that a simulated SUV with a downsized SULEV30 engine from a passenger car has similar tailpipe emissions to the original SULEV30 passenger car, with both meeting the LEV III SULEV30 tailpipe emission standards. However, once a malfunction was implanted in the vehicles, the higher weight vehicle exhibited a much greater increase in exhaust emissions compared to emissions on the smaller vehicle, resulting in emissions higher than the proposed 2.0 NMOG+NOx multiplier on the heavier vehicle. Based on these results, manufacturers proposed a 2.5 NMOG+NOx multiplier for the first three model years (up to and including 2019 model year) a test group certifies to the ULEV50 or ULEV70 standard, eventually dropping down to a 2.0 NMOG+NOx multiplier in the 2020 model year. Manufacturers also suggested that a higher CO multiplier is needed because of uncertainty regarding whether future vehicles would be able to meet staff's proposed threshold and a need for a greater compliance margin, and proposed a 1.75 multiplier for CO emissions to be applied indefinitely. ARB staff disagrees and believes that its proposal is already technically feasible.

Staff analyzed 2014 and 2015 model year LEV III ULEV70 vehicle emission demonstration data submitted by manufacturers and confirmed that the proposed NMOG+NOx and CO thresholds are already being achieved. However, to provide manufacturers with some relief for vehicles certified to the ULEV70 or ULEV50 standards in the near term, staff is proposing a higher interim threshold for mandatory recall in the OBD II enforcement regulation (section 1968.5(c)(3)) for these vehicles. The current OBD II enforcement regulation specifies that a nonconforming OBD II system may be subject to mandatory recall if the emission threshold monitor is unable to detect a malfunction before emissions exceed twice the malfunction criteria (e.g., if the malfunction criteria is 2.0 times the applicable standards, the mandatory recall level is set at 4.0 times the applicable standards). Staff is proposing that for the first three years a vehicle is certified to the LEV III ULEV50 or ULEV70 standards, but no later than the 2019 model year, OBD II systems would be subject to recall if an emissions threshold monitor is unable to detect a fault before emissions exceed a threshold of 2.5 times the malfunction criteria, which is equivalent to 5.0 times the NMOG+NOx tailpipe standard for ULEV50 and ULEV70 vehicles. Increasing the recall threshold reduces the in-use liability for manufacturers should the vehicles not perform in-use as expected and demonstrated during certification.

Gasoline LEV III SULEV20 thresholds
Staff used a similar method to determine the proposed threshold for LEV III SULEV20 applications. Specifically, staff derived a NMOG+NOx malfunction criteria of 2.5 times the NMOG+NOx standard (i.e., 50 mg/mi NMOG+NOx) by using a linear interpolation between the LEV III LEV160, ULEV125, and SULEV30 malfunction criteria. Manufacturers have voiced concerns regarding ARB staff's proposed threshold, and have stated that a malfunction criteria of 50 mg/mi is not feasible without changes to the monitoring strategy and/or hardware changes. For example, manufacturers have suggested that in order to comply with the proposed threshold of 50 mg/mi NMOG+NOx for the gasoline catalyst monitor, they would be forced to either develop new monitoring strategies or add precious metals to the catalyst, which would significant cost increases that would be difficult to justify across their large sales volume models. Manufacturers have instead proposed aligning the SULEV20 threshold with the proposed SULEV30 threshold of 2.5 times the SULEV30 standard (i.e., 75 mg/mi NMOG+NOx), which would be equivalent to 3.75 times the SULEV20 NMOG+NOx standard.

To evaluate manufacturers' proposal, staff reviewed emission demonstration data from LEV II SULEV vehicles and LEV III SULEV30 vehicles in which the vehicle's baseline NMOG+NOx emissions were below the SULEV20 tailpipe standard (i.e., 20 mg/mi). Staff found that a majority of the major monitors were able to meet the proposed threshold of 50 mg/mi NMOG+NOx without any additional calibration work. However, not all major monitors were able to meet the 50 mg/mi threshold, especially given emission test-to-test variability. ARB staff is therefore proposing to allow manufacturers to use a malfunction criteria of 3.25 times the applicable NMOG+NOx standard (i.e., an absolute threshold of 65 mg/mi NMOG+NOx) for the first three model years a vehicle is certified to the LEV III SULEV20 tailpipe standard through the 2025 model year (i.e., manufacturers cannot use the 3.25 multiplier on 2026 and subsequent model year SULEV20 applications). While staff's proposal is not as high as the 75 mg/mi that manufacturers were proposing, staff believes that based on the LEV III SULEV30 demonstration data, the 65 mg/mi threshold is feasible. Additionally, staff believes that with some calibration work, manufacturers will be able to reduce SULEV20 emissions of demonstration monitors to levels comfortably lower than 2.5 times the applicable standard.

Gasoline catalyst CO emission data
The current OBD II regulation requires OBD II systems to detect gasoline catalyst faults before NMOG and NOx emissions exceed specific levels. Until recently, staff has assumed that CO emissions were not a limiting factor when calibrating the catalyst monitor, especially considering the generally low baseline emissions and high LEV II

standards. Staff, however, does not have enough data showing the CO emissions impact of a malfunctioning catalyst to determine if this assertion is generally true for most vehicles. Because of the expected evolution of emission control systems in LEV III vehicles, staff is concerned that malfunctions may have a bigger impact on CO emissions on future vehicles. Therefore, while staff is not proposing a CO threshold for gasoline catalyst monitors at this time, staff is proposing that manufacturers provide CO emission data with all gasoline catalyst monitor demonstration data starting with the 2017 model year. ARB staff would use these data to determine if a malfunctioning catalyst has a bigger impact on CO emissions than previously believed, and whether or not a CO threshold needs to be proposed for future model year vehicles.

Gasoline LEV III PM thresholds
Staff is also proposing new PM thresholds for emission threshold monitors on 2019 and subsequent model year LEV III gasoline applications. The OBD II regulation currently generally requires faults to be detected before emissions exceed 1.5 times the "applicable standards." The current light-duty PM tailpipe standard is 10 mg/mi, equating to a threshold of 15 mg/mi PM (1.5 x 10 mg/mi).

ARB staff has traditionally assumed that PM emissions from gasoline-fueled vehicles are well below OBD emission malfunction threshold levels when a malfunction occurs because the baseline PM emissions levels from such vehicles have been so low compared to the relatively high PM tailpipe standards. Staff, however, does not have enough data showing the PM emissions impact of a malfunction to determine if this assertion is generally true for most gasoline vehicles. Nonetheless, staff believes that PM emissions will become an issue and PM thresholds will be needed as the increasingly stringent PM standards in the LEV III program are implemented across the vehicle fleet. For passenger cars, light-duty trucks, and MDPVs, the PM tailpipe standards drop from 10 mg/mi to 3 mg/mi to 1 mg/mi according to the following phase-in schedule set forth in title 13, CCR section 1961.2(a)(2)(A):

Table 2: LEV III PM Emission Standard Values and Phase-in for Passenger Cars, Light-Duty Trucks, and MDPVs		
Model Year	**% of vehicles certified to a 3 mg/mi standard**	**% of vehicles certified to a 1 mg/mi standard**
2017	10	0
2018	20	0
2019	40	0
2020	70	0
2021	100	0
2022	100	0
2023	100	0
2024	100	0
2025	75	25
2026	50	50
2027	25	75
2028 and subsequent	0	100

These more stringent PM tailpipe standards present a greater possibility that malfunctions will result in significantly increased PM emissions relative to the PM tailpipe standards. Some technologies such as gasoline direct injection engines might be even more susceptible to a large increase in PM emissions when a fault occurs. Staff is therefore proposing PM thresholds for emission threshold monitors, except catalyst monitoring, on all 2019 and subsequent model year gasoline LEV III applications. Specifically, staff proposes an absolute threshold of 17.5 mg/mi PM for passenger cars, light-duty trucks, and MDPVs. This threshold was proposed by industry, based on current monitoring strategy capability and available sensor technology.

While ARB staff believes the proposed PM thresholds are feasible given the relatively high proposed PM levels of these thresholds compared to the PM tailpipe standard and the current level of PM emissions from gasoline vehicles, as mentioned earlier, both staff and manufacturers have limited PM data. As such, even though the PM thresholds would not apply until the 2019 model year, staff is proposing to require manufacturers to include PM data with all LEV III OBD demonstration data starting with the 2017 model year. Manufacturers have stated that they have not previously measured PM emissions from their gasoline vehicles, considering PM OBD II thresholds and even PM tailpipe standards were not enforced on gasoline vehicles, and will need to upgrade their test facilities to do so. To address these concerns, staff is proposing to limit the PM data collection to those LEV III applications selected for demonstration testing and included in the PM tailpipe standard phase-ins in Table 2. Staff will use these data to evaluate and review the 17.5 mg/mi PM threshold and propose future changes as necessary.

Proposed Medium Duty Gasoline Vehicle Thresholds
Staff is proposing that the same NMOG+NOx and CO multipliers as those currently required for light-duty vehicles in the OBD II regulation apply to LEV III chassis-certified medium-duty vehicles. Specifically, staff is proposing these medium-duty vehicles be required to meet thresholds of 1.75 times the NMOG+NOx standards for the gasoline catalyst monitor and thresholds of 1.5 times the NMOG+NOx and CO standards for the rest of the monitors. To determine the appropriate thresholds, staff compared the NMOG+NOx results of LEV II certification demonstration data to the proposed LEV III NMOG+NOx thresholds. This was done by adding the NMOG and NOx standards of the LEV II vehicles and comparing their emission results with the NMOG+NOx thresholds of the LEV III category whose NMOG+NOx standard most closely matched the added NMOG and NOx standards of the LEV II category. As an example, a medium-duty vehicle (8,501 to 10,000 lbs. GVWR) certified to ULEV II would have a 0.143 g/mi NMOG standard and a 0.2 g/mi NOx standard. If the NMOG and NOx standards are added, the resulting NMOG+NOx sum is equal to 0.343 g/mi. The LEV III category with the closest NMOG+NOx standard is the ULEV340 category, which has an NMOG+NOx standard of 0.340 g/mi. Using this method, it was determined that for most monitors of the LEV II vehicles, the malfunctions were detected below the proposed LEV III OBD thresholds. Only 2 of the vehicles detected the faults above the proposed LEV III thresholds for the exhaust gas recirculation (EGR) flow and fuel system lean shift monitors. It is expected that with minor calibration changes, these vehicles would be able to meet the proposed thresholds across all monitors. The proposed LEV III CO threshold of 1.5 times the standard for medium-duty vehicles is believed to be readily achievable, with none of the LEV II vehicles approaching the proposed LEV III CO thresholds before detecting any fault.

Additionally, similar to passenger cars, light-duty trucks, and MDPVs, the PM tailpipe standards for medium-duty vehicles become more stringent with LEV III implementation in accordance with the following phase-in schedule set forth in title 13, CCR section 1961.2(a)(2)(B)2:

Table 3: LEV III PM Emission Standard Phase-in for Medium-Duty Vehicles, Other than MDPVs

Model Year	**Total % of medium-duty vehicles certified to the 8 mg/mi PM Standard or to the 10 mg/mi PM Standard, as applicable**
2017	10
2018	20
2019	40
2020	70
2021 and subsequent	100

For medium-duty vehicles that are not included in the LEV III PM tailpipe standard phase-in specified in Table 3 (i.e., are certified to either a 120 mg/mi or 60 mg/mi PM standard), staff is proposing a PM threshold multiplier of 1.5 (i.e., a threshold of 1.5

times the PM standard). For medium-duty vehicles that are included in the PM tailpipe standard phase-in (i.e., are certified to either a 10 mg/mi or 8 mg/mi PM standard), staff is proposing an absolute threshold of 17.5 mg/mi PM for 2019 model year and subsequent vehicles. As stated above, this threshold was proposed by industry, based on current monitoring strategy capability and available sensor technology. These proposed PM thresholds would be applicable to all emission threshold monitors except the catalyst monitor. As with light-duty vehicles, staff is also proposing to require that manufacturers submit PM data for all 2017 and subsequent model year vehicles selected for demonstration testing and included in the PM tailpipe standard phase-in in Table 3.

2. PROPOSED EMISSION MALFUNCTION THRESHOLDS FOR LEV III DIESEL APPLICATIONS

The emission malfunction thresholds for diesel vehicles also need to be amended to account for the LEV III tailpipe standards. Staff is proposing the following thresholds (in terms of multiplier of the tailpipe standards) for LEV III diesel applications, with Table 4 describing the proposed thresholds for most diesel monitors and Table 5 describing the proposed thresholds for the diesel PM filter filtering performance monitor:

Table 4: LEV-III OBD II Diesel Emission Malfunction Thresholds

<table>
<tr><th colspan="2">Exhaust Standards</th><th colspan="3">Monitor Thresholds[1]</th><th colspan="3">Aftertreatment Monitor Thresholds[2]</th></tr>
<tr><th>Vehicle Type</th><th>Vehicle Emission Category</th><th>NMOG+NOx Mult.</th><th>CO Mult.</th><th>PM Mult.</th><th>NMOG+NOx Mult.</th><th>CO Mult.[3]</th><th>PM Mult.</th></tr>
<tr><td rowspan="6">Passenger Cars, Light-Duty Trucks, and Chassis Certified MDPVs</td><td>LEV160</td><td rowspan="2">1.50</td><td rowspan="4">1.50</td><td rowspan="6">2.00</td><td rowspan="2">1.75</td><td rowspan="4">1.50</td><td rowspan="6">2.00[3]</td></tr>
<tr><td>ULEV125</td></tr>
<tr><td>ULEV70</td><td rowspan="2">2.00</td><td rowspan="2">2.00</td></tr>
<tr><td>ULEV50</td></tr>
<tr><td>SULEV30</td><td rowspan="2">2.50</td><td rowspan="2">2.50</td><td rowspan="2">2.50</td><td rowspan="2">2.50</td></tr>
<tr><td>SULEV20[6]</td></tr>
<tr><td>2016-2018 model years Chassis Certified Medium-Duty Vehicles (except MDPVs)</td><td>All Medium-Duty Vehicle Emission Categories</td><td>1.50</td><td>1.50</td><td>2.00</td><td>1.75</td><td>N/A</td><td>N/A</td></tr>
<tr><td>2019+model years Chassis Certified Medium-Duty Vehicles (except MDPVs)</td><td>All Medium-Duty Vehicle Emission Categories</td><td>1.50</td><td>1.50</td><td>1.50[4] or 2.00[5]</td><td>1.75</td><td>1.50</td><td>1.50[4] or 2.00[5]</td></tr>
</table>

1. Applies to (f)(3.2.5), (f)(4)-(f)(7), (f)(9.2.2), (f)(12)-(f)(13)
2. Applies to (f)(1)-(f)(2), (f)(8), and (f)(9.2.4)(A)
3. Applies to 2019 and subsequent model years
4. Applies to vehicles not included in the phase-in of the PM standards set forth in Table 3 above
5. Applies to vehicles included in the phase-in of the PM standards set forth in Table 3 above
6. For SULEV20 vehicles, in lieu of the 2.50 NMOG+NOx multiplier set forth in Table 4, manufacturers shall use an NMOG+NOx multiplier of 3.25 for the first three model years a vehicle is certified, but no later than the 2025 model year

<table>
<tr><th colspan="6">Table 5: LEV-III OBD II Diesel PM Filter Filtering Performance Monitor Threshold</th></tr>
<tr><th colspan="2">Exhaust Standards</th><th colspan="4">PM Filter Filtering Performance Monitor Threshold</th></tr>
<tr><th>Vehicle Type</th><th>Vehicle Emission Category</th><th>NMOG+NOx Mult.[1]</th><th>CO Mult.[1]</th><th>PM Mult.</th><th>PM THD (g/mi)</th></tr>
<tr><td rowspan="6">Passenger Cars, Light-Duty Trucks, and Chassis Certified MDPVs</td><td>LEV160</td><td rowspan="2">1.50</td><td rowspan="4">1.50</td><td rowspan="6">N/A</td><td rowspan="6">0.0175</td></tr>
<tr><td>ULEV125</td></tr>
<tr><td>ULEV70</td><td rowspan="2">2.00</td></tr>
<tr><td>ULEV50</td></tr>
<tr><td>SULEV30</td><td rowspan="2">2.50</td><td rowspan="2">2.50</td></tr>
<tr><td>SULEV20[4]</td></tr>
<tr><td>2016-2018model years Chassis Certified Medium-Duty Vehicles (except MDPVs)</td><td>All Medium-Duty Vehicle Emission Categories</td><td>N/A</td><td>N/A</td><td>1.75[2]</td><td>0.0175[3]</td></tr>
<tr><td>2019+model years Chassis Certified Medium-Duty Vehicles (except MDPVs)</td><td>All Medium-Duty Vehicle Emission Categories</td><td>1.50</td><td>1.50</td><td>1.50[2]</td><td>0.0175[3]</td></tr>
</table>

1. Applies to 2019 and subsequent model years
2. Applies to vehicles not included in the phase-in of the PM standards set forth in Table 3 above
3. Applies to vehicles included in the phase-in of the PM standards set forth in Table 3 above
4. For SULEV20 vehicles, in lieu of the 2.50 NMOG+NOx multiplier set forth in Table 4, manufacturers shall use an NMOG+NOx multiplier of 3.25 for the first three model years a vehicle is certified, but no later than the 2025 model year

The OBD II regulation currently specifies emission malfunction thresholds that are based on separate non-methane hydrocarbon (NMHC) and NOx standards, and not all diesel monitors have NMHC, CO, NOx and PM thresholds. For example, the diesel PM filter filtering performance monitor only has a PM threshold, the NOx catalyst and NOx adsorber monitors only have NMHC and NOx thresholds, and the NMHC catalyst and catalyzed PM filter monitors only have an NMHC threshold. Because the LEV III standards now combine NMOG+NOx, using an NMHC-only threshold for monitors like the NMHC catalyst is no longer feasible. Further, future aftertreatment solutions may combine functions to control multiple pollutants (e.g., an SCR catalyst in the same unit as a PM filter to achieve both NOx and PM control). Staff is therefore proposing an NMOG+NOx threshold for those monitors that previously had an NMHC threshold alone. Additionally, staff is proposing adding NMOG+NOx and CO thresholds for the PM filter filtering performance monitor, and adding PM and CO thresholds for the NMHC catalyst, NOx catalyst, catalyzed PM filter NMHC conversion, and NOx adsorber monitors, on all 2019 and subsequent model year diesel LEV III applications. The rationale for the proposed light- and medium-duty diesel NMOG+NOx and CO thresholds are the same as those described above for light- and medium-duty LEV III gasoline applications respectively, as staff is proposing the same NMOG+NOx and CO thresholds for each vehicle emission category.

For PM thresholds, the OBD II regulation currently requires emission threshold monitors, except PM filter performance and aftertreatment monitors, to detect a malfunction before PM emissions exceed 2.0 times the applicable (Federal Test Procedure (FTP) PM standard. Because of the technical capabilities of current aftertreatment diagnostics, staff is proposing a 2.0 multiplier for PM emissions for all emission threshold monitors and aftertreatment monitors on 2019 and subsequent model year diesel passenger car, light-duty truck, and MDPV applications, as well as diesel LEV III medium-duty vehicles included in the phase-in of the PM standards set forth in Table 3. Manufacturers are expected to meet these proposed thresholds through the use of existing hardware (e.g., pressure sensors) and recalibration because tailpipe PM emissions will be minimized by the high efficiency of the diesel particulate filter. As such, PM emissions will not likely be the limiting factor when calibrating a monitor to detect malfunctions before emissions exceed the specified thresholds. However, if a malfunction causes higher PM emissions, staff expects manufacturers can calibrate existing monitoring strategies to detect that malfunction before the proposed PM thresholds are exceeded. Due to the significantly higher PM standards of medium-duty vehicles not included in the phase-in of the LEV III PM standards, staff is proposing a threshold of 1.5 times the applicable standard for all 2019 and subsequent model year medium-duty vehicles not included in the phase-in of the PM standards.

For passenger cars, light-duty trucks, and MDPVs, the OBD II regulation currently requires OBD II systems to monitor for PM filter performance and detect a malfunction before vehicle PM emissions exceed 1.75 times the applicable FTP PM standard. Currently, the monitoring capability of PM filters is robust down to 17.5 mg/mi. As the PM standard drops below 10 mg, the current monitoring capability may not be robust enough to monitor at such low PM emission levels. If the current multiplicative threshold was applied to LEV III PM standards, the monitoring threshold would drop below 17.5 mg/mi, requiring further development of the PM filter monitoring technology. Because of these limitations, staff is proposing an absolute PM filter monitoring threshold of 17.5 mg/mi instead of a multiplier for future model year vehicles due to the future lower PM standard as set forth in Table 2 and limits in current monitoring technology. Staff expects manufacturers would only need to make calibration changes to their current monitoring strategies and would not need new hardware to meet these proposed thresholds.

Current medium-duty chassis PM standards are as high as 120 or 60 mg/mi before dropping to 10 mg/mi or 8 mg/mi during 2017-2021 model years PM phase-in set forth in Table 3. Proposing an absolute threshold of 17.5 mg/mi would not be appropriate for a 120 or 60 mg/mi standard but is appropriate for vehicles certified to 10 mg/mi or 8 mg/mi since the monitoring capability of PM filters is robust down to 17.5 mg/mi. For vehicles certified to the 120 mg/mi or 60 mg/mi, the regulation currently requires PM filter monitoring at a detection level of 1.75 times the PM standard. With such a large

PM emission standard, staff believes that a reduction in the PM monitoring threshold could be implemented readily considering the current PM filter monitoring technology. As such, ARB staff is proposing a PM monitoring threshold of 1.5 times the standard for 2019 and subsequent model year medium-duty chassis vehicles that are not included in the PM phase-in set forth in Table 3. Manufacturers have commented that a change in the threshold for the remaining two model year vehicles that are not part of the lower PM standard phase-in is unnecessarily burdensome since re-calibration of the PM filter monitor would be required once the PM standard drops. Staff considered industry's comments in light of the current PM emission standards of 120 and 60 mg/mi. However, these PM standards are already so large that manufacturers' existing PM filter diagnostics should easily meet the proposed PM threshold of 1.5 times the standard. Today, some manufacturers are using a delta pressure sensor based strategy to light the MIL when a malfunction equivalent to an empty can (i.e., missing substrate) is detected based on an allowance in the current regulation requiring detection of "when no detectable amount of PM filtering occurs" in cases where no failure or deterioration of the PM filtering performance could result in a vehicle's PM emissions exceeding the applicable malfunction criteria. This is referred to as a functional check of PM filter performance. Based on emissions data observed by staff during OBD certification reviews, it is likely that most manufacturers would continue to meet the proposed 1.5 times multiplier with their existing delta pressure based monitors. Since the PM standard is significantly large and provides significant margin before reaching the PM emission threshold, most manufacturers would fall below the threshold and would not need to add additional hardware (i.e., continue with a functional check of the PM filter). In cases where the manufacturer cannot test out of the threshold requirements for PM filter monitoring, it is reasonable to foresee that, in lieu of adding new hardware, manufacturers would slightly modify/decrease engine out PM emissions and continue OBD certification with a functional PM filter monitor using existing hardware and monitoring strategies.

3. OTHER LEV III-RELATED PROPOSED AMENDMENTS

The proposed amendments include changes to the direct ozone reduction (DOR) system monitoring requirements. According to the current OBD II regulation, for vehicles in which the NMOG credit assigned to the DOR is less than or equal to half the applicable FTP NMOG emission standard to which the vehicle is certified, the OBD II system is required to detect a malfunction when the DOR system has no detectable amount of ozone reduction. Otherwise, if the NMOG credit assigned is greater than 50 percent of the applicable FTP NMOG standard, the manufacturer is required to implement a threshold monitor.

In order to account for the combined NMOG and NOx standards for LEV III vehicle applications, staff is proposing the following amendments to the DOR system monitoring requirements. Specifically, for all LEV III vehicle applications in which the NMOG credit assigned to the DOR system is less than or equal to 5 mg/mi, manufacturers would be required to perform a functional check of the DOR system to verify that the coating is still present on the radiator. Alternatively, if the NMOG credit assigned is greater than 5 mg/mi, the manufacturers would be required to detect a malfunction when the ozone reduction performance of the DOR system deteriorates to a point where the difference between the NMOG credit assigned to the properly operating DOR system and the NMOG credit calculated for a DOR system performing at the level of the malfunctioning system exceeds 5 mg/mi NMOG. ARB staff believes that 5 mg/mi is appropriate based on past experience with certifying DOR-equipped LEV II vehicle applications.

Further, according to the current OBD II regulation, manufacturers are allowed to use the NMOG credit assigned to the DOR system to modify the applicable OBD NMOG malfunction criteria, where appropriate. Since LEV III vehicle applications will have an NMOG+NOx emission threshold, ARB staff is proposing requirements that would allow a manufacturer to modify the applicable NMOG+NOx malfunction criteria for any of the emission threshold monitors by adding the NMOG credit to the required NMOG+NOx malfunction criteria (e.g., (1.5 x NMOG+NOx standard) + DOR system NMOG credit).

Staff also proposed interim emission malfunction thresholds to apply to LEV III vehicles in the first few years for gasoline fuel system monitoring of air-fuel ratio cylinder imbalance malfunctions. The proposal is described in section II.E.3. “Gasoline Fuel System Monitoring” below.

Finally, in conjunction with adopting these changes, staff is also proposing new definitions in section 1968.2(c) related to the LEV III applications, specifically “Low Emission Vehicle III application” and the various emission sub-categories.

B. DEFINITIONS

Staff is proposing a definition for “alternate-fueled vehicle” that is similar to the definition in the HD OBD regulation. While the OBD II regulation currently does not have a specific definition for alternate-fueled vehicles, 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 use the same emission controls as 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. This clarification would provide manufacturers with direction as to how possible future configurations would be classified. Concurrently, staff is proposing to delete reference to “alternate-fueled engines” from the definition of “gasoline engines.”

Staff is also proposing to amend the definition of a “diagnostic or emission critical” electronic powertrain control unit. OBD II 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 inspection and maintenance (I/M) programs (e.g., California Smog Check) 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 II 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 OBD II 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 (ECU) 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 II program benefit. With the advent of more and more electronic controllers or ‘smart’ sensors that have integrated controllers on vehicles, the existing definition resulted in many modules with relatively minor roles in the OBD II system having to support CAL ID and CVN. Staff is therefore proposing to modify the definition of “diagnostic or emission critical” in order 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 proposed amendments, which would align with the definition in the HD OBD regulation, increase the amount of OBD II content for most controllers before CAL ID and CVN would be required while still providing assurance that the controllers with the most critical OBD content will have CAL ID and CVN. The changes more directly target inclusion of controllers that are at higher risk for being modified or tampered by including controllers that are reprogrammable and have material OBD II content.

Staff is also proposing to add a new definition for “Highway Fuel Economy Driving Cycle.” The demonstration requirements for certification (section 1968.2(h)) allow manufacturers to use the federal Highway Fuel Economy Driving Cycle as a second preconditioning cycle if approved by ARB. However, there is no definition in section 1968.2(c) indicating how this driving cycle is defined. Thus, the new definition would indicate that this is the ~760-second cycle defined in Part II of the “California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light Duty Trucks, and Medium Duty Vehicles.” It should be noted that while manufacturers typically run this driving cycle twice for other purposes such as determining fuel economy calculations, the OBD II regulation requires manufacturers to run the cycle only once as a second preconditioning cycle for demonstration testing.

Staff is also proposing to amend the definition of “gasoline engine.” Currently, the OBD II regulation defines “gasoline engine” as an Otto-cycle engine or an alternate-fueled engine. First, staff is proposing to delete reference to “alternate-fueled engine,” since staff is already proposing a new, separate definition for “alternate-fueled vehicle.” Second, staff is modifying the definition to define “gasoline engine” as “an engine using a spark ignition thermodynamic cycle.” The revised definition more accurately describes the types of vehicle that would be required meet the gasoline OBD II requirements and better encompass some of the gasoline engine technologies that are being implemented to meet the LEV III and Advanced Clean Cars/GHG requirements.

Staff is also proposing amendments to the definition of “propulsion system active,” which is currently used in determining when the in-use monitor performance denominators for hybrid vehicles should be incremented (which requires more than 600 seconds of propulsion system active time to increment the denominator). The language currently defines this as the “the state where the powertrain is enabled by the driver such that the vehicle is ready to be used.” Manufacturers, however, have expressed concern that the current definition would cause OBD II systems to unnecessarily increment the denominators during driving cycles with very little driving but where the vehicle owner used remote start activations for various reasons such as conditioning the cabin prior to actually using the vehicle. This may result in low in-use monitor performance ratios that would not meet the minimum required ratio specified in the regulation. Staff is thus proposing to revise the definition of “propulsion system active” to exclude remote start activations that do not cause the engine to start unless prompted by the driver.

Staff is also proposing three new definitions related to emission standards and test procedures. Staff is proposing a new definition for “50ºF FTP,” which refers to the 50ºF emission test procedure currently used for purposes such as determining emissions at lower temperatures, and is proposing a new definition for “Supplemental Federal Test Procedure (SFTP) Composite Emission Standard,” which is currently used for purposes such as determining emissions compliance. Both definitions would reference the associated procedure or standard described in “California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light Duty Trucks, and Medium Duty Vehicles.” Staff is also proposing a new definition for “Highway Fuel Economy Test (HWFET),” which is currently used for purposes such as determining fuel economy calculations, and the proposed definition references the procedures defined in 40 CFR 600 Subpart B or 40 CFR §1066.840 with the migration provisions of §600.111-08 introduction. For OBD purposes, staff is proposing to use these three standards and procedures to evaluate the emissions impacts and possible exemption from monitoring requirements for some comprehensive components. This is discussed in more detail in section II.E.11, “Gasoline Comprehensive Component Monitoring.”

Staff is also proposing new definitions for “emission neutral default action,” “emissions neutral diagnostic,” “safety-only component or system,” and “smart device.” These proposed definitions are also discussed in detail in section II.E.11. “Gasoline Comprehensive Component Monitoring.”

Finally, staff is proposing new definitions for “active off-cycle credit technology,” “charge depleting operation,” “charge increasing operation” and “charge sustaining operation.” The definitions for “active off-cycle credit technology,” “charge depleting operation,” and “charge increasing operation” would be used in conjunction with the proposed new data stream parameters related to real-world vehicle and fuel usage while the definitions for “charge depleting operation” and “charge sustaining operation” would be used in conjunction with the proposed new specific procedures for plug-in hybrid electric vehicles to determine the malfunction criteria for emission threshold monitors. The proposed definitions are discussed in detail in section II.G.4. “Data Stream Parameters” and section II.L. “Other Proposed Amendments.”

C. MALFUNCTION INDICATOR LIGHT (MIL) AND FAULT CODE SPECIFICATIONS

The OBD II regulation currently requires the MIL to continuously illuminate for at least 15 seconds during the functional check (i.e., the “bulb check”) at key on, engine off (section 1968.2(d)(2.1.2)), which informs the operator or technician whether or not the MIL is functioning properly. When the requirement was first adopted, vehicles were using light bulbs for the MIL. Since then, instrument panel technology has evolved to where some vehicles now use liquid crystal display (LCD) screens, which may result in some delay in the illumination of the MIL symbol during the functional check due to the “boot up” time. To address these MILs, staff is proposing language that indicates that if there is a delay in MIL illumination for these LCD MILs, the delay may not exceed 5 seconds starting with the 2019 model year.

Staff is also proposing clarifying changes to the requirements for vehicles that enter a default or “limp home” mode of operation. The OBD II regulation currently requires the OBD II system to illuminate the MIL and store a fault code if the vehicle enters a default mode of operation that affects emissions or other OBD II monitors. If the default mode of operation is recoverable, the OBD II system may “delay illumination of the MIL” until the next driving cycle in which the vehicle again enters the default mode of operation. The current language, however, is not clear about what is required with fault code storage. Therefore, staff is proposing language clarifying that if the default mode of operation is not recoverable, the OBD II system would be required to store a pending fault code and a confirmed fault code in addition to illuminating the MIL. If the default mode of operation is recoverable, the OBD II system would be allowed to delay illuminating the MIL and storing a confirmed fault code until the next driving cycle in which the vehicle enters the default mode of operation.

Further, similar to what is allowed in the HD OBD regulation, staff is also proposing additional language that would exempt manufacturers from illuminating the MIL and storing a fault code if the vehicle enters a default mode of operation if certain criteria are met (section 1968.2(d)(2.6.1)). Specifically, MIL illumination and fault code storage would not be required if the default strategy meets all three of the following conditions: (1) it causes an overt indication such that the driver is certain to respond and have the problem corrected, (2) it is not caused by a component required to be monitored by the OBD II system under sections 1968.2(e) through (f), and (3) it is not invoked to protect a component required to be monitored by the OBD II system under sections 1968.2(e) through (f). Further, manufacturers would also not be required to illuminate the MIL or store a fault code if the default strategy is an auxiliary emission control device that is properly activated due to the occurrence of conditions that have been approved by ARB. Manufacturers have argued that conditions (2) and (3) (specifically the inclusion of components covered under the comprehensive component monitoring requirements) would preclude them from allowing any component to be exempt from illuminating the MIL and storing a fault code under the proposal. Specifically, they indicated that components that malfunction and consequently activate a default mode of operation that affects emissions or other OBD II monitors would be required to be monitored under the comprehensive components section, and thus would not be able to meet condition (2) or (3). Staff, however, disagrees that such components would be covered under the comprehensive component monitoring requirements in all cases. If a component malfunctions but it does not adversely affect emissions or other OBD II monitors, it is not required to be monitored as a comprehensive component regardless of whether or not it activates a default mode of operation that does affect emissions or other OBD II monitors.

Staff is also proposing clarifying language to the freeze frame storage and erasure protocol. Currently, the OBD II regulation requires only one set of freeze frame information to be stored (in accordance with section 1968.2(g)(4.3.4)). Although the existing regulation indicates that freeze frame information for gasoline and diesel misfire and fuel system faults can replace currently stored freeze frame information, it does not clearly specify whether freeze frame information for any other fault can replace currently stored freeze frame information. Thus, staff is including language (in section 1968.2(d)(2.2.7)) to clarify that if freeze frame conditions are currently stored for a fault, the manufacturer may not replace the stored freeze frame conditions with those of a subsequently detected fault unless the subsequently detected fault is a misfire or fuel system fault.

Staff is also proposing amendments to the extinguishing protocol for the MIL and the erasure protocol for confirmed fault codes. The OBD II regulation currently states that the MIL “may” be extinguished after three subsequent sequential driving cycles in which the monitor responsible for illuminating the MIL determined that the malfunction is no longer present. Because this language may be misinterpreted, staff is proposing to clarify this language to state that an OBD II system “shall,” not “may,” extinguish the MIL after “at least” three of the aforementioned driving cycles. The amendment therefore clarifies that an OBD II system may not extinguish the MIL unless the OBD II system has determined the malfunction is no longer present during a minimum of three subsequent sequential driving cycles. However, manufacturers may elect to design OBD II systems that extinguish MILs if malfunctions are not detected during more than three subsequent sequential driving cycles. Staff believes that unnecessarily keeping a MIL illuminated is unwarranted, especially after an OBD II system has determined the malfunction is no longer present over three separate driving cycles, and given the likelihood of unduly worrying vehicle owners and confusing technicians attempting to repair transitory malfunctions.   Staff is therefore proposing that starting with the 2019 model year, OBD II systems would be required to extinguish the MIL after the three aforementioned driving cycles are met, not "after at least" three driving cycles. This would ensure consistency among manufacturers in the timing of extinguishing the MIL for each monitor.

For confirmed fault codes, the OBD II regulation currently states that an OBD II system "may" erase a confirmed fault code if the fault is not subsequently detected "in at least" 40 warm-up cycles" and the MIL is not presently illuminated for that fault. This requirement presents similar concerns as those discussed above relating to extinguishing the MIL, and the existing language may be misinterpreted with the use of the term "may," even though the intent was that manufacturers are not allowed to erase the confirmed fault code sooner than 40 warm-up cycles. Staff is also aware of instances where OBD II systems unnecessarily store confirmed fault codes over extended periods of time, including a few manufacturers' OBD II systems that store confirmed fault codes forever, which provides no benefit and may cause confusion and issues in the field. To address this issue and to also ensure consistency among manufacturers, staff originally proposed that OBD II systems be required to erase a confirmed fault code if the malfunction was not again detected in 40 consecutive warm-up cycles and the MIL is not presently illuminated for that malfunction – thus OBD II systems would be required to erase a confirmed fault code at the end of that 40th warm-up cycle. Manufacturers however, requested that OBD II systems be allowed to erase a subset of confirmed fault codes (e.g., all confirmed fault codes within a control module) at the same time instead of erasing each confirmed fault code individually. They indicated that some control modules do not have enough memory to keep track of each individual fault code, so they would need new control modules to comply with staff's proposal. Staff's intent in proposing these amendments was to prevent manufacturers from erasing confirmed fault codes too soon and too late. So based on these discussions, staff is proposing language requiring that the OBD II system erase the confirmed fault code (1) no sooner than the end of the driving cycle in which the identified malfunction has not been again detected in at least 40 consecutive warm-up cycles and the MIL is presently not illuminated for that malfunction, and (2) no later than the end of the driving cycle in which no malfunction has been detected in 41 consecutive warm-up cycles and the MIL is presently not illuminated for any malfunction. For example, if there is only one confirmed fault code, an OBD II system could erase the confirmed fault code anytime between the end of the 40th warm-up cycle meeting condition (1) and the end of the 41st warm-up cycle meeting condition (2). Thus, vehicles that power off the engine control module at the end of a driving cycle and thus cannot erase the permanent fault code at the end of the 40th warm-up cycle could erase the permanent fault code at the start of the next (i.e., 41st) warm-up cycle. This amendment, which would apply starting with the 2019 model year, would allow OBD II systems to erase individual confirmed fault codes or erase a subset of confirmed fault codes at the same time, and would help ensure that repair technicians focus on recently detected faults and are not misled or distracted by troubleshooting faults that have long since disappeared.

Finally, staff is proposing amendments to the erasure protocol for permanent fault codes in the event the fault information in the on-board computer has been cleared (through the use of a scan tool or battery disconnect). Currently, monitors required to meet a minimum acceptable in-use monitor performance ratio (i.e., that are “subject to the minimum ratio requirements of section 1968.2(d)(3.2)”) are required to erase a permanent fault code if the monitor ran and passed without any indication of a malfunction. Those monitors that are not subject to the minimum ratio requirements of section 1968.2(d)(3.2) are required to erase a permanent fault code if the monitor has run and passed without any indication of a malfunction and the criteria similar to those for a general denominator of section 1968.2(d)(4.3.2)(B) have been satisfied (with the exception that the general denominator conditions require ambient temperatures above 20 degrees Fahrenheit or below 8000 feet in elevation). The latter requirement was aimed at monitors that are required to run continuously such as the gasoline misfire and fuel systems monitors, and are thus “not subject to the minimum ratio requirements of section 1968.2(d)(3.2).” Staff, however, inadvertently overlooked the fact that the engine cooling system thermostat monitor and engine coolant temperature (ECT) sensor “time to closed-loop” monitor are also not subject to the minimum ratio requirements, even though they are not continuous monitors. Thus, staff is proposing amendments to clarify that the thermostat monitor and ECT sensor “time to closed-loop” monitors are also required to erase the permanent fault code only if the monitor ran and passed without any indication of a malfunction. Additionally, staff is proposing language clarifying that for vehicles in which multiple permanent fault codes are currently stored, the OBD II system shall erase a specific permanent fault code if the monitor for that specific fault code met the required criteria for erasure. In other words, the OBD II system may not wait until the monitors for “all” the stored permanent fault codes have met the required criteria before erasing any of the permanent fault codes. Staff is proposing this clarifying language to address manufacturer confusion regarding when to erase permanent fault codes and to prevent permanent fault codes from being stored longer than appropriate.

D. STANDARDIZED METHOD TO MEASURE REAL WORLD MONITORING PERFORMANCE

The OBD II regulation requires manufacturers to track OBD II system monitoring 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. It is important to note that the denominator is a measure of vehicle activity, not a measure of “monitoring opportunities.” The regulation requires manufacturers to design monitors that meet a minimum acceptable ratio. Currently, the OBD II regulation allows the in-use monitor performance data (e.g., numerators, denominators) to be stored in keep-alive memory (section 1968.2(g)(5.2.1)(B)), resulting in a potential loss of data during such events as a battery disconnect. Staff is therefore proposing to require the in-use monitor performance data to be stored in non-volatile random access memory (NVRAM) starting in the 2019 model year. The data could then only erase if the control module is reflashed or replaced. The reasoning behind this change is so that the ignition cycle counter (including the plug-in hybrid electric vehicle-specific ignition cycle counter) could be used in conjunction with the proposed new data stream parameters related to real-world vehicle and fuel usage. More details about this can be found in section II.G.4. “Data Stream Parameters.”

Tracking and reporting requirements

Staff is proposing changes to the tracking and reporting requirements. First, for OBD II systems with dedicated air-fuel ratio cylinder imbalance monitors (i.e., monitors specifically designed to detect air-fuel ratio cylinder imbalance faults), staff is proposing that such OBD II systems track and report the in-use monitor performance data of the monitor with a three-year phase-in starting in the 2019 model year. Staff has had concerns with the monitoring frequency of this monitor for many years and believes requiring the tracking and reporting of its in-use monitoring frequency would better assist staff in determining whether or not the monitor complies with the OBD II regulation.

Second, staff is proposing changes to the in-use performance tracking and reporting requirements for diesel NOx and PM sensor monitors. The regulation currently requires OBD II systems in medium-duty vehicles to track and report the diesel NOx/PM sensor “monitoring capability” monitors (section 1968.2(f)(5.2.2)(D)), which detect malfunctions when the sensor is no longer sufficient for use as an OBD II monitoring device. However, OBD II systems in light-duty vehicles are only required to track and report the diesel NOx/PM sensor performance monitors that are emission threshold-based (section 1968.2(f)(5.2.2)(A)). Staff is now proposing that OBD II systems in passenger cars, light-duty trucks, and MDPVs certified to a chassis dynamometer tailpipe emission standard also track and report the in-use monitoring performance data for the diesel NOx/PM sensor “monitoring capability” monitors starting in the 2019 model year. Many OBD II systems in these vehicles currently do not have emission threshold monitors for these sensors but are more likely to have “monitoring capability” monitors. Because NOx and PM sensors are essential to the monitoring of major aftertreatment emission control devices, OBD II systems need to ensure that these sensors are being sufficiently monitored in-use.

Finally, while the OBD II regulation currently lists the specific monitors that the OBD II system must track and report the in-use monitor performance data (section 1968.2(d)(3.2.2)), manufacturers have raised questions regarding whether OBD II systems must track the data for monitors that are not listed. While some of these monitors are subject to minimum required ratios and have specifications in the regulation on how to increment the associated denominators, the regulation does not require that the in-use monitor performance data for these monitors be tracked. Staff is therefore proposing amendments to clarify that for monitors not listed in section 1968.2(d)(3.2.2), the in-use monitor performance data are not required to be tracked. However, manufacturers may elect to track these monitors to ensure their OBD II systems are meeting the required minimum ratios.

<u>Gasoline positive crankcase ventilation (PCV) and diesel crankcase ventilation (CV) monitor in-use monitor performance ratios</u>
Staff is proposing to phase-in more stringent monitoring requirements that would require manufacturers to develop new monitors to detect more failure modes of the gasoline PCV and diesel CV systems by the 2025 model year. Details of the proposed monitoring requirements are discussed in section II.E.6. “Positive Crankcase Ventilation (PCV) Monitoring” and section II.F.7. “Diesel Crankcase Ventilation (CV) Monitoring.” In conjunction with these proposed changes, staff is proposing that these new monitors be required to meet an interim minimum acceptable in-use monitor performance ratio of 0.100 through the 2027 model year before transitioning to the final ratio of 0.336. This would provide an adequate interim period where manufacturers could collect data on the performance of the monitors and adjust the monitoring conditions accordingly based on feedback from the field. The lead time for complying with the final ratio should be more than adequate considering the considerable lead time already provided for implementing the monitor.

<u>General denominator</u>
Staff is proposing optional requirements for incrementing the general denominator. Currently, OBD II systems are required to increment the general denominator if the criteria under section 1968.2(d)(4.3.2)(B) are met for most vehicles. Hybrid vehicles, however, are required to increment the general denominator if another set of criteria (described under section 1968.2(d)(4.3.2)(K)) are met, with these criteria based on “propulsion system active time” and requiring at least 10 seconds of “fueled engine operation.” Some manufacturers have indicated that they want to use common software across their vehicle product lines, and have asked for the option to increment the general denominator for non-hybrid vehicles based on the criteria for hybrid vehicles. Since the general denominator numbers would generally be the same for non-hybrid vehicles using either set of incrementing criteria, staff is proposing language to allow manufacturers the option to increment the general denominator using the criteria for hybrid vehicles under section 1968.2(d)(4.3.2)(K).

Staff is also proposing amendments to the general denominator (section 1968.2(d)(5.6)) that the OBD II system is required to output on plug-in hybrid electric vehicles. As described above, hybrid vehicles, including plug-in hybrid electric vehicles, are required to increment the general denominator based on criteria specified under section 1968.2(d)(4.3.2)(K), which includes the criterion requiring at least 10 seconds of fueled engine operation time. This denominator is also used for some of the monitors required to track and report in-use monitor performance data such as the catalyst monitor and oxygen sensor monitors. Staff is proposing that starting with the 2019 model year for plug-in hybrid electric vehicles, OBD II systems would be required to increment the general denominator based on criteria under section 1968.2(d)(4.3.2)(K) except for the criterion requiring the 10 seconds of fueled engine operation. This new general denominator definition for plug-in hybrid electric vehicles would allow staff to compare the vehicle activity reported through this denominator with the existing vehicle activity data from non-plug-in hybrid electric vehicles. Further, staff would also compare this new denominator definition with the current definition (engine fueling included) to determine how many drive cycles had all-electric operation (i.e., no engine fueling occurring on the drive cycle). It should be noted, however, that while the “general denominator” value will be based on these new criteria, the denominators for monitors such as the catalyst monitor and oxygen sensor monitors would still be incremented based on the current criteria (specifically, all the criteria under section 1968.2(d)(4.3.2)(K) including the 10-second fueled engine operation criterion). Therefore, the ratios for these monitors would still be determined based on the current denominator-incrementing criteria.

Other plug-in hybrid electric vehicle changes

Staff is proposing additional amendments to the in-use monitor performance requirements for plug-in hybrid electric vehicles. For these vehicles, the OBD II regulation currently requires a minimum in-use ratio of 0.100 up through the 2016 model year for monitors of components/system that require engine operation (e.g., catalyst, exhaust gas sensor). Manufacturers have requested that the 0.100 ratio be extended past the 2016 model year due to concerns about decreasing engine runtime in-use based on several factors, including increased availability of charging stations and improved hybrid battery performance on the vehicle. Staff is therefore extending the 0.100 ratio up through the 2019 model year.

Gasoline evaporative system “high-load purge flow” monitors

Staff is proposing amendments to the in-use monitor performance requirements for gasoline evaporative system monitors. Currently, the OBD II regulation requires an OBD II system to increment the denominator for the evaporative system monitors (including the purge flow monitors) if, among other criteria, specific cold start criteria are met. These requirements were set based on the general assumption that the evaporative system monitors were dependent on ambient conditions or cold starts for accurate detection of faults. As described in more detail below in section II.E.2. “Gasoline Evaporative System Monitoring,” frequent purge flow monitoring of the high pressure purge line on vehicles with boosted/turbocharged engines has proven difficult because these lines are generally only purged during aggressive driving conditions. Thus, high-load purge monitoring may not occur frequently in-use and consequently the in-use monitor performance ratios may be low.

Staff therefore proposed that the evaporative system “normal” purge flow monitor and the high-load purge flow monitor have separate numerators and denominators. Further, for the high-load purge flow monitor, staff initially proposed to remove the cold start criteria from the denominator and instead proposed that the high pressure purge monitor denominator increment if, in addition to the criteria of section 1968.2(d)(4.3.2)(B), high pressure purge is commanded to function 2 or more times for more than 2 seconds each time or for a time period of 10 or more cumulative seconds (i.e., based on the denominator criteria of section 1968.2(d)(4.3.2)(F)). Staff believed that requiring purge command conditions in lieu of cold start conditions would result in less incrementing of the denominator. Manufacturers have indicated however that they command purging of the high-load lines during various driving conditions, not just extreme driving conditions, and that freezing of the lines during very cold ambient conditions may prevent purging from occurring even though purging is still "commanded" to occur. Manufacturers are concerned that the denominator will increment more frequently than conditions under which high-load purging is actually occurring, thus possibly resulting in low in-use monitor performance ratios. To address these concerns, staff is proposing to require the denominator for the high-load purge flow monitor to increment if, in addition to the criteria of section 1968.2(d)(4.3.2)(B), the minimum high load purge activation conditions (i.e., conditions similar to section 1968.2(d)(4.3.2)(F)) are met and the ambient temperature is greater than 40 degrees Fahrenheit (newly proposed section 1968.2(d)(4.3.2)(M)). The high-load purge flow monitor would still be subject to a minimum in-use monitor performance ratio of 0.520 with this new denominator. To accommodate any design or calibration alterations that may be necessary to meet these changes, staff is proposing that all 2019 and subsequent model year gasoline vehicles comply with this requirement.

PM filter monitor

Staff is proposing amendments to the denominator incrementing criteria for the PM filter filtering performance and missing substrate monitors for light-duty diesel vehicles. The OBD II regulation currently requires these PM filter monitors to increment the denominator when, in addition to the general denominator criteria (specified in section 1968.2(d)(4.3.2)(B)), the cumulative miles of vehicle operation exceed 500 miles. Further, the OBD II regulation requires these monitors to meet a ratio of 0.336 starting in the 2013 model year.

The OBD II regulation was recently amended for medium-duty diesel vehicles certified to an engine dynamometer tailpipe emission standard. Specifically, the regulation now requires the denominators for the PM filter filtering performance and missing substrate monitors on these medium-duty vehicles to increment when the general denominator criteria are met in lieu of 500 miles of vehicle operation starting in the 2016 model year. Further, the OBD II regulation was also modified 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. These changes were made to address the improving monitoring strategies for the PM filter monitors. Past PM filter monitoring strategies were limited to running during a narrow window relative to a PM filter regeneration event, but such strategies raised concerns since 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 increasing significantly, leading to longer and longer intervals between monitoring events and considerable 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 amended the denominator incrementing criteria and the minimum required in-use ratios for medium-duty vehicles.

Staff is now proposing the same changes to apply to light-duty diesel vehicles (specifically passenger cars, light-duty trucks, and MDPVs certified to a chassis dynamometer tailpipe emission standard). Specifically, OBD II systems in these vehicles would be required to increment the PM filter filtering performance and missing substrate monitor denominators when the general denominator criteria are met in lieu of 500 miles of vehicle operation starting in the 2019 model year. Staff is also proposing to lower the required in-use ratio to 0.100 for the 2019 through 2021 model years for these vehicles.

Finally, staff is proposing amendments to clarify the in-use monitor performance requirements for PM filter monitors on medium-duty diesel vehicles certified to a chassis dynamometer tailpipe emission standard. The OBD II regulation currently describes these requirements (including minimum in-use ratio and denominator incrementing criteria) for light-duty vehicles and medium-duty diesel vehicles certified to an engine dynamometer tailpipe emission standard, but is not clear on which requirements applied to medium-duty diesel vehicles certified to a chassis dynamometer tailpipe emission standard. Since these medium-duty vehicles are required to meet the same PM filter monitoring requirements as light-duty vehicles (see section 1968.2(f)(17.1.6)), staff is proposing that these vehicles also meet the same in-use monitor performance requirements for the PM filter monitor as those of the light-duty vehicles.

Other monitor denominator incrementing criteria

Staff is proposing changes to the denominator incrementing requirements for certain monitors. Specifically, staff is proposing changes for engine cooling system input component (i.e., ECT sensor) and comprehensive component input component temperature sensor rationality monitors. OBD II systems must currently increment the denominators for these monitors based on manufacturer-proposed criteria that require ARB approval (section 1968.2(d)(4.3.2)(H)). In general, manufacturers have proposed incrementing the denominator using the cold start criteria specified for use with the evaporative system monitor denominator (section 1968.2(d)(4.3.2)(D) or (L), whichever is applicable). Because ARB has previously approved denominator incrementing criteria that are similar to the criteria for the evaporative system monitor, staff is proposing that the ECT sensors and comprehensive component input component temperature sensors use the same denominator incrementing criteria as the evaporative system monitor. For all vehicles except plug-in hybrid electric vehicles, OBD II systems would be required to use the denominator-incrementing criteria in section 1968.2(d)(4.3.2)(D) for these monitors with a three-year phase-in starting in the 2019 model year. For plug-in hybrid electric vehicles, OBD II systems would be required to use the denominator-incrementing criteria in section 1968.2(d)(4.3.2)(L) for these monitors on all 2019 and subsequent model year vehicles.

Staff is also proposing amendments to correct some oversights. First, the OBD II regulation presently allows monitors of "other emission control or source devices" to increment the denominator using two different set of criteria, one based on the component being commanded to function two or more times or for greater than 10 seconds (section 1968.2(d)(4.3.2)(F)) and the other based on alternate criteria proposed by the manufacturer (section 1968.2(d)(4.3.2)(H)). The proposed amendments would require manufacturers to increment the denominator for these monitors using alternate criteria proposed by the manufacturer under section 1968.2(d)(4.3.2)(H), which is the less stringent of two current options. Second, the OBD II regulation currently requires the diesel catalyzed PM filter feedgas generation monitor to increment the denominator based on the general denominator criteria. However, the denominator for the NMHC converting catalyst feedgas generation monitor is incremented based on the criteria of section 1968.2(d)(4.3.2)(G), which requires at least 500 cumulative miles of vehicle operation. Given that both these monitors are designed to detect feedgas generation malfunctions, staff believes they both should increment the denominators based on the same criteria, with the criteria under section 1968.2(d)(4.3.2)(G) being more appropriate. Thus, staff is proposing to require manufacturers to use the criteria in section 1968.2(d)(4.3.2)(G) to increment the PM filter feedgas generation monitor denominator on 2019 and subsequent model year vehicles.

Disablement of numerators and denominators

Staff is proposing to correct an error in the requirements to disable numerators and denominators. The OBD II regulation currently allows OBD II systems to disable incrementing of all numerators and denominators if a fault is detected of any component used to determine any of the criteria in sections 1968.2(d)(4.3.2)(B) through (D). The intent of this allowance is to disable incrementing of all numerators and denominators since the denominators for these monitors would generally be affected by the specified faults. However, staff now recognizes that faults that affect any of the criteria under sections 1968.2(d)(4.3.2)(C) and (D) should not apply to all monitors, since these specific criteria would only affect a limited number of monitors (e.g., secondary air system monitors and evaporative system monitors). Further, manufacturers may be using the criteria in section 1968.2(d)(4.3.2)(K) in lieu of those under section 1968.2(d)(4.3.2)(B), as allowed by the regulation. Staff is therefore proposing to amend the requirement to specify that disablement of all numerators and denominators is only allowed if a fault is detected of any component used to determine the criteria under either section 1968.2(d)(4.3.2)(B) or (d)(4.3.2)(K), whichever is applicable, starting in the 2019 model year.

The OBD II regulation currently does not allow OBD II systems to disable incrementing of numerators and denominators for a specific monitor if a fault of any component used to determine any denominator incrementing criteria for that specific monitor is detected (e.g., does not allow disablement of the numerators and denominators for the cold start emission reduction strategy monitor if a fault is detected of any component used to determine the criteria in section 1968.2(d)(4.3.2)(E)). Staff did not intend for manufacturers to continue incrementing these numerators and denominators if such a fault occurred, since the resulting data and ratios would not be representative of actual monitor performance in-use. Thus, staff is proposing to require manufacturers to disable incrementing of these numerators and denominators if such a fault occurred with a three-year phase-in starting in the 2019 model year.

Ignition cycle counter

Staff is also proposing changes to the requirements for the ignition cycle counters. Currently, the OBD II regulation requires OBD II systems in plug-in hybrid electric vehicles to report two ignition cycle counters while OBD II systems in all other vehicles are required to report only one ignition cycle counter. Manufacturers have asked for the option to report two counters on non-plug-in hybrid electric vehicles to allow the use of common software across their entire product line. Staff therefore is proposing to allow manufacturers the option of reporting two ignition cycle counters on vehicles that are not plug-in hybrid electric vehicles.

E. GASOLINE MONITORING REQUIREMENTS

1. GASOLINE MISFIRE MONITORING

Proposed amendments to the misfire monitoring criteria for plug-in hybrid electric vehicles are needed to ensure misfire faults are detected in a timely manner. The regulation currently requires OBD II systems to detect a misfire fault if the misfire exceeds the malfunction threshold during the first 1000 revolution period or when the misfire exceeds the threshold during four subsequent 1000 revolution periods. Plug-in hybrid electric vehicles generally operate over prolonged periods of battery-only operation and therefore are more likely to have difficulty getting sufficient engine operation to obtain enough 1000-revolution periods to detect misfire, which will result in untimely detection of misfire faults. Staff therefore proposes that OBD II systems in plug-in hybrid electric vehicles detect misfire faults if misfire exceeds the malfunction threshold during any one 1000 cumulative revolution period.

Staff is also proposing to amend the misfire monitor malfunction criteria for plug-in hybrid electric vehicles. OBD II systems are currently required to detect misfire before emissions exceed a specific emission threshold level (i.e., 1.5 times the applicable standards). To address potential concerns that may result from the proposed reduction of the required 1000-revolution periods for malfunction detection and as part of staff's efforts to streamline requirements in the regulation, staff is proposing to require the same misfire monitor malfunction threshold for all plug-in hybrid electric vehicles. Specifically, staff is proposing a single misfire malfunction criteria target based on a percentage of misfire detected, which is a more straightforward emission calibration exercise for the manufacturers than establishing a misfire threshold based on calibrating misfire rate to exceedance of emissions threshold levels. To determine the proposed malfunction criteria, staff evaluated the misfire thresholds currently used by manufacturers of plug-in hybrid electric vehicles and found that the vast majority were in the range of 1 to 2 percent of misfire detected. Based on these data, staff is proposing that in lieu of an emission threshold-based malfunction criteria, manufacturers are required to detect a fault when the percentage of misfire exceeds 2 percent during any one 1000 cumulative revolution period. Manufacturers would be allowed to use a misfire percentage threshold greater than 2 percent provided emissions do not exceed specific emission thresholds. Finally, this requirement would apply to all 2019 and subsequent model year plug-in hybrid electric vehicles, although manufacturers may elect to implement this requirement prior to the 2019 model year.

Staff is also proposing to clarify existing misfire monitoring requirements for all gasoline vehicles. A previous ARB mail-out (Mail-Out #95-20, "Guidelines for Compliance with On-Board Diagnostic II (OBD II) Requirements," May 22, 1995), allowed the OBD II system to detect a misfire malfunction for situations that are caused by a single component failure for multiple cylinder misfire situations that result in a misfire rate greater than or equal to 50 percent of all engine firings. Staff determined that this allowance should also be mentioned in the OBD II regulation and is thus proposing to include this allowance in the gasoline misfire monitoring requirements.

Staff is also proposing amendments to provisions applicable to hybrid vehicles. For vehicles that employ engine shutoff strategies that do not require the vehicle operator to restart the engine to continue driving, the OBD II regulation currently requires manufacturers of these vehicles to request and obtain approval from ARB of the monitoring conditions under which misfire monitoring would first enable (after the initial start) and re-enable after each engine shutoff period. To provide clarification to manufacturers, staff proposes adding language to specify that vehicles employing engine shutoff strategies include vehicles that utilize a start-stop system.
Staff has also determined that misfire monitoring for hybrid vehicles should be re-enabled after engine shutoff periods within time periods that are similar to those applicable to non-hybrid vehicles after engine start. Thus, for 2019 and subsequent model year hybrid vehicles, OBD II systems would be required to enable the misfire monitor from no later than the end of the second crankshaft revolution after engine fueling and re-enable the misfire monitor no later than the end of the second crankshaft revolution after each time fueling resumes, which also would align with the gasoline misfire requirement in the HD OBD regulation.

2. GASOLINE EVAPORATIVE SYSTEM MONITORING

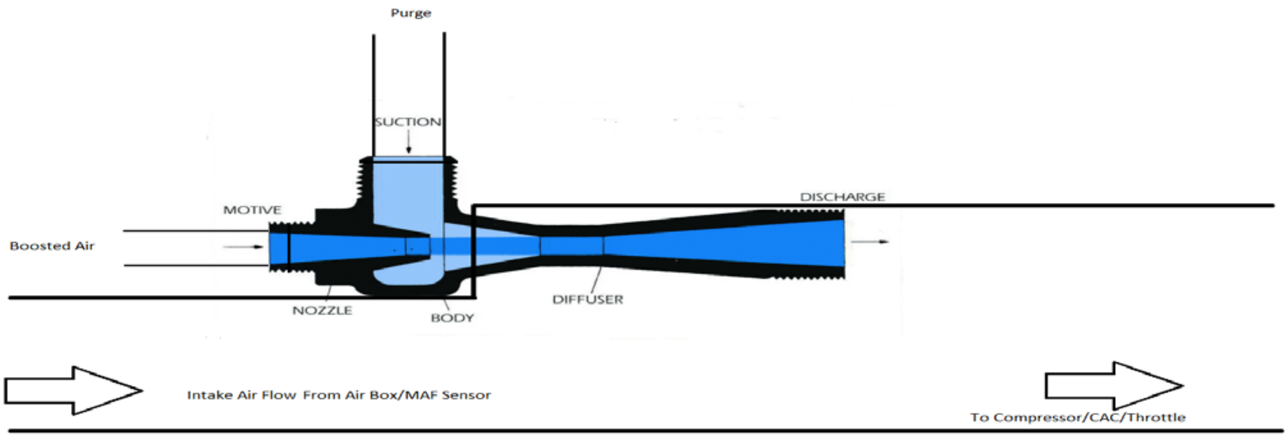
<u>Evaporative system purge flow monitoring requirements</u>
OBD II systems are currently required to verify purge flow to the engine on all evaporative system purge flow paths. Many engines include at least two purge flow paths to the engine, a path for low-load engine operation (i.e., lines for purging the evaporative system canister under conditions where the intake manifold pressure is less than ambient pressure) and a path for high-load engine operation (i.e., lines for purging the evaporative system canister under conditions where the intake manifold pressure is greater than ambient pressure). The most common examples are turbocharged

engines that have multiple purge lines to enable purging under both low and high intake manifold pressure conditions.

Manufacturers have encountered difficulties in designing robust monitoring strategies for the high-load purge lines. Some of these lines are not added to meet the evaporative emission standards but rather to ensure purging and control of evaporative emissions under extreme driving conditions, such as conditions in excess of the US06 cycle. Since monitors must be designed to operate during these extreme driving conditions to ensure the system is purging as designed, frequent robust monitoring is a challenge and can also lead to problems like erasing permanent fault codes, since the vehicle would need to be driven during those same extreme driving conditions in order for the monitor to encounter the same monitoring conditions.

In addition to the complications associated with the monitoring frequency of the high-load purge lines, these lines often have failure modes that can cause excessive evaporative emissions by drawing vapors out of the system into the atmosphere. For example, a typical design of the high-load purge line on a turbocharged engine includes an ejector to pull the purge vapors into the intake system upstream of the turbocharger (Figure 1). Disconnections between the ejector and the fresh air intake, can result in high emissions, and can be especially difficult to monitor. ARB staff has currently allowed some ejector designs that are directly mounted to the fresh air intake system to be exempt from monitoring the purge flow through the high-load purge line. Specifically, ARB has been exempting OBD II systems from monitoring the high-load purge path for ejector designs that were shown to be resistant to failure or breakage since portions of the ejector that are between the pressure sensor and the intake air system are difficult to monitor for purge flow delivery to the engine. However, this allowance requires ARB staff to conduct a design review of the system and can increase staff's review time. This allowance also requires staff to predict the failure modes of a design and specify testing requirements to prove the robustness of the design. Additionally, since the actual high-load purge system components are often required for evaluation, a manufacturer has to fabricate a part that is as representative as possible to a production part for staff to evaluate. All of these steps tend to prolong the OBD II approval process for high-load purge systems and may not result in equivalent performance among manufacturers. Further, vehicles with turbocharged engines are expected to increase substantially in the upcoming years with the implementation of the Advanced Clean Car program. Thus, ARB considered ways to modify the OBD II requirements to effectively address the issues described above.

Figure 1 - Ejector design located inside the intake air system



Staff is proposing amendments that would ensure OBD II systems adequately monitor evaporative systems that have gross high-load purge emissions (such as low-powered boosted engines that are frequently boosted under FTP operating conditions) and that would help streamline the OBD II review process. Specifically, staff is proposing to sunset approval of high-load purge system designs that do not monitor the delivery of high-load purge flow delivery to the engine (i.e., to the enclosed area of the air intake system) for all high-load purge delivery paths but instead rely on robust designs for portions of the system that are unmonitored. Starting in the 2019 model year, manufacturers would be required to implement performance-based monitors for high-load purge lines on forced-induction engines. For 20 percent of 2019 model year gasoline vehicles, 50 percent of 2020 model year gasoline vehicles, and 100 percent of 2021 model year gasoline vehicles, OBD II systems would be required to detect evaporative system malfunctions when no purge flow can be detected from the evaporative system through the high-load purge delivery paths to the engine when high load purge flow is expected.

For vehicles that are not included in the performance-based monitoring phase-in described above, manufacturers may request Executive Officer approval of a monitoring strategy that cannot detect all blockages, disconnections, or broken lines. Approval would be granted based upon manufacturers submitting data and/or engineering evaluation that demonstrates the following factors: the unmonitored portion is small compared to the fully monitored portion, leak detection for the unmonitored portion of the high-load purge lines cannot be fully achieved when employing proven monitoring technology (i.e., a technology that provides for compliance with these requirements on other engines), and the high-load purge system design is inherently resistant to deterioration (e.g., breakage, disconnections, blockage) of the unmonitored portions of the purge lines.

For certain vehicles (e.g., high performance vehicles with high power-to-weight ratios) that utilize the high-load purge lines primarily to ensure purging under extreme operating conditions (e.g., speeds and accelerations that are in excess of the driving conditions on the US06 cycle), staff is proposing to exempt OBD II systems from monitoring such high-load purge lines. Specifically, staff is proposing to specify a test-out criterion that would exempt OBD II systems from monitoring purge lines that are not expected to be exercised frequently in use. OBD II systems in vehicles with high-load purge mass flow less than 1 percent of the total purge mass flow on the US06 cycle and 0 percent of the total purge mass flow on the Unified cycle would be exempted from monitoring the high-load purge lines. For purposes of determining eligibility for the exemption, the high-load purge mass flow measurement only includes the actual high-load purge mass flow and not the mass flow from the boosted air from the intake manifold for systems (e.g., on systems that utilize ejectors to deliver the high-load purge mass to the engine).

Staff believes that the proposed overall purge system monitoring requirements are technically feasible by the proposed compliance time frames. Several manufacturers already monitor the high-load purge flow by either utilizing existing sensors (e.g., mass air flow sensor, fuel tank pressure sensor) or redesigning the high-load purge system so that the unmonitored portion is internal to the intake air system (i.e., disconnections and broken lines will not result in emissions escaping into the atmosphere) such that disconnections of the unmonitored portion will result in the high-load purge mass being delivered to the engine.

As previously mentioned, a common high-load purge system design typically utilizes an ejector to deliver the high-load purge flow to the engine (Figure 1). Current OBD II systems can generally monitor all portions of high-load purge lines for disconnections or blockages except for the portions of the high-load purge line downstream of the venturi. For the example shown in Figure 1, the venturi portion of the ejector is located internal to the intake air system such that a disconnection or broken line downstream of the venturi does not have to be detected by the OBD II system because the high-load purge flow has already been delivered to the engine.

While manufacturers would not be required to utilize the internal design option, manufacturers that currently have a monitoring exemption of an external high-load purge path would need to either modify their system design to make the unmonitored portion internal to the intake air system or monitor all of the high-load purge lines upstream from the engine (i.e., between the purge valve and the fresh air intake system). For manufacturers that choose to redesign the intake air system to accommodate the internal ejector, staff believes the proposed 2019-2021 model year phase-in provides enough lead time to accomplish this.

Staff is also proposing changes to the in-use monitor performance criteria for the high-load purge monitor to address the monitoring frequency issues described above. These proposed changes are discussed in section II.D. “Standardized Method to Measure Real World Monitoring Performance” above.

<u>Other evaporative system monitoring requirements</u>

The OBD II regulation currently exempts vehicles from evaporative system monitoring requirements if they are not required to be equipped with evaporative emission systems. Technically, ARB regulations do not require vehicles to be equipped with components and systems to control evaporative emissions, but they do delineate which vehicles and engines are subject to evaporative emission standards. Staff is proposing amendments to clarify that vehicles are exempted from OBD evaporative system monitoring requirements if such vehicles are not subject to evaporative emission standards. For example, under current regulations compressed natural gas (CNG) vehicles are not subject to evaporative emission standards but liquid propane gas (LPG) vehicles are subject to the standards. The amendment would clarify that evaporative system monitoring is required for LPG vehicles, irrespective of whether the manufacturer claims it has or has not equipped the vehicle with an evaporative emission system. In the future, ARB may implement evaporative emissions standards for CNG vehicles due to the growing concern over the greenhouse gas impacts of methane. If such regulatory actions occur, the proposed OBD regulatory changes make it clear that evaporative system monitoring requirements would apply to these vehicles as well. Staff is also proposing language to clarify that manufacturers of alternate-fueled vehicles that are subject to evaporative emission standards are required to submit a plan for Executive Officer approval regarding proposed evaporative system monitoring strategies and their equivalence to the evaporative system monitoring requirements for gasoline applications.

Staff is also proposing clarifications regarding a “complete evaporative system.” The OBD II systems are currently required to detect a fault if the “complete evaporative system” has a 0.040 inch leak or a 0.020 inch leak. Future vehicles may utilize much larger evaporative systems that consist of multiple fuel tanks, canisters, and/or purge valves that would increase the difficulty of detecting such leaks compared to existing evaporative systems. Staff is therefore proposing to allow manufacturers to request ARB approval to define multiple “complete evaporative systems” within a vehicle, provided that there are no shared vapor lines or paths between each complete system. Thus, the manufacturer would be required to detect a 0.040 inch leak and 0.020 inch leak in each of the “complete evaporative systems” instead of the entire evaporative system as a whole.

3. GASOLINE FUEL SYSTEM MONITORING

OBD II systems must currently monitor for and detect air-fuel ratio cylinder imbalance malfunctions before emissions exceed specific emission thresholds. Light-duty LEV II SULEVs are currently subject to an interim threshold of 4.0 times the standards and must meet a final threshold of 2.5 times the standards by the 2014 model year, while all other vehicle categories are subject to an interim threshold of 3.0 times the standards and must meet a final threshold of 1.5 times the standards by the 2014 model year. Some manufacturers have expressed concerns about meeting these current requirements, given the large decrease between the interim and the final thresholds and in light of the mandatory recall criteria in the OBD II enforcement regulation (title 13, CCR section 1968.5). Specifically, vehicles are subject to mandatory recall if the monitor cannot detect a fault before emissions exceed twice the required malfunction criteria (e.g., if the malfunction criteria is 1.5 times the standards, recall would be required if a fault is not detected before emissions exceed 3.0 times the standards). Further, the OBD II regulation (section 1968.2(k)(1)) states that a vehicle may not be certified or granted a deficiency if any of the mandatory recall provisions are met. For example, if a monitor is only capable of detecting faults before emissions exceed 4.0 times the standards, the OBD II system could be certified with a deficiency based on the interim threshold of 3.0 times the standards. However, manufacturers would not be able to certify the same OBD II system having that same deficiency once the final threshold of 1.5 times is required because the monitor would now meet mandatory recall provisions (i.e., 4.0 times the standards is greater than twice the malfunction criteria of 1.5 times the standards). These manufacturers have indicated that they need to use new hardware to comply with the final emission malfunction thresholds and therefore need more lead time to meet the requirements.

In order to accommodate manufacturers' requests, staff is proposing amendments to the emission malfunction thresholds in the OBD II regulation and the mandatory recall criteria in the OBD II enforcement regulation for vehicles certified to the LEV II emission standards, as summarized below in Table 6. The amendments would delay the effective date of the final malfunction emission thresholds by one model year, from 2014 to 2015, and would allow vehicles that were previously certified to the interim thresholds in the 2011 through 2014 model years and carried over to the 2015 model year to continue using the interim thresholds for the 2015 model year only. Additionally, during the first two years that the final thresholds are required (i.e., the 2015 and 2016 model years), the mandatory recall criteria would be set at two times the level of the interim malfunction criteria –8.0 times the standard for light-duty LEV II SULEVs and 6.0 times the standards for all other vehicles.

Table 6: Proposed NMHC, NOx, and CO Monitor Thresholds/Recall Criteria for LEV II Vehicles

	2011	2012	2013	2014	2015	2016	2017+
Passenger Car/Light-Duty Truck SULEV	4.0x	4.0x	4.0x	4.0x	2.5x*	2.5x	2.5x
Recall Criteria	12.0x	12.0x	8.0x	8.0x	8.0x	8.0x	5.0x
All other	3.0x	3.0x	3.0x	3.0x	1.5x*	1.5x	1.5x
Recall Criteria	9.0x	9.0x	6.0x	6.0x	6.0x	6.0x	3.0x

* - may carryover 4.0x or 3.0x threshold if first certified vehicle in 2011-2014 model years

Staff is also proposing to amend the air-fuel ratio cylinder imbalance monitor requirements to address LEV III applications. Neither the currently specified emission malfunction thresholds nor the proposed amendments summarized above in Table 6 apply to LEV III applications, so the staff is proposing new malfunction emission thresholds to align with those proposed previously in section II.A. for LEV III vehicles. Manufacturers have requested higher emission malfunction thresholds for this monitor on some of the cleaner LEV III vehicles, indicating that changes to the emission control system structures needed to meet the LEV III standards may increase the difficulty of detecting faults at lower emission thresholds. For example, manufacturers using the air-fuel ratio sensor to detect air-fuel ratio cylinder imbalance faults have stated that changing the placement of the catalyst after the engine could adversely affect the optimal placement of the air-fuel ratio sensor, thereby weakening the sensor's signal and decreasing its ability to detect cylinder imbalance faults at lower emission levels. Manufacturers have therefore requested higher thresholds than those discussed in section II.A. for LEV III ULEV70, ULEV50, SULEV30, and SULEV20 vehicles.

Although staff believes that existing information does not justify establishing a higher threshold indefinitely, staff nevertheless believes that some relaxations are needed to address these potential issues, and that higher interim thresholds for the cleaner LEV III vehicles would provide manufacturers sufficient time to thoroughly investigate if such issues do exist and to make any necessary changes to the monitors to meet the final thresholds. For LEV III LEV 160, ULEV 125, and medium-duty vehicles, staff is proposing thresholds analogous to those proposed for non-light-duty LEV II SULEV vehicles above, with the final thresholds effective in the 2015 model year. For LEV III ULEV70, ULEV50, SULEV30, and SULEV20 vehicles, staff's proposal would include higher interim emission thresholds for the first few years before the final thresholds are required starting in the 2019 model year. Staff is also proposing higher mandatory recall criteria for the first few years that the final monitor thresholds are required for the LEV III ULEV70, ULEV50, SULEV30, and SULEV20 vehicles. The proposed NMHC+NOx and CO monitor thresholds and mandatory recall criteria are presented below in Table 7. PM thresholds would be required starting in the 2019 model year and would be set at the PM emission thresholds specified in Table 1 in section II.A. (e.g., 1.5

times the PM standard or 17.5 mg/mi PM). Staff is also proposing that the mandatory recall criteria for the PM thresholds be the same as currently required in the OBD II enforcement regulation – specifically, twice the PM malfunction criteria (e.g., 3.0 times the PM standard or 35 mg/mi PM).

Table 7: Proposed NMHC+NOx and CO Monitor Thresholds/Recall Criteria for LEV III Vehicles

	2014	2015-2018	2019-2022	2023+
LEV160	3.0x	1.5x	1.5x	1.5x
ULEV125	3.0x	1.5x	1.5x	1.5x
Recall Criteria	6.0x	3.0x	3.0x	3.0x
ULEV70	3.0x	3.0x	2.0xNMHC+NOx 1.5xCO	2.0xNMHC+NOx 1.5xCO
ULEV50	3.0x	3.0x	2.0xNMHC+NOx 1.5xCO	2.0xNMHC+NOx 1.5xCO
Recall Criteria	6.0x	6.0x	6.0x	twice the malfunction criteria
SULEV30	4.0x	4.0x	2.5x	2.5x
SULEV20	4.0x	4.0x	2.5x	2.5x
Recall Criteria	8.0x	8.0x	8.0x	5.0x
Medium-Duty Vehicles	3.0x	1.5x	1.5x	1.5x
Recall Criteria	6.0x	3.0x	3.0x	3.0x

Staff is also proposing to clarify the calibration requirements for the air-fuel ratio cylinder imbalance monitor. Manufacturers have requested clarification on whether the air-fuel ratio cylinder imbalance monitor must be calibrated based on a fault in one cylinder or more than one cylinder. Requiring manufacturers to calibrate this monitor based on faults in more than one cylinder would require extensive effort, especially considering the multiple combinations of cylinders that manufacturers would need to consider. Therefore, staff is proposing to clarify that manufacturers need to calibrate the air-fuel ratio cylinder imbalance monitor using a fault that affects only a single cylinder.

The OBD II regulation currently specifically allows manufacturers to adjust the criteria and/or limit(s) to compensate for changes in altitude, for temporary introduction of large amounts of purge vapor, or other operating conditions when they occur. Staff is proposing to delete this provision as it is now unnecessary given staff's proposal to amend the monitoring conditions to allow manufacturers to disable fuel system monitoring during conditions that do not ensure robust detection of malfunctions (section 1968.2(e)(6.3.5)).

Staff is also proposing to amend monitoring requirements for engines that employ engine shutoff strategies (e.g., hybrid vehicles that shut off the engine at idle). The OBD II regulation currently requires OBD II systems to detect fuel system malfunctions if the fuel control system does not enter closed-loop operation within a certain time after engine start, but does not specifically address engines that employ engine shutoff strategies that can restart the engine multiple times within a single driving cycle. In order to ensure that engines employing shutoff strategies re-enter closed-loop operation within appropriate times, staff is proposing to require OBD II systems detect fuel system malfunctions for these engines if the fuel systems do not enter closed-loop operation within a certain time after every engine restart.

Staff is further proposing to amend the requirements for fuel system monitoring conditions. The OBD II regulation currently requires OBD II systems to continuously monitor for all fuel system malfunctions, except for air-fuel ratio cylinder imbalance faults. However, this continuous monitoring requirement should not apply to circumstances where a fuel system fails to enter closed-loop within an appropriate time after engine start or, for engines that employ engine shutoff strategies, after every engine restart. Thus, staff is proposing modifications that would require OBD II systems to monitor for these faults either once per driving cycle or, for engines using engine shutoff strategies, multiple times per driving cycle.

4. GASOLINE EXHAUST GAS SENSOR MONITORING

Staff is proposing to add a new requirement that OBD II systems detect a secondary oxygen sensor fault that causes the fuel system to stop using the sensor as a feedback input (e.g., causes open-loop operation), considering these sensors are critical to maintain secondary feedback control. The HD OBD regulation currently has an analogous requirement for gasoline engines. While the OBD II regulation currently requires OBD II systems to monitor fuel systems for secondary feedback control faults that cause emissions to exceed specific emission malfunction threshold levels, it does not specifically require monitoring of secondary oxygen sensors for faults that affect secondary feedback control. The proposed requirement would require continuous monitoring of these secondary oxygen sensor faults starting in the 2019 model year.

Staff is also proposing specific language clarifying the fault code storage requirements for exhaust gas sensor faults. The regulation (specifically section 1968.2(g)(4.4.2)) currently requires OBD II systems to store a fault code that “pinpoints the likely cause of the malfunction,” to the extent feasible. Staff has determined that some OBD II systems have been storing a single fault code to represent all out-of-range and circuit malfunctions (e.g., out-of-range low, out-of-range high, open circuit), even if the OBD II system is able to separately identify each specific failure mode. Therefore, staff is proposing language clarifying that OBD II systems must store unique fault codes for each distinct malfunction unless the circuit fault cannot be distinguished from an out-of-range fault.

Manufacturers, however, have expressed concerns regarding the level of pinpointing that would be required for exhaust gas sensors that have a separate control unit and sensor unit connected by multiple wires. The current OBD II regulation requires separate fault codes for each failure mode of each connecting wire, even though all elements of the sensor are permanently attached to each other and the sensor is uniquely calibrated to the controller. Manufacturers have also stated that the only proper repair action in the field is to replace the exhaust gas sensor in its entirety and have therefore requested reduced pinpointing requirements, similar to those being proposed for smart devices (explained in section II.E.11. “Gasoline Comprehensive Component Monitoring”). To address manufacturers’ concerns, staff is proposing to exempt OBD II systems from storing different fault codes for lack of circuit continuity and out-of-range faults for exhaust gas sensors if: (1) the sensing element (i.e., probe or sensor externally connected to the sensor control module) is a subcomponent integral to the function of the complete sensor unit; (2) the sensing element is permanently attached to the sensor control module with wires or one-time connectors; (3) the complete sensor unit is designed, manufactured, installed, and serviced per manufacturer published procedures as a single component; and (4) the sensor control module and sensing element are calibrated together during the manufacturing process such that neither can be properly individually replaced in a repair scenario.

5. GASOLINE EXHAUST GAS RECIRCULATION (EGR) SYSTEM MONITORING

OBD II systems are currently required to detect an EGR system fault before an increase or decrease from the manufacturer-specified EGR flow rate causes emissions to exceed 1.5 times the applicable standards. Currently, if no fault of the EGR system will cause emissions to exceed this level, OBD II systems must detect a fault if there is no detectable amount of EGR flow.

Staff believes that the monitoring requirements should completely cover all faults of the EGR system and be consistent with the requirements for other component/system monitors. Additionally, staff has identified needed clarifications to account for feedback controlled and non-feedback controlled EGR systems. Therefore, staff is proposing a new requirement to require OBD II systems to add a functional check for EGR high flow faults. Specifically, if a fault that causes an increase in EGR flow can never cause emissions to exceed the emission malfunction thresholds, OBD II systems would be required to detect when the EGR system has reached its control limits such that it cannot reduce the EGR flow on feedback controlled systems, or when the EGR system has maximum detectable EGR flow when little or no flow is expected for non-feedback controlled systems. This proposed requirement would be required with a three-year phase-in starting in the 2019 model year.

Staff further proposes amendments to clarify the functional check criteria for EGR low flow faults to account for feedback controlled and non-feedback controlled EGR systems. Specifically, if a fault that causes a decrease in EGR flow can never cause emissions to exceed the emission malfunction thresholds, manufacturers would be required to detect a fault when there is no detectable amount of EGR flow when EGR flow is expected for non-feedback controlled systems, or when the EGR system has reached its control limits such that it cannot increase the EGR flow to achieve the commanded flow rate for feedback controlled systems.

6. GASOLINE POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM MONITORING

The OBD II regulation currently requires OBD II systems to detect disconnections in the PCV system between the crankcase and the intake manifold on the PCV valve side of the system. Most OBD II systems utilize existing monitors such as the fuel system monitors or idle system monitors to detect disconnections of the PCV system between the PCV valve and the intake manifold. Detecting disconnections between the PCV valve and the crankcase (e.g., between the PCV valve and the fresh air intake) is generally significantly more difficult for most vehicles without the addition of hardware such as pressure sensors, and the OBD II regulation therefore does not require OBD II systems to detect this type of disconnection if the PCV system is designed in a way that is resistant to deterioration or accidental disconnections and makes technicians more likely to disconnect the hose or hoses between the PCV valve and the intake manifold.

Staff has identified a few issues with the existing PCV monitoring requirements. First, some of the hoses used in existing PCV systems have exhibited durability issues that have not been detected by existing OBD II systems, because the existing monitoring requirements are primarily focused on monitoring of connections and not on monitoring overall system integrity. Second, the existing criteria that exempt OBD II systems from monitoring disconnections if robust connections are used do not detect malfunctions in the PCV lines themselves, and may hinder repairs of the PCV system because the connections cannot be removed without specialized tools and/or damaging the connections. Finally, the exemption criteria requires an evaluation by staff of large amounts of information, which often leads to protracted discussions with manufacturers during design reviews and certification and increases the time staff needs to evaluate and approve OBD II systems.

To address these issues, staff is proposing that OBD II systems monitor PCV systems for proper performance. OBD II systems would be required to detect any disconnections of any hose, tube, or line that transports crankcase vapors or any leaks in such hoses, tubes or lines that are equal to or greater than the smallest internal cross-sectional area of that hose, tube, or line. Additionally, leaks that result in rapid oil loss, engine stall, or other overt conditions of a problem that is certain to be repaired would be exempted from monitoring. No changes are being proposed to the existing allowance that allows PCV system designs that are completely internal to the engine (with no external tubing or hoses) to be exempt from the leak monitoring requirement. Exemptions from monitoring the PCV lines would also be allowed for vehicles with dry-sump lubrication if robust monitoring of these lines cannot be conducted while utilizing proven monitors (i.e., a technology that provides for compliance with these requirements on other engines).

Similar to the delivery systems for the evaporative purge system, some engines such as forced induction engines include at least two PCV flow paths to the engine, one path for low-load/pressure engine operation and a different path for high-load/pressure engine operation (i.e., when intake manifold pressure is greater than ambient pressure due to boosted operation). For forced induction engines, high-load PCV lines would be exempted from the PCV performance monitoring requirements if manufacturers can demonstrate by providing data and/or an engineering evaluation that engine boost operation does not occur during the US06 cycle. Only extremely high-powered vehicles are expected to qualify for this monitoring exemption. Staff believes this is a reasonable exemption for several reasons. Since crankcase vapors only flow through the high-load PCV line under boost, the emissions impact of a disconnected high-load PCV line will be minimal under typical in-use operation conditions. Additionally, frequent monitoring is difficult at operating conditions more aggressive than the US06 cycle and can result in problems with erasing permanent fault codes should a fault be detected and repaired.

Some manufacturers have already added pressure sensors and/or algorithms to their current model year systems to detect disconnected lines, with some monitors capable of detecting a missing oil dipstick. With refinement, staff believes such approaches will be capable of leak detection anywhere in the system. To allow time for manufacturers to make these changes across their product lines, the proposal allows manufacturers to phase-in this requirement starting with the 2023 model year, with all 2025 and subsequent model year gasoline vehicles required to meet the requirement. Staff believes this lead time is appropriate because some engines may comply with the requirement by incorporating PCV passages into the base engine. The proposed lead time should provide all manufacturers sufficient time to incorporate these changes into future engines and OBD II systems.

7. GASOLINE ENGINE COOLING SYSTEM MONITORING

The OBD II regulation requires OBD II systems to monitor cooling systems, specifically the thermostat and the ECT sensor, for malfunctions that affect emissions or other diagnostics. Malfunctions resulting in improper engine temperature regulation may disable OBD II system diagnostics, reduce OBD II system monitoring frequency, and cause changes in engine and emission control operation, and increase vehicle emissions. Some manufacturers have recently utilized technologies other than the thermostat to regulate ECT on the vehicle. For example, an electric water pump can regulate the ECT by modulating the pump on or off to achieve the desired target regulating temperature. Further, variable speed electric water pumps may be modulated to turn the pump on or off and further to achieve more flow or less flow. Since the electric water pump can regulate the cooling system temperatures without the presence of a mechanical thermostat, staff is proposing language to clarify that manufacturers with such components/systems are required to submit a monitoring plan for review, with approval based on the monitoring plan being as effective as the monitors required for thermostat monitoring in the regulation.

Staff is also proposing amendments to the thermostat monitoring requirements. The OBD II regulation requires OBD II systems to detect thermostat malfunctions if any of the following occurs: (i) the 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. The OBD II regulation currently requires detection of these failures "within an Executive Officer approved time interval after starting the engine." Manufacturers have requested the use of a parameter that is not specifically a "time" parameter to detect the malfunctions, indicating that other engine parameters may be more useful in determining the time and driving characteristics before deciding if there is a thermostat malfunction. Thus, staff is proposing modifications that would allow manufacturers to detect a thermostat malfunction if a fault is detected within a "time-equivalent calculated value after starting the engine."

Staff is also proposing that OBD II systems in gasoline vehicles monitor for failures that cause the ECT to cool back down below diagnostic enablement temperatures after they have been reached (e.g. monitoring to ensure temperatures stay above thresholds after they are initially reached). This monitoring requirement already applies to the thermostats in diesel vehicles. In certain situations, an idling vehicle with a malfunctioning thermostat and low airflow across the engine bay can reach warmed-up temperatures and pass thermostat monitoring yet when the vehicle reaches higher speeds, additional cooling is introduced across the radiator and engine block, lowering the ECT below the temperature necessary for other OBD II diagnostics. This situation could effectively disable all diagnostics that require off-idle operation without being detected as a cooling system fault as well as cause an increase in emissions in some instances. The proposed revisions to the regulation include specific language identifying this malfunction and requiring monitoring with a three-year phase-in starting in the 2019 model year. As with other required thermostat monitors, manufacturers would have the ability to constrain monitoring to operating conditions where they can robustly determine if the system is passing or failing and exclude conditions (e.g., very cold temperatures, very low speed driving) where such decisions cannot be made.

Staff is also proposing clarifying language for thermostat monitoring conditions. Currently the regulation requires the 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. This language has caused confusion regarding when the thermostat monitor can be enabled on a given driving cycle. Staff is therefore proposing amendments to clarify when the thermostat monitor can be enabled. Specifically, manufacturers must disable the thermostat monitor on driving cycles where the ECT at engine 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 up the system by a few degrees. However, manufacturers would be able to request Executive Officer approval to enable the monitor if the ECT at engine 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.

8. GASOLINE COLD START EMISSION REDUCTION STRATEGY MONITORING

Cold start emission reduction strategies sometimes utilize components/elements (e.g., idle speed) that are also used when the cold start strategy is not active and required to be monitored elsewhere in the regulation (e.g., comprehensive component monitoring requirements). Staff is proposing language clarifying that OBD II systems are required 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). While the OBD II regulation currently requires storing of fault codes distinguishing different failure modes, staff believes this clarifying language is needed to avoid confusion and to prevent OBD II systems from using only one fault code/monitor to indicate both types of faults. This proposed language would also prevent the premature erasure of pending fault codes. If the cold start strategy monitor runs both when the cold start strategy is active and when it is not active, there may be cases where the cold start strategy monitor properly detects a cold start strategy fault and stores a pending fault code in one driving cycle, but then the monitor inappropriately passes on the next driving cycle during warmed-up conditions, thus erasing the pending fault code.

9. GASOLINE VARIABLE VALVE TIMING AND/OR CONTROL (VVT) SYSTEM MONITORING

The OBD II regulation currently requires monitoring of VVT systems for target error and slow response malfunctions, while the individual electronic components used in the VVT system are required to be monitored based on the comprehensive component monitoring requirements. Manufacturers have been confused about what systems constitute VVT systems, and some manufacturers have incorrectly determined that systems that only control valve lift or systems with discrete operating states (e.g., two-step valve train systems) are not considered VVT systems. Staff is therefore proposing to clarify that VVT systems include systems that can infinitely vary valve actuation as well as systems that can control valve lift to two or more discrete profiles (e.g., high lift and low lift). This clarification would be made by adding the term “lift” to the titles in sections 1968.2(e)(13) and (f)(13).

Manufacturers have also raised questions regarding the specific failure modes that OBD II systems must detect for target error and slow response malfunctions in VVT systems. Staff is therefore proposing amendments to specify the level of failure of a VVT system that an OBD II system must detect for target error and slow response malfunctions, and these amendments include examples of malfunctions such as a mechanical failure of a pin to move into the desired position on a lift mechanism or partial or complete blockage of hydraulic passages.

The OBD II regulation currently requires manufacturers to demonstrate that their OBD II systems can detect target error and slow response malfunctions prior to any failure or deterioration that would cause the vehicle's emissions to exceed an emission threshold. For infinitely varying valve actuation systems, it is possible to calibrate monitors to detect a target error and/or slow response malfunction prior to exceeding the threshold. However, for VVT systems with discrete operating states (e.g., two step valve train systems) where the system is either working or failed (e.g., stuck pin) with no possible failure mode in-between, the failures may be practically impossible to detect prior to emissions exceeding the threshold. Staff is therefore proposing to clarify that VVT systems with discrete operating states are not required to detect a malfunction prior to exceeding the threshold but are still required to detect all failures that exceed the threshold.

The OBD II regulation currently provides that if VVT system malfunctions do not cause emissions to exceed emission malfunction thresholds, OBD II systems are only required to monitor VVT systems for proper functional response in accordance with comprehensive component monitoring requirements. Staff is proposing to amend these provisions to clarify that only the electronic components of VVT systems are required to meet this functional monitoring requirement. Thus, hardware failures that do not cause emissions to exceed the emission malfunction threshold, even if there is an emission increase, are not required to be monitored for proper functional response.

10. GASOLINE DIRECT OZONE REDUCTION (DOR) MONITORING

The proposed amendments related to DOR monitoring are described in section II.A. “Emission Malfunction Thresholds for Low Emission Vehicle III (LEV III) Applications” above.

11. GASOLINE COMPREHENSIVE COMPONENT MONITORING

Emissions impact assessment

One of the most expansive components of the OBD II regulation requires comprehensive monitoring of all electronic powertrain components or systems that either can affect emissions during any reasonable in-use driving condition or are used as part of the OBD II diagnostic strategy for another monitored component or system. This includes input components such as sensors and output components or systems such as valves, actuators, and solenoids. The present regulation requires all components and systems with any effect, no matter how small, to be monitored by an OBD II system. If a manufacturer or ARB staff expects a component to have minimal impact on emissions, the current regulation requires the manufacturer to either monitor that component via an OBD II system or to expend potentially significant resources to demonstrate no effect on emissions in order to obtain an exemption from monitoring requirements. Multiple tests are often required to distinguish between components with very small emissions effects and normal test to test variability. Testing must also be conducted across multiple drive cycles to identify conditions where the component has maximum impact. These analyses are performed on a case-by-case basis and significant staff resources are often required to work with manufacturers to identify appropriate driving conditions and evaluate the test data.

Staff is therefore proposing amendments to limit the testing required to demonstrate that a fault will have a minimal effect on emissions. Specifically, staff proposes to limit the driving conditions to those drive cycles presently used to demonstrate tailpipe emission standards compliance and to determine that a component does not affect emissions if the following is less than 15 percent of the applicable standard: the difference between the mean of three or more emission measurements performed with a faulty component or system and the mean of three or more emission measurements without a malfunction. The test cycles on which the manufacturers would be required to confirm the emissions impact are the FTP test, 50°F FTP, HWFET, SC03, US06 cycle, and Unified cycle. For test cycles such as the Unified cycle that do not have tailpipe emission standards, the manufacturer would be required to compare the emissions impact with 15 percent of the SFTP Composite Emission Standard. Fault detection and MIL illumination would not be required for components that meet these criteria. Components that are not activated or used on the standard cycles would still require joint evaluation by staff and the manufacturer to select suitable test conditions. This proposed exemption from monitoring requirements would not apply to components and systems used as part of the diagnostic strategy for another monitored component.

ARB staff has generally evaluated manufacturer requests to exempt components from OBD II monitoring requirements on a case-by-case basis, which is highly resource intensive. The proposed amendments would provide for more uniformity, clarity, and efficiency in how these systems should be handled and would require manufacturers to disclose in applications for certification all comprehensive components that the manufacturer believes are exempt under this provision. The disclosure would enable ARB staff to more readily identify and resolve any issues wherein staff believes that a manufacturer has incorrectly classified a vehicle component or system as being exempt from monitoring.

<u>Hybrid monitoring requirements</u>

Staff is proposing specific monitoring requirements for hybrid components. While hybrid powertrain components are subject to monitoring, the current regulation does not contain specific guidelines for hybrid components but instead requires manufacturers to submit a monitoring plan to ARB for review and approval. Consequently, some manufacturers have expressed uncertainty in designing monitoring requirements for hybrid components. After many years of reviewing hybrid OBD II systems, staff believes it has gained sufficient experience to clarify certain monitoring requirements for hybrid components (proposed sections 1968.2(e)(15.2.3) and 1968.2(f)(15.2.3)). The proposed requirements would provide manufacturers with criteria to aid in designing malfunction thresholds for most hybrid components rather than providing specific performance and diagnostic requirements. Ultimately, the proposed amendments primarily clarify existing regulatory language and would not likely result in significant changes to the OBD II system designs for most manufacturers. The proposal would promote consistency and equity in implementation. To account for manufacturers that would need to make changes to their OBD designs to comply with the proposed amendments, staff proposes the changes take effect starting with the 2019 model year to provide some lead time.

The proposed amendments focus on the major hybrid electric systems and components: the energy storage system (ESS), hybrid thermal management system, regenerative braking system, drive motor, generator, and plug-in hybrid electric vehicle ESS charger. For the purpose of defining vehicles subject to these new clarifications, and to clarify that vehicles with start-stop systems would not be subject to the proposed requirements, staff is proposing new definitions in section 1968.2(c) of "mild hybrid electric vehicle" and "strong hybrid electric vehicle" and proposing to amend the existing definition of "plug-in hybrid electric vehicle." These proposed definitions are identical to those contained in title 13, CCR, section 1961.3 with the exception of a correction to an error with the test procedure reference and changes that would broaden the scope of the definitions to include all hybrid vehicles as opposed to just gasoline hybrid vehicles. Staff believes that these new definitions would provide greater clarity regarding which vehicles would be subjected to the new requirements. For vehicles not specifically described by the new definitions, the requirements for hybrid component monitoring will remain unchanged.

For monitoring of the ESS (e.g., battery), staff is proposing specific monitoring requirements for state of health (SOH), state of charge (SOC), and cell balancing monitoring. Staff believes these monitors are necessary for maintaining proper operation of the ESS and determining when the ESS is no longer able to perform basic functions. SOH is used to measure the deterioration of the ESS (e.g., battery) and its ability to perform as compared to a new ESS. While manufacturers would still be required to submit a monitoring plan for SOH monitoring, specific guidelines for malfunction criteria would be outlined in the regulation. Specifically, SOH monitors would be required to detect malfunctions or deterioration of the ESS system that prevent the activation and operation of emission control strategies, the ability of the vehicle to operate such that the monitoring frequencies of all other diagnostics are not adversely affected, and ESS failures that result in loss of all hybrid function or no start of the engine. Manufacturers would be required to submit proposed SOH thresholds in comparison to these levels of failure so staff would be able to determine whether the manufacturer proposed thresholds are appropriate.

SOC is the level capacity of an ESS that is readily available for use, much like a fuel level gauge. The proposed amendments would require ESS SOC monitors to detect malfunctions when the SOC is outside the manufacturer-defined usable range intended for hybrid operation. Many manufacturers control SOC to keep the battery from deteriorating too quickly. For example, a manufacturer may choose to limit hybrid operation when the SOC is below 20 percent of total battery capacity, or may choose to stop charging the battery when SOC is above 80 percent total capacity. These strategies are intended to protect the batteries and as a result, staff is proposing that manufacturers monitor the batteries for malfunctions that could potentially push them outside the usable range such that damage to the battery occurs or charging capability is limited. Additionally, if another diagnostic requires SOC to be above or below a certain level, manufacturers would be required to verify that the system is able to reach and maintain the proper SOC to enable and complete the diagnostic.

Cell balancing is another control strategy that has large effects on the hybrid ESS. Improper cell balancing can result in failure of the battery to charge correctly or increased battery deterioration. Staff is proposing that manufacturers monitor the cell balancing system for proper functional response by verifying the proper target voltages are reached or by monitoring the individual switches used to command cell balance. Staff believes these malfunction criteria would be sufficient for most manufacturers. However, if a manufacturer does not determine cell balance via voltage measurement, the manufacturer would be required to submit a monitoring plan to ARB proposing an alternate method of monitoring the ESS cell balancing system. Alternate methods that include functional monitoring of all components used for cell balancing would likely be approved.

Additionally for ESS monitoring, staff is proposing all other input and output components used as part of the ESS but not specifically named would be subject to the input and output comprehensive component monitoring requirements of sections 1968.2(e)(15.2.1), (e)(15.2.2), (f)(15.2.1), and (f)(15.2.2). ESS components that would fall under these requirements include ESS temperature sensors, ESS voltage sensors, battery cells, and pre-charge contactors. Because these components are often integrated into larger units, staff is proposing to allow manufacturers to store a fault code pinpointing the smallest replaceable unit for in-use repair. For example, the OBD II system may store a single fault code for all battery cell voltage sensor out-of-range high failures if all the sensors are designed to be replaced as a single unit. This provision would also be allowed for ESS cell balancing monitors, such that manufacturers would be able to store fault codes pinpointing the smallest replaceable unit for in-use repair of the ESS (e.g., battery pack, battery module, or battery cell). If a manufacturer elects to pinpoint further, it would be allowed to do so.

Staff is also proposing hybrid ESS thermal management system monitoring requirements to reduce confusion about what is required to be monitored for both active and passive ESS thermal management systems. Active thermal management systems use dedicated components that are commanded by the vehicle for proper cooling and heating of the hybrid systems. When these components fail, the thermal management system is unable to properly function. Passive thermal management systems do not solely have dedicated components, and instead use air from the passenger cabin. Since passive thermal management systems do not depend on dedicated components for temperature control, manufacturers have suggested that they do not need to be monitored. The proposed language does not distinguish between components in passive and active thermal management systems; in both systems, all electronic input and output components commanded by the hybrid system would be required to be monitored. For example, if a passive cabin cooled system has a fan commanded by the vehicle in order to cool the ESS, manufacturers would be required to monitor that component. Electronic components commanded solely by driver demand and used for ESS thermal management would not be considered electronic input or output components and thus would not be required to be monitored. An example of such components that would be exempt from monitoring includes air conditioning components commanded only by the driver for purposes of cooling the cabin. To the extent feasible, manufacturers would also be required to implement a functional check on the thermal management system, which would generally involve ensuring that the thermal management system is activated when commanded. Staff is also proposing similar requirements for inverter thermal management systems, although staff would not allow manufacturers to be exempt from monitoring components commanded solely by driver demand in the case of inverter thermal management.

Regenerative braking is an important function in hybrid vehicles that allows for the recapturing of kinetic energy to be stored in the ESS. Staff is proposing that manufacturers monitor the regenerative braking function for malfunctions that cause regenerative braking performance to be reduced, or cause regenerative braking to be disabled. Any inputs used to enable regenerative braking or inputs whose failure would result in the disablement of regenerative braking would be subject to monitoring. An example of a component failure resulting in reduced performance would be an input device such as brake pedal position used for feedback into the regenerative braking system. If this component were to malfunction, regenerative braking would revert to a default mode of operation such as a flat regenerative braking percentage, look-up table values, or disablement of regenerative braking; all of which result in degraded performance.

Staff is proposing requirements for drive motor and generator monitoring similar to those proposed for ESS SOH monitoring. Manufacturers would be required to submit a plan for monitoring following specific guidelines outlined in the regulation. Specifically, the plan should include detection of malfunctions that prevent the activation and operation of emission control strategies, the ability of the vehicle to operate such that the monitoring frequencies of all other diagnostics are not adversely affected, and failures that result in loss of all hybrid function or no start of the engine. Showing these levels of deterioration in comparison to one another would greatly aid staff in understanding how the manufacturer has calibrated the diagnostic and when a failure can be detected. Manufacturers have asked for a single requirement for drive motor and generator monitoring as many vehicle configurations have one system performing both functions. Staff disagrees with such manufacturers and believes two separate requirements are necessary given that one system performs the two separate functions under different operating conditions, and allowing one diagnostic to monitor both functions may not be robust. Nonetheless, manufacturers would be allowed to use a single monitor to detect failures of both the drive motor and the generator if the monitor is able to fulfill the proposed monitoring requirements for both drive motor and generator fault detection.

Staff is also proposing monitoring requirements specific to plug-in hybrid electric vehicles, specifically the ESS charger. ESS chargers differentiate plug-in hybrid electric vehicles from regular hybrid vehicles and provide plug-in vehicles the ability to charge the ESS and gain all-electric range. Failing ESS chargers would prevent a plug-in hybrid electric vehicle from operating solely on electric power for propulsion, resulting in higher emissions from increased engine operation. Staff is proposing that manufacturers monitor the on-board ESS charger for malfunctions causing the disablement of battery charging or affecting charging performance. Monitoring of ESS chargers would be limited to on-board chargers; detection of indeterminate failures that cannot be distinguished from those originating from outside the vehicle such as failures of the electric vehicle supply equipment or poor electrical service would not be required.

Finally, staff is proposing language specific to plug-in hybrid electric vehicles regarding the methodology for testing out of monitoring requirements. Mild and strong hybrid electric vehicles would be able to use the test-out provisions for comprehensive components as described in the “Emission impact assessment” section at beginning of section II.E.11. above to demonstrate that the individual components have minimal impacts on emissions and therefore are not subject to monitoring per the comprehensive component requirements. However, plug-in hybrid electric vehicles have the capacity to be driven under all-electric operation, potentially avoiding engine starts all together during a given drive cycle. As such, any malfunction of a plug-in hybrid electric vehicle component that could result in an engine start when there would not otherwise be any tailpipe emissions is cause for requiring monitoring of that component under the OBD II regulation. Thus, in order for a manufacturer to prove that a given plug-in hybrid electric vehicle component has little or no impact on emissions, the manufacturer would need to demonstrate that the malfunction does not result in an engine start when there would otherwise not be an engine start. Staff is proposing language that provides the procedure manufacturers would be required to use in order to be exempt from the monitoring requirements for plug-in hybrid electric vehicle components. The proposed procedure includes: (1) a demonstration that the malfunctioning component does not result in an engine start when the engine would otherwise not start, and (2) a demonstration that the malfunctioning component does not result in significantly increased use of energy from the high voltage battery during charge depletion driving. These proposed procedures would apply to all of the proposed hybrid monitors described above except thermal management system monitors, since these systems generally only operate under extreme conditions not observable during the standard test cycle procedures. As such, staff is proposing that manufacturers submit a plan proposing a test procedure for testing out of thermal management system monitoring. The plan would be approved based on consideration of when the thermal management system operates (e.g., charging, extreme ambient temperatures, high loads) and determination that the manufacturer has submitted data and/or engineering evaluation that the testing conditions represent in-use driving conditions where all electric range is likely to be most affected by the malfunctioning component/system.

In addition to these proposed hybrid monitoring requirements, staff is also proposing clarifying language in the gasoline and diesel air conditioning (A/C) system monitoring requirements (sections 1968.2(e)(12) and (f)(14)). The regulation currently specifically requires monitoring of the A/C system if the vehicle incorporates an engine control strategy that is altered (e.g., alters off-idle fuel and/or spark control) when the A/C system is on. Staff is proposing to add a clause indicating that even if the A/C system does not meet these criteria, the A/C system components may still be subject to the monitoring requirements under the comprehensive component monitoring requirements if they are utilized for hybrid-related activities such as battery cooling.

Emissions neutral diagnostics

ARB staff is proposing two exceptions to the existing OBD requirements for system/component monitoring and illumination of the MIL. The first proposed exception addresses components and systems that trigger an "emissions neutral default action" when a malfunction within the component or system occurs, with the monitor detecting this malfunction referred to as an "emissions neutral diagnostic". The provisions would apply to component and systems subject to the comprehensive component monitoring requirements (sections 1968.2(e)(15) and (f)(15)) that would ordinarily cause an increase in vehicle emission levels and/or affect (e.g., enable or disable at inappropriate times, increase probability of false detections or false passes) the function of other OBD II system monitors when malfunctioning. However, upon detection of a malfunction, the continued use of the component or system within the powertrain would be terminated or altered such that neither of these impacts would occur (hence, an "emissions neutral default action"). In such cases, because the fault has no residual impact on emissions or OBD II system performance, the proposed revisions to sections 1968.2(d)(2.6), (e)(15.4.4), and (f)(15.4.5) of the OBD II regulation would allow the OBD II system to neither illuminate the MIL nor store a fault code within the on-board computer memory, although the OBD II system may store a non-emission-related fault code for use by the service industry to repair the fault when the vehicle is next serviced.

Although MIL illumination and fault code storage would not be required, monitoring of the component or system would still be necessary so that the emissions neutral default action can be triggered when a fault occurs. The monitoring strategy used for this purpose would be required to comply with all applicable requirements except MIL illumination and fault code storage. For example, the monitoring frequency of emissions neutral diagnostic functions would need to meet or exceed the minimum requirements in the OBD II regulation, and the emissions neutral default action would be required to be invoked if a fault is detected during two consecutive monitoring events. Further, the manufacturer would be required to document in its certification applications both the monitoring strategy that invokes the emissions neutral default action and the details of the default action. In order to ensure adequate security and reliability for the monitors associated with emissions neutral default action, staff's proposal would require such emissions neutral diagnostics and emissions neutral default actions to be controlled by either a diagnostic or emission critical control unit (as defined by the regulation), or a unit that complies with the requirements of Automotive Safety Integrity Level (ASIL) C or D according to the processes outlined in ISO 26262. Additionally, production vehicle evaluation testing of the emissions neutral diagnostics would be required under section 1968.2(j)(2), although instead of ensuring the diagnostics store a fault code and illuminate the MIL when a fault is detected, manufacturers would be required to ensure that the diagnostic triggers the emissions neutral default action when a fault is detected.

Acceptable “emissions neutral default actions” would need to meet proposed conditions specified in the definition of the term under section 1968.2(c). First, use of the default action when a fault occurs cannot result in increased emissions compared to the non-faulted state during reasonable in-use driving conditions. Second, the default action cannot disable any other OBD II system monitors or otherwise render them out of compliance with the regulation (for example, by reducing the monitoring frequency or robustness of fault detection strategy). Third, once invoked on a driving cycle, the default operation must remain in effect for the remainder of the driving cycle. If the diagnostic strategy that triggers the emissions-neutral default action requires more than 10 seconds to detect the malfunction and invoke the action, the default action must remain activated from one driving cycle to the next until the fault is cleared either by the OBD II system based upon passing results from the monitor that set the default action or by a service technician with a diagnostic scan tool. This condition will ensure that vehicles will not experience significant periods of high emissions operation on every driving cycle as the process of detecting the malfunction and invoking the emissions-neutral default action is repeated. Fourth, if any other vehicle malfunction would prevent the emission-neutral action from taking place as intended, detection of that malfunction is required, and the MIL must be illuminated and a fault code stored. Finally, emissions-neutral default actions that render the vehicle inoperable (e.g., by preventing engine starting or by shifting out of park/neutral) can only be implemented for components and systems that are not specifically called out for monitoring in the comprehensive component monitoring sections (sections 1968.2(e)(15) and (f)(15)) of the OBD II regulation (with the exception of transmission-related diagnostics). This last provision is a safeguard to ensure that manufacturers do not unnecessarily use such a default action to avoid warranty costs or any other requirements potentially associated with illumination of the MIL.

One example of a component that could qualify under these provisions would be the steering angle sensor. On vehicles equipped with start-stop technology to shut the engine off during periods of rest (e.g., at a stop light), input from the steering angle sensor is used by the manufacturer to prevent undesired operation of the star-stop system when the vehicle is undergoing tight maneuvers in a parking lot. When the sensor indicates that the driver is actively turning the wheel, the on-board computer will temporarily prevent the start-stop function from activating so that the vehicle operator does not experience the engine stopping and starting during the parking sequence. However, if the steering angle is malfunctioning, it could permanently disable the stop-start feature from activating, increasing vehicle emissions at times when the vehicle is stopped (when the engine would have otherwise been turned off if the start-stop system was working properly) and the steering wheel is not being turned. Under the proposed provisions, the manufacturer's control strategy could disregard the steering angle input when the sensor is malfunctioning. The effect would be that steering angle input would no longer be able to inhibit the start-stop function. Vehicle owners may experience start-stop activity even when the wheel is being turned, but by keeping the start-stop system enabled, the default action would ensure that emissions would not be increased as a result of the malfunction. Once the malfunction is repaired, the input from the steering angle sensor would again be used by the control strategy.

Dedicated safety functions (safety-only components or systems)
ARB staff is also proposing another exception to the existing OBD II requirements for system/component monitoring and illumination of the MIL for components and systems that are dedicated to perform safety functions. Examples of such systems include traction control functions, lane departure controls, and even air bag systems. These components and systems are designed and used solely to prevent or mitigate damage to the vehicle and/or its occupants; however, when they are activated to address unsafe conditions, powertrain controls are sometimes altered in a way that could affect emissions and/or OBD II system performance. Such impacts could also occur if there is a malfunction within the safety system that causes it to activate even when the conditions it was designed to work under are not present.

ARB staff is proposing amendments to the OBD II regulation to clarify that such systems would not be subject to the monitoring requirements (under sections 1968.2(e)(15) and (f)(15)) even if their use can impact powertrain performance in some instances. Circumstances under which these systems operate are not frequently encountered by most drivers, and when the systems do operate, they typically do so for very short periods of time. Therefore, any impact on emissions would be very minimal. In the case of systems that may operate more frequently and for longer periods of time due to a malfunction, the vehicle operator is typically made aware of the problem by safety-related warning indicators and possibly by powertrain changes that affect the drivability of the vehicle. ARB staff does not believe there is sufficient added benefit in having the MIL illuminated in such circumstances or to require monitoring for emission-related purposes under the OBD II requirements.

Under the existing regulation, ARB staff has been determining the applicability of the OBD II requirements to safety-only components or systems on a case-by-case basis. The proposed amendments would provide greater uniformity and clarity in how these systems should be handled and would require manufacturers to disclose in applications for certification all the safety systems believed to be exempt under this provision. The disclosure would enable ARB staff to identify and resolve in a timely manner any issues wherein staff believes that a manufacturer has incorrectly classified a vehicle component or system as being exempt from monitoring.

Smart Devices

As technological advances in the automotive industry continue, manufacturers are increasingly using “smart devices” in place of conventional sensors and actuators to control and monitor powertrain functions. The primary difference between smart devices and similar conventional components is that smart devices incorporate microprocessors to condition or convert input and output signals so that such signals can be used more effectively and reliably. Also, smart devices most commonly communicate with the on-board computer through a digital interface instead of analog signals. In order to address the increased use of smart devices in vehicles, ARB staff is proposing to add a definition of “smart device” in section 1968.2(c), and is also proposing amendments to clarify how the OBD II monitoring requirements apply to smart devices.

An example of a current production smart device is a smart fuel rail pressure sensor. This sensor provides temperature-corrected pressure readings of the fuel pressure at the fuel injectors in a digital format to the on-board computer. A corresponding conventional sensor design would either correct for temperature with analog circuitry or have the correction made within the on-board computer based on a separate temperature input. Smart sensors are typically less sensitive to electro-magnetic interference and can offer cost and durability improvements compared to purely analog designs.

From the perspective of ARB’s OBD program, the emission-related objectives for monitoring smart devices are essentially the same as those for conventional sensor technologies. That is, if the device is an emission control device (e.g., a smart exhaust gas sensor), it needs to be monitored for malfunctions that cause vehicle emissions to exceed the emission thresholds for the corresponding major monitor requirement. Failure mode identification and the setting of corresponding fault codes must follow the specific requirements of the relevant section. If the device falls under the requirements for “Other Emission Control or Source Monitoring” (section 1968.2(e)(16) or (f)(16)), manufacturers need to propose an appropriate monitoring strategy for the detection and identification of malfunctions that may occur, as is currently the case for devices that would not meet the definition of a smart device.

If a smart device is an emission-related powertrain device subject to monitoring under the regulation’s comprehensive component monitoring category (sections 1968.2(e)(15) and (f)(15)), monitoring is required for circuit faults, out-of-range values, and rationality if it is an input to an on-board computer and for functional response to computer commands if it is an output device. To this end, the proposed modifications to sections 1968.2(e)(15.1.1) and (f)(15.1.1) would make clear that every input from a smart device to the on-board computer must be evaluated for circuit faults, out-of-range values, and to the extent feasible, rationality. Proposed amendments to sections 1968.2(e)(15.2.1) and (f)(15.2.1) would allow for fault code consolidation for out-of-range faults when the input is transmitted digitally to the on-board computer. The proposed amendments would further clarify that communication errors that prevent digital transmission of the data must be detected and must be identified by storing a separate, failure-specific fault code. These proposed requirements are essentially the digital equivalent of verifying circuit continuity between the component and the on-board computer. Designs that check for out-of-range values within the smart device may transmit an error code to the on-board computer instead of signal values when the sensor values are outside of expected bounds. The on-board computer will then translate that error code into a corresponding fault code that can be downloaded by a technician or I/M program.

Similarly, smart output components may receive either analog or digital signals from the on-board computer. Staff believes the current language in the OBD II regulation adequately covers the requirements for these output components. The OBD II system is required to monitor each output for evidence (via other on-board sensors or systems) that the component is functioning in response to the computer commands. If such a functional check is not feasible, the OBD II system must at a minimum verify the circuit continuity (or integrity of the digital communication link) of the output from the computer to the device. The table below (Table 8) summarizes the monitoring requirements for input and output devices (for both smart devices and traditional sensors/actuators) and the corresponding requirements regarding fault identification. It includes a provision for consolidation of circuit fault and out-of-range fault codes for components that are physically attached to the circuit board of an on-board computer because such components are generally not serviceable apart from replacement of the circuit board. A single fault code that indicates the malfunctioning component is acceptable in such cases.

Table 8

Type of Component	Monitoring Required? / Fault Code Requirement				
	Circuit Continuity	**Communication**	**Out-of-Range**	**Rationality**	**Functional**
Analog Input	Yes, Fault specific codes (open circuit, circuit high, circuit low) unless component is fixed to ECU	N/A	Yes, Fault Specific codes (out of range high/low) unless component is fixed to ECU	Yes, to extent feasible. Single code can cover two sided failure modes	N/A
Digital Input	N/A	Yes. Single fault code acceptable	Yes, single fault code acceptable to cover failure modes	Yes, to extent feasible. Single code can cover two sided failure modes.	N/A
Analog Output	Yes, if functional check is not feasible. Single fault code acceptable.	N/A	N/A	N/A	Yes, if feasible. Single fault code acceptable
Digital Output	N/A	Yes, if functional check is not feasible. Single fault code acceptable	N/A	N/A	Yes, if feasible. Single fault code acceptable

Each smart device may be evaluated based solely on the input it provides to the on-board computer, or the commands that it receives from it. That is, faults internal to the smart device would not need to be separately pinpointed by the OBD II system's monitoring strategies because they are generally not serviceable at this level. As an example, if a smart input device contains two internal sensors, Sensor A and Sensor B, that are used to create a single data parameter transmitted to the on-board computer (e.g., a temperature corrected pressure), the diagnostic strategy would not need to determine whether Sensor A or Sensor B has failed for fault code setting. The monitor would only be required to evaluate the input that the device provides to the on-board computer for circuit continuity/proper communication, out-of-range values, and rationality (and to set fault codes specific to those failure modes).

Due to the processing power contained within smart devices, there is opportunity to attach external input or output components to them with external wiring or connectors. This could be done for purposes as simple as minor conditioning of the data used or generated by the smart device, or it could include more complex calculations involving combinations of signals that used to be carried out within the on-board computer when using conventional sensor technology. In order to ensure that inputs or outputs attached to smart devices are adequately evaluated with respect to emissions and/or OBD II system performance, the proposed smart device definition in section 1968.2(c) and amendments to sections 1968.2(e)(15.1.1) and (f)(15.1.1) would make clear that external inputs and outputs to the smart devices are considered separate components, and as such, are separately subject to the OBD II monitoring requirements. This means that manufacturers would be required to evaluate components providing input to a smart device for circuit continuity, out-of-range values, and rationality if their failure can impact emissions and/or OBD II system performance. Further, manufacturers would be required to monitor output components driven by smart devices for functional response to the commands they receive if feasible, and at a minimum, for circuit continuity if a functional check is not feasible. As an exception, the proposed definition of smart device would state that an external subcomponent to a smart device can be considered part of the device if it is integral to the function of the smart device (i.e., the smart device could serve no purpose without the subcomponent, nor the subcomponent without the smart device). It must be permanently attached to the smart device, and the smart device/subcomponent combination must be designed, manufactured, installed, and serviced as a single component.

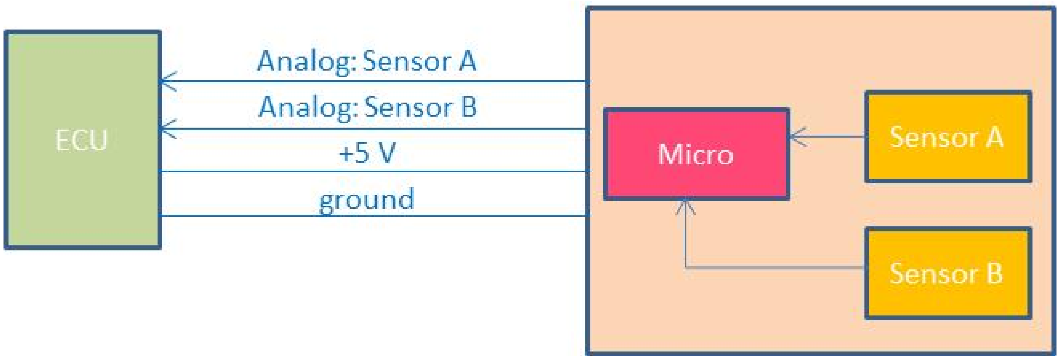
For some smart device applications, portions of the OBD II monitoring requirements may be carried out within the smart device itself, which would then transmit the necessary information to the on-board computer to facilitate fault handling and MIL illumination when a problem occurs. Amendments are proposed to section (i) of the regulation to make clear that such monitoring strategies must be fully described in the manufacturer's OBD II certification application that is reviewed and approved by ARB staff.

The proposed amendments would exclude transmissions and hybrid battery pack controllers from the definition of smart devices for purposes of the OBD II regulation even though they typically use microcontrollers to govern their operation. Consequently, OBD II systems must continue to individually detect the malfunction of electronic transmission and hybrid battery system components internal to the devices that can affect emissions and/or OBD II performance and to set subcomponent and failure mode specific fault codes. The reason for staff's proposal is that these are major systems on vehicles that may be commonly repaired by technicians in the service environment (instead of being simply replaced). The staff believes that the availability of the more detailed fault information is valuable to technicians and remanufacturers, resulting in more effective repair work.

In concluding this section, four examples are provided below to illustrate how the requirements specifically apply to various smart sensor designs.

In Example 1, a smart sensor contains sensors A and B, which are conditioned within the device by a microprocessor before the sensor values are transmitted to the on-board computer using an analog interface. In this case, monitoring of the smart device is for all intents and purposes the same as for two separate analog sensors. Under the requirements, the OBD II system would independently monitor the inputs for Sensor A and Sensor B for circuit continuity, out of range values, and rationality. Separate fault codes for each failure mode would be required. As indicated in Table 8 above, circuit continuity fault codes would be required to differentiate open circuit, circuit high, and circuit low faults, and out of range high faults must be differentiated from out of range low faults. This level of fault isolation is important to help technicians find and fix external circuit and wiring problems that can affect proper transmission of the sensor data over the analog interface. Beyond these requirements, the isolation of faults within the smart sensor itself is not required because the only reasonable repair action for an internal sensor fault is replacement of the sensor.

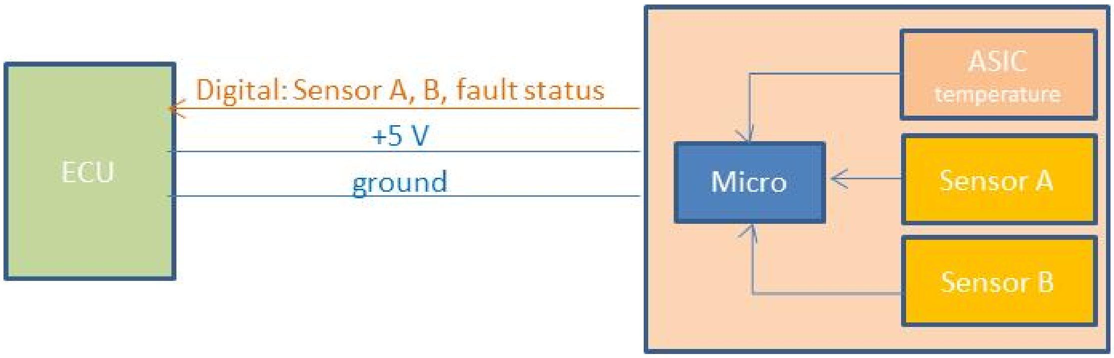
Example 1:
Smart Sensor with Analog Interface



Example 2 helps illustrate the requirements when a digital interface is used. The smart sensor contains two internal sensors that are conditioned by a microprocessor based on temperature. The temperature information is not used outside of the smart sensor and is therefore not required to be monitored. Monitoring of the digital interface between the smart sensor and the on-board computer would replace the circuit continuity checks for the analog connections between the device and the on-board computer in Example 1 above. A malfunction must be detected if the interface is unable to transmit data or fault information for either sensor. Proper digital transmission of the data ensures that the connection between the device and the on-board computer is functioning as expected.

Monitoring for out of range values and rationality can occur within either the smart device or the on-board computer. Regardless of where the monitoring takes place, the manufacturer would be required to disclose and describe the monitoring strategy, monitoring conditions, fault criteria, and fault codes used in its certification documentation. Only a single fault code would be required to indicate both out of range high and out of range low errors.

Example 2
Smart Sensor with Digital Interface

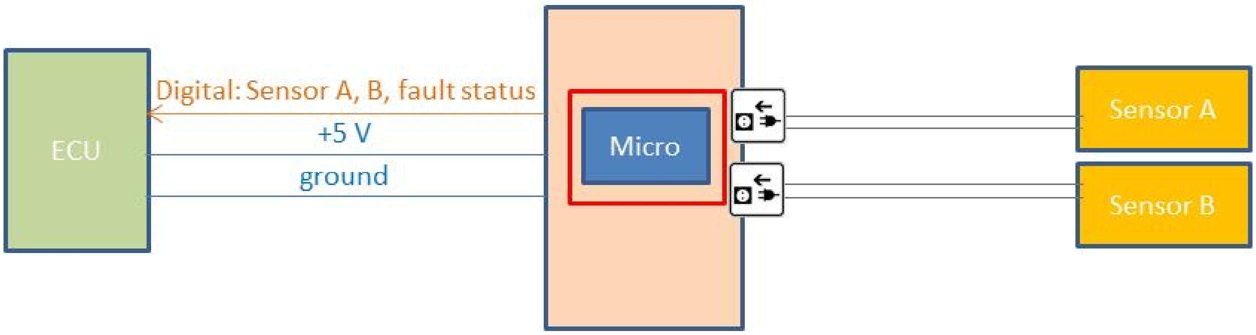


Example 3 provides a slightly more complex scenario. In this case, the smart device is a sensor interface that receives analog inputs from Sensor A and Sensor B. The interface processes the data and sends it in digital format to the on-board computer. Under the requirements, Sensors A and B, and the smart interface are all considered separate comprehensive components for which monitoring is necessary.

Because they provide analog inputs to the smart interface, Sensors A and B must be monitored for circuit continuity, out of range values, and rationality. Each failure mode must use separate fault codes to help technicians diagnose the root cause of the detected problem. Monitoring for circuit faults would occur within the interface, and the interface would be required to transmit to the on-board computer necessary fault status information to permit storage of the appropriate fault codes and MIL illumination. Monitoring for out of range values and rationality can occur within either the interface or the on-board computer. Both out of range high and out of range low would be indicated with separate fault codes because the sensors transmit their data in analog fashion to the interface. Again, regardless of where the monitoring takes place, the manufacturer would be required to disclose and describe the monitoring strategy, monitoring conditions, fault criteria, and fault codes used in its certification documentation.

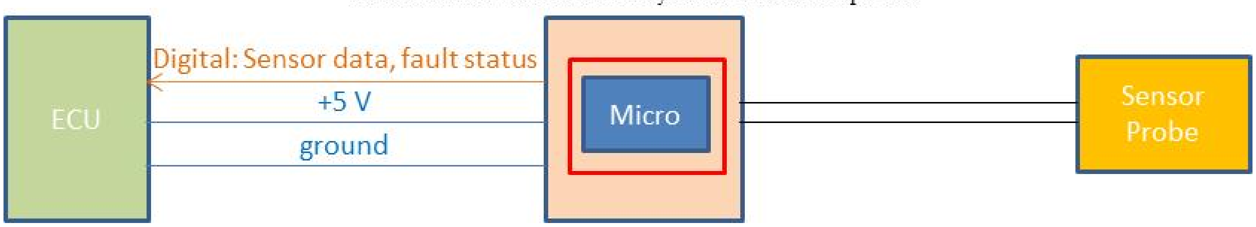
As in Example 2, the regulations would require the smart interface to be monitored for its ability to communicate the sensor information to the on-board computer. A malfunction must be detected if the interface is unable to transmit data or fault information for either sensor.

Example 3
External Analog Sensors Processed by Digital Interface



Example 4 illustrates the requirements for a similar smart device that uses a sensor probe as an integrated subcomponent. Using the provision described earlier, the sensor probe is considered part of the smart device because the probe and controller are designed, produced, and serviced as a single unit, and neither subpart can serve any purpose by itself. Therefore, even though it is externally connected to the controller, the regulation would not require each individual connection between the probe and the controller to be separately monitored for purposes of fault isolation because if a malfunction in one of the connections occurred, replacement of the whole assembly is the only reasonable and proper service action. Instead, as if the sensor probe was internal to the smart device controller, the sensor data that is transmitted to the on-board computer would evaluated for out of range values and rationality. Further, the digital communication link would be monitored for its ability to transmit data and fault status information.

Example 4
Smart Device with Permanently Attached Subcomponent



<u>Camshaft/crankshaft alignment monitoring</u>

Staff is also proposing amendments to the monitoring requirements for camshaft and crankshaft alignment. The OBD II regulation currently requires gasoline vehicles that require precise alignment between the camshaft and the crankshaft to monitor the camshaft and crankshaft position sensors for proper alignment between the camshaft and crankshaft. Further, for vehicles equipped with VVT systems and a timing belt or chain, manufacturers are required to 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) or when the minimum number of teeth/cogs misalignment needed to cause a measurable emission increase during any reasonable driving condition has occurred.

As discussed in section II.E.9. “Gasoline Variable Valve Timing and/or Control (VVT) System Monitoring” above, due to some confusion about what systems constituted VVT systems, staff is proposing to add language clarifying that VVT systems include systems that can control valve lift to two or more discrete profiles in addition to systems that can infinitely vary valve actuation. However, because of the confusion about what systems constituted VVT systems, some manufacturers have not implemented a monitor to detect a misalignment between the camshaft and crankshaft on vehicles with VVT systems with discrete operating states. Additionally, manufacturers have indicated that vehicles with VVT systems with discrete operating states would require new trigger wheels and improved position sensors with better resolution in order to robustly detect when a single tooth/cog misalignment has occurred.

Staff is therefore proposing to add language clarifying that only vehicles equipped with VVT camshaft phasing systems would be required to detect a single tooth/cog misalignment, whereas starting in the 2019 model year, all vehicles with VVT systems would be required to detect the smallest amount of misalignment possible using their existing hardware. Thus, manufacturers with vehicles equipped with discrete profile VVT systems would not have to incur additional cost to improve or add hardware to meet the proposed regulation. Additionally, as part of staff’s efforts to streamline requirements in the regulation, staff is also proposing to require manufacturers to detect either the smallest detectable level of misalignment between the camshaft and the crankshaft based on existing hardware or the minimum number of misaligned teeth/cogs that causes emissions to exceed the levels specified for determining emissions impact as described in the “Emission impact assessment” section above (section 1968.2(e)(15.1.2)). This would be allowed for all 2019 and subsequent model year vehicles equipped with VVT systems and a timing belt or chain.

<u>Emission control strategy monitoring</u>
Staff is also proposing clarifying language related to gasoline emission control strategies using input and output components. Based on past meetings with manufacturers, staff is concerned that manufacturers are not designing OBD II systems to monitor certain aspects of emission control systems, especially those aspects that are not “specifically” identified in the regulation. The intent of the OBD II regulation is that OBD II systems monitor and detect virtually any malfunction that results in an emissions increase, yet staff is discovering some manufacturers have additional emission controls or strategies that they have not readily disclosed to staff and/or not considered when developing OBD II systems. Staff has already adopted language clarifying the requirements for diesel comprehensive component monitors and is now proposing similar amendments for gasoline comprehensive component monitors. Specifically, staff is proposing to amend the gasoline comprehensive component monitoring requirements to reiterate and clarify that, if there is an emission control strategy being used by the engine, OBD II systems should be monitoring such strategies for proper operation to the extent possible. Such monitoring should include

faults that disable, prevent, or delay the strategy from properly operating and faults that cause the strategy to reach adaptive or authority limits and be unable to achieve the desired goal under conditions where it should be able to achieve them. In most cases, this will include monitoring of input components that are used to enable the strategy or as feedback for feed-forward information, output components that are controlled by the strategy to achieve the desired goal, and the overall function of the strategy itself.

12. GASOLINE OTHER EMISSION CONTROL OR SOURCE SYSTEM MONITORING REQUIREMENTS

Staff is proposing clarifying language related to gasoline emission control strategies using other emission control or source systems, similar to the proposal for comprehensive components. Details of the proposal were described for “Emission control strategy monitoring” in section II.E.11 “Gasoline Comprehensive Component Monitoring.” As explained in that section, much of the monitoring will be done at the component level per the comprehensive component requirements. Additionally, monitoring is also required to detect malfunctions that prevent the strategy from operating in its intended manner.

13. GASOLINE EXCEPTIONS TO MONITORING REQUIREMENTS

Staff is proposing to relax certain monitoring requirements to address manufacturers’ concerns about expending resources to monitor components that only affect emissions or other diagnostics during extreme conditions. Staff is proposing to exempt OBD II systems from monitoring a component if a failure of that component affects emissions or other diagnostics only during conditions where the vehicle speed is greater than 82 miles-per-hour, which is the peak vehicle speed on the US06 cycle. Staff is also proposing to exempt OBD II systems from monitoring a component if the failed component affects emissions or other diagnostics only when the ambient temperature is below 20 degrees Fahrenheit. For each case, the OBD II system would be required to monitor the sensor determining the vehicle speed (e.g., vehicle speed sensor) and the ambient temperature (e.g., intake air temperature sensor). Staff believes there is not much benefit in monitoring components that only affect emissions under these extreme driving and ambient conditions, considering the limited amount of time vehicles are operated in these vehicle speed and temperature ranges.

Staff is also proposing amendments to the requirements for disabling monitors due to vehicle battery or system voltages. The OBD II regulation currently allows manufacturers to disable monitors affected by high vehicle battery or system voltages provided manufacturers demonstrate that monitoring is unreliable at the high voltages and that either of the following occur when the battery voltage reaches a level that disables other monitors: (1) an alternate warning light is illuminated or (2) the OBD II system detects a fault and illuminates the MIL. Manufacturers have indicated that high battery voltages may cause the instrument cluster to completely shutdown, which may prevent any light (including the alternate warning light) from illuminating, and have requested that a third option be added allowing for disablement of monitors if the high battery voltage causes this instrument cluster shutdown. Staff understands this issue, but also wants to ensure that the affected vehicle owners would seek to repair their vehicles as soon as possible if such a failure occurred. Thus, staff is proposing that manufacturers could also disable monitors due to high battery voltages if the instrument cluster completely shuts down when the battery voltage reaches a level that disables other monitors. Staff is also specifically indicating that "instrument cluster completely shuts down" would mean that, at a minimum, the vehicle speed, fuel level, and engine speed improperly reads zero or cannot be displayed, which would more likely prompt drivers to seek repair as soon as possible. Further, if these information are also displayed through other methods (e.g., on head up displays), these information would be required to meet the shutdown conditions as well.

Staff is also proposing to amend existing provisions that allow OBD II systems to disable monitoring while vehicles are operated in power take-off (PTO) operations. The OBD II regulation currently allows OBD II systems to disable monitors affected by PTO operation provided readiness status is cleared (set to "not complete") while the PTO unit is activated. This allowance was provided due to the unknown outside influences of PTO devices while also providing an indication to inspectors or technicians during PTO operation that the system is not fully functioning. Manufacturers have expressed concerns that the existing provision does not cover applications that involve extensive mobile PTO operation (e.g., hydraulic pump operation for applications such as a salt spreader) and have requested to delay immediate clearing of the OBD readiness status until a certain amount of cumulative PTO operation has occurred with the affected monitor disabled. Thus, staff is proposing to allow manufacturers to continue to use the existing strategy or to use a new strategy that would not immediately clear all readiness status whenever the PTO is active. The new strategy would track the cumulative time that a PTO device has been activated and the time since the affected monitor(s) had last run, and would clear the readiness status if the cumulative PTO operation reached 750 minutes and the affected monitor(s) had not run during that 750 minute time period (e.g., neither during PTO operation where it was disabled nor during periods of engine operation between PTO operations). This amendment would allow vehicles with frequent PTO activation (including perhaps, PTO devices that cannot be easily disabled during an emission inspection) to output a valid readiness status that would allow for vehicle inspection of emissions and proper OBD II operation in most situations.

F. DIESEL MONITORING REQUIREMENTS

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

For diesel passenger cars, light-duty trucks, and MDPVs certified to a chassis dynamometer tailpipe emission standard, the OBD II regulation currently requires OBD II systems to detect an NMHC catalyst malfunction when the catalyst conversion capability decreases to the point that NMHC emissions exceed a level based on the "applicable FTP NMHC standards," which are currently based on both intermediate useful life standards (i.e., 50,000 mile standards) and full useful life standards for these vehicles. However, the catalyst monitoring requirements for gasoline vehicles in section

1968.2(e)(1) specify that the emission malfunction thresholds are based on multiples of "FTP full useful life standards." Staff believes that the emission malfunction thresholds for NMHC catalysts should also be limited to the applicable full useful life NMHC standards to be consistent with the requirements for gasoline catalyst monitors and is therefore proposing that diesel NMHC catalyst monitors be calibrated to emission thresholds based on the "full useful life" standards.

Staff is also proposing to amend the existing "test-out" provisions in the NMHC catalyst monitoring requirements section. The OBD II regulation currently exempts OBD II systems from monitoring NMHC catalyst feedgas generation if complete failure of the component or loss of the function results in (1) a tailpipe emissions increase that is less than 15 percent of the full useful life standard for any pollutant (NMHC, CO, NOx, and PM) over an applicable test cycle, and (2) tailpipe emissions (NMHC, CO, NOx, and PM) remaining below the standard with the failure. The regulation additionally exempts OBD II systems from monitoring catalysts downstream of the SCR system (e.g., catalysts used to prevent ammonia slip) if complete failure of the catalyst results in "no measurable emission impact on the criteria pollutants (i.e., NMHC, CO, NOx, and PM) during any reasonable driving condition where the catalyst is most likely to affect criteria pollutants."

To account for the combined NMOG+NOx standards that were implemented with the LEV III regulations, staff is proposing to revise the NMHC catalyst feedgas generation monitoring requirement to also allow testing out of the monitoring requirement if the NMOG+NOx emissions increase resulting from a complete failure or loss of function is less than 15 percent of the full useful life combined NMOG+NOx standard. Further, for consistency, staff is also proposing to align the test-out criteria for catalysts located downstream of the SCR system with the criteria required for NMHC catalyst feedgas generation monitoring. Manufacturers had requested greater allowances for emissions increases due to failures or loss of function on ULEV70, ULEV50, and SULEV vehicles (i.e., 20 percent increase for ULEV 70/50 and 25 percent for SULEVs). The rationale for the higher test-out criteria was that the tighter emission thresholds resulted in a larger influence of test-to-test variation, which would make it more difficult to test out of feedgas generation monitoring on these lower emission vehicles. However, based on test-out data submitted by manufacturers, staff believes that the 15 percent test-out criteria is more appropriate, especially given the combined NMOG+NOx standards, which provide for a greater emissions increase of a single pollutant compared to those for criteria based on separate NMHC and NOx standards.

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

Similar to the proposal for diesel NMHC catalyst monitors above, staff is also proposing changes to the tailpipe emission standards for which the emission thresholds are based on for passenger cars, light-duty trucks, and MDPVs certified to a chassis dynamometer tailpipe emission standard. Specifically, the emission threshold monitors would be required to be calibrated based on the FTP "full useful life" standards. Details about the changes were discussed under section II.F.1. “Diesel Non-Methane Hydrocarbon (NMHC) Converting Catalyst Monitoring” above.

For diesel vehicles with SCR systems that use a reductant other than fuel, the OBD II regulation currently requires manufacturers to detect a malfunction when the reductant level is too low or if the wrong reductant is present in the tank. Manufacturers have argued that low reductant levels or no reductant do not constitute actual malfunctions since the driver can simply fill the tank with reductant to “fix” the malfunction. Manufacturers have also argued that the presence of an improper reductant is not an actual malfunction since the driver can simply replace the improper reductant in the tank with the correct reductant. Therefore, they believe that the OBD II system should not consider these situations to constitute malfunctions and thus should not turn on the MIL when these problems are detected. Manufacturers have also stated that their SCR systems are already subject to other non-OBDII-related requirements that would cover such issues, given the importance of SCR systems in controlling emissions from diesel vehicles. Specifically, manufacturers are required to implement strategies (i.e., inducement strategies) to limit vehicle operation when the SCR system is not working properly. These could be for reasons such as someone tampering with the system (e.g., disconnecting the reductant dosing valve, disconnecting sensors such as the reductant quality sensor) or no reductant in the tank. Inducement strategies could include derating the engine or any other condition that would limit operation of the vehicle and therefore ensure that drivers will get the SCR system fixed, either by actually fixing of the failure or refilling the tank with proper reductant.

To address these manufacturer concerns, staff is proposing an option that manufacturers may elect to use in lieu of meeting the existing OBD II requirements for monitoring low or no reductant levels and the presence of the correct reductant. Specifically, to meet the monitoring requirements for low or no reductant, manufacturers could elect to implement inducement strategies that adequately prevent sustained vehicle operation with no reductant and additionally monitor the inputs to the inducement strategy (e.g., reductant level sensing system) in accordance with the comprehensive component monitoring requirements. To meet the monitoring requirements for the presence of improper reductant, manufacturers could elect to implement an inducement strategy that adequately prevents sustained vehicle operation with improper reductant and additionally monitor the inputs to the inducement strategy (e.g., reductant quality sensor) in accordance with the comprehensive component monitoring requirements.

It should be noted that staff is also proposing amendments to the comprehensive component monitoring requirements (section 1968.2(f)(15)) requiring that for all vehicles with inducement strategies, manufacturers would be required to monitor all components used as part of the inducement strategies. Details about this amendment are provided below in section II.F.12. “Diesel Comprehensive Component Monitoring.”

3. DIESEL MISFIRE MONITORING

For light-duty diesel vehicles, OBD II systems 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 II requirements also specify that for 2010 and subsequent model year light-duty vehicles equipped with sensors that can detect combustion or combustion quality, OBD II systems must continuously monitor for misfire under all positive torque engine speeds and load conditions and to detect misfire before emissions exceed specific thresholds (e.g., 1.5 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 so that misfires could likely exist only in limited operating regions and go undetected by a monitor that only runs at idle.

However, the complexity of existing control strategies on all diesel engines and the addition of new technologies in recent years, such as the aggressive use of EGR, target air-fuel ratios, and 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 are undetected with today's monitors. 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. Further, manufacturers have expressed concerns about establishing a level of misfire that would equate to a specific tailpipe emission level, and have stated 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.

The Board recently adopted 2012 amendments to the OBD II regulation that require medium-duty vehicles to detect a fault when the misfire percentage is equal to or exceeds 5 percent to be phased in starting in the 2016 model year. The Board also adopted changes requiring continuous monitoring of the misfire under positive torque conditions up to 75 percent of peak torque with engine speed up to 75 percent of the maximum engine speed except within a limited low torque and high engine speed disablement area during the initial phase-in years, while medium-duty vehicles would be required to continuously monitor for misfire under all positive torque engine speed conditions (except a limited disablement area), to be phased in starting with the 2019 model year. Staff is now proposing that these same requirements apply to light-duty vehicles. Specifically, passenger cars, light-duty trucks, and MDPVs certified to a chassis dynamometer emission standard would be required to phase-in monitoring for misfire faults when the misfire percentage is equal to or greater than 5 percent during the 2019 through 2021 model years. Manufacturers would be allowed to increase the threshold to a misfire percentage higher than 5 percent if they could show that emissions would not exceed specific emission thresholds.

Further, staff is proposing to require these light-duty vehicles to phase-in monitoring all the way up to maximum engine speed and load for the 2022 to 2024 model years. In addition to the new proposed misfire monitor requirements, manufacturers would still be subject to the current idle-only misfire monitor requirements. Staff expects that manufacturers will be able to meet both requirements by revising their current idle-only misfire monitors to cover the expanded speed and load ranges. However, in cases 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 II system is incapable of detecting it.

Further, manufacturers of these light-duty vehicles would be required to collect and report data demonstrating the compliance of the misfire monitor as part of the certification application (section 1968.2(i)), 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 monitor 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.

Staff is also proposing amendments related to storage of freeze frame conditions when diesel misfire is detected for both light- and medium-duty vehicles. Currently, if the diesel misfire monitor detects a fault and freeze frame data are already stored for another fault other than diesel misfire, the OBD II regulation requires the freeze frame data related to the diesel misfire fault to replace the currently stored freeze frame data. However, for the gasoline misfire monitor, the OBD II regulation currently prohibits the freeze frame data for a gasoline misfire fault to replace the currently stored freeze frame data if the stored data are for a gasoline fuel system fault. Manufacturers have questioned why the policy seems to be different between diesel and gasoline monitors, and staff has determined that there is no valid reason for this discrepancy. Thus, staff is proposing to require freeze frame data for a diesel misfire fault to replace the currently stored freeze frame data only if the stored data are not for a diesel misfire fault or a diesel fuel system fault starting in the 2019 model year.

4. DIESEL FUEL SYSTEM MONITORING

The OBD II regulation currently requires OBD II systems to monitor several aspects of the fuel system (fuel system pressure control, injection quantity, injection timing) and detect faults before emissions exceed a specific emission threshold. Manufacturers have questioned whether they should be using a single injector fault or a fault that equally affects all cylinders when calibrating the diesel fuel pressure, quantity, and timing monitors to the OBD II emission thresholds. To clarify the requirements, staff amended the regulation in 2009 to provide clear calibration criteria for manufacturers of medium-duty vehicles certified to an engine dynamometer tailpipe emission standard. Staff believes those criteria are a reasonable compromise between calibrating for all possible combinations of failures and a manageable number of combinations and is now proposing similar requirements for manufacturers of passenger cars, light-duty trucks, and MPDVs certified to a chassis dynamometer tailpipe emission standard. Specifically, up through the 2018 model year, manufacturers of those vehicles would be allowed to calibrate the malfunction criteria based on either a single injector fault or a fault that affects all injectors equally. Starting with the 2019 model year, for fuel system pressure control, injection quantity, and injection timing monitoring 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), staff is proposing that manufacturers be responsible for calibrating for both a single cylinder fault that causes the system to reach the malfunction criterion as well as a fault that equally affects all cylinders such that the malfunction criterion is reached. Staff believes this represents reasonable coverage for failures in use, be it a gradual deterioration or fault that affects all cylinders virtually equally or a more severe degradation or malfunction of a single injector that by itself causes such an emission increase. For systems that achieve injection pressure outside of the injector (e.g., common-rail systems), staff is proposing that for injection quantity and timing monitoring, manufacturers would be required to calibrate for both a single cylinder fault and a fault that equally affects all cylinders, while for fuel system pressure control monitoring, manufacturers would only be required to calibrate for a fault that equally affects all cylinders. Staff's rationale for the difference in fuel system pressure control monitoring is that systems like a common-rail system achieve injection pressure independent of the individual injectors and are unlikely to have a pressure fault affecting a single cylinder (but are still susceptible to quantity or timing faults that would affect a single cylinder or all cylinders equally).

5. DIESEL EXHAUST GAS SENSOR MONITORING

The OBD II regulation currently requires OBD II systems to monitor for upstream and downstream air-fuel ratio sensor monitoring capability faults "every time the monitoring conditions are met during the driving cycle." Staff is proposing to reduce the monitoring frequency for such sensors to once per driving cycle since staff does not see a need for such monitors to run that often and because some monitors that are currently used to meet this requirement would not be able to meet the monitoring frequency requirement if they were intrusive monitors, which may be necessary for robust monitoring.

Staff is also proposing to require OBD II systems to separately detect and store different fault codes for circuit and out-of-range faults in diesel exhaust gas sensors. While the regulation presently requires OBD II systems to pinpoint the likely cause of a malfunction under section 1968.2(g)(4.4), staff believes that additional specification is needed because some manufacturers have been inappropriately storing the same fault code for both circuit and out-of-range faults. If the diesel exhaust gas sensor is designed and manufactured to be replaced as a single unit, staff is proposing to allow some consolidation of fault codes as described in section II.E.4. “Gasoline Exhaust Gas Sensor Monitoring” above.

6. DIESEL PM FILTER MONITORING

The OBD II regulation currently requires OBD II systems to monitor the NMHC conversion performance of the catalyzed PM filter and to detect a fault before NMHC emissions exceed 1.5 times the applicable NMHC standards. Manufacturers have indicated that this malfunction threshold is more stringent than the current malfunction threshold for the diesel NMHC catalyst conversion efficiency monitor under section 1968.2(f)(1), which requires detection of faults before emissions exceed 1.75 times the applicable NMHC standards. Staff did not intend for this discrepancy to occur, and is therefore proposing to amend the malfunction threshold to 1.75 times the applicable NMHC standards for catalyzed PM filter NMHC conversion monitors on non-LEV III applications. Further, similar to the proposal for diesel NMHC catalyst and NOx catalyst monitors above, staff is also proposing to require the emission threshold monitors for the catalyzed PM filter NMHC conversion monitor to be calibrated based on the FTP “full useful life” standards. Details about the changes were discussed under section II.F.1. “Diesel Non-Methane Hydrocarbon (NMHC) Converting Catalyst Monitoring” above.

The OBD II regulation currently requires OBD II systems in 2016 and subsequent model year medium-duty vehicles to monitor the ability of NMHC catalysts 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). Through discussions with manufacturers, staff learned that catalyzed PM filters are also used to generate such feedgas. Staff believes that OBD II systems should monitor all components that generate feedgas to enhance the performance of downstream aftertreatment components.

Catalyzed PM filters used to generate feedgas constituency (e.g., NO_2) to assist SCR systems on medium-duty vehicles are currently required to be monitored for the capability to generate desired feedgas. Staff is now proposing to require OBD II systems in 2019 and subsequent model year passenger cars, light-duty trucks, and MDPVs certified to a chassis dynamometer emission standard to monitor the ability of catalyzed PM filters to generate desired feedgas to promote better performance in a downstream aftertreatment component. Concurrently, similar to what is allowed for medium-duty vehicles, staff is proposing to exempt passenger cars, light-duty trucks, and MDPVs from this monitoring requirement if complete failure of the component or loss of the function results in (1) a tailpipe emissions increase that is less than 15 percent of the standard for any pollutant (NMHC, NOx (or NMOG+NOx if applicable), CO, or PM) over an applicable test cycle (e.g., FTP or Supplemental Emission Test (SET) cycle) during the useful life, and (2) tailpipe emissions (NMHC, NOx (or NMOG+NOx if applicable), CO, or PM) being below the standard with the failure. This would better ensure that any emission impact from a fault of these functions is truly ‘minor’ and is not necessary to meet the standard or provide significant compliance margin.

Staff is also proposing to amend the monitoring conditions for PM filter performance monitoring. Currently, the OBD II regulation requires this monitor to run every time the monitoring conditions are met. Manufacturers have indicated that requiring the monitor to run multiple times in a driving cycle may affect the PM sensor durability due to the multiple heating cycles per driving cycle, and also indicated that the PM filter would not be expected to fail over one driving cycle but not another driving cycle. To accommodate these concerns, staff is proposing to now only require the PM filter filtering performance monitor to run once per driving cycle.

7. DIESEL CRANKCASE VENTILATION (CV) MONITORING

The proposed amendments to the diesel CV system monitor requirements are similar to the previously described proposed changes to the gasoline PCV system monitor requirements (see section II.E.6. “Gasoline Positive Crankcase Ventilation (PCV) Monitoring”). The new proposed monitoring requirements for the diesel CV system would apply starting with the 2025 model year, which should provide substantial lead time for diesel manufacturers to make changes to their systems in order to meet the new requirements. The main differences between the gasoline PCV and diesel CV monitor proposals are that the amendments to the diesel CV system monitor requirements would not include monitoring exemptions for engines utilizing dry-sump lubrication or a test-out provision for the CV lines that are used to transport CV under boosted conditions. Since diesel engines do not tend to utilize dry-sump lubrication and do not have separate CV lines for boosted and non-boosted fresh air induction operation, the gasoline PCV allowances would not have been appropriate for diesel engines.

8. DIESEL ENGINE COOLING SYSTEM MONITORING

The OBD II regulation requires OBD II systems to monitor cooling systems for malfunctions that affect emissions or other diagnostics. Manufacturers often modify engine operation strategies based on ECT and utilize it to enable other OBD II diagnostics. Diesel engines generally use ECT to initiate closed-loop control of some emission control systems, such as EGR systems. Similar to closed-loop fuel control on gasoline engines, if the coolant temperature does not warm up, closed-loop control of these emission control systems will usually not begin. Malfunctions resulting in improper engine temperature regulation may disable OBD II diagnostics, reduce OBD II monitoring frequency, cause changes in engine and emission control operation, and cause an increase in vehicle emissions. Therefore, similar to the requirements for gasoline vehicles, OBD II systems in diesel vehicles and engines must monitor the ECT sensor for “time to reach closed loop enable temperature” malfunctions.

The existing requirements have raised issues requiring clarification because unlike gasoline vehicles, which generally have only one emission control system (i.e., the fuel system) that requires a minimum ECT to enable closed-loop control, diesel vehicles can have many emission-related controls (e.g., EGR system, SCR system, fuel pressure system) that require different minimum ECTs for closed-loop, feedback, or feed-forward operation. Staff is therefore proposing modifications to the language similar to current language in the HD OBD regulation to clarify this monitoring requirement for all diesel vehicles. Specifically, staff is proposing to change the title of section 1968.2(f)(11.2.2)(B) from "time to reach closed-loop enable temperature" to the more appropriate "time to reach enable temperature for emission control strategies." Further, the proposed amendments would make clear that manufacturers are required to detect faults if the "ECT sensor does not achieve the highest stabilized minimum temperature which is needed to begin closed-loop, feedback, or feed-forward operation of all emission engine control strategies." The manufacturer would be required to ensure that this temperature is achieved within a certain ARB-approved time interval.

Finally, similar to what is proposed for gasoline cooling system monitoring, staff is also proposing amendments for the diesel thermostat monitoring requirements regarding the usage of time-equivalent parameters, clarifications to the thermostat monitoring conditions, and vehicles using technologies other than thermostats to regulate ECT. Details of these proposed changes are described in section II.E.7. "Gasoline Engine Cooling System Monitoring" above.

9. DIESEL COLD START EMISSION REDUCTION STRATEGY MONITORING

Similar to what staff is proposing for gasoline cold start emission reduction strategy monitoring, staff is proposing amendments to clarify that OBD II systems must 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). Details of the proposed amendments are described in section II.E.8 "Gasoline Cold Start Emission Reduction Strategy Monitoring" above.

10. DIESEL VVT SYSTEM MONITORING

Staff is proposing amendments to the diesel VVT system monitoring requirements similar to those proposed for gasoline VVT system monitoring. Details of the proposed amendments can be found in section II.E.9. "Gasoline Variable Valve Timing and/or Control (VVT) System Monitoring" above.

11. DIESEL AIR CONDITIONING (A/C) SYSTEM COMPONENT MONITORING

Air conditioning system usage can significantly affect tailpipe emissions, and both gasoline and diesel vehicles are accordingly required to meet A/C test and SC03 emission standards (title 13, CCR section 1961(a)) to ensure that emissions generated during air conditioning operations remain well-controlled. To ensure that emission controls are maintained during periods of air conditioning operation, manufacturers of gasoline vehicles have employed revised fuel control, spark control, and other strategies.

The OBD II regulation currently requires OBD II systems in gasoline vehicles using such alternate engine control strategies to monitor the A/C system for failures prior to emissions exceeding an emission level, but does not require monitoring of most aspects of the proper operation of the driver-operated controls or the various sensors for sunlight load, passenger compartment temperature, and other parameters. This is because the A/C Test procedure ensures that the A/C compressor is operating virtually full time during the test, and therefore represents a worst case condition. At worst, failure of the above components could result in more A/C operation than otherwise selected by the driver, but the vehicle should still be capable of meeting the A/C Test standards. The exception would be for manufacturers that utilize an alternate engine control strategy for reducing emissions during air conditioning operation. Should the air conditioning system be commanded on but fail to become operational, the alternate engine control strategy would be invoked without increasing the engine load. Under these conditions, the level of emissions would be uncertain since the engine control strategy is not properly matched to the engine load. The other possibility is that failure of some components could result in the operation of the air conditioning system but not the alternate engine control strategy, which would also result in the mismatching of the engine load and control strategy. For example, should a manufacturer employ a richer fueling strategy to reduce NOx emissions, and this strategy was not invoked when the air conditioning was operating, higher NOx emissions might result.

Currently, the OBD II regulation does not contain similar A/C monitoring provisions for diesel vehicles as are in place for gasoline vehicles. Staff believes this may have been an oversight and that diesel vehicles should be subject to A/C system monitoring requirements, especially considering these vehicles are also subject to the SC03 emission standards and may have similar issues with emissions as those mentioned above due to A/C system-related malfunctions. Thus, staff is proposing to require 2019 and subsequent model year diesel vehicles using alternate engine control strategies during A/C operation to monitor the A/C system for malfunctions.

Specifically, OBD II systems in diesel vehicles using alternate engine control strategies would be required to detect failures of A/C system electronic components before emissions exceed a specific emission level based on either the FTP or SC03 standards. Generally, the FTP standards would be applicable for malfunctions occurring when a special engine control strategy has been invoked, but the compressor has not been engaged (i.e., the A/C system is off). The SC03 standards would be applicable for malfunctions that result in compressor engagement (i.e., the A/C system on) but with an accompanying A/C engine control strategy that is not active. The monitors for these components may involve electrical circuit and rationality diagnostics for input components and electrical circuit and functional checks for output components. By conducting electrical circuit checks in combination with monitoring of compressor cycling performance during appropriate periods or in response to commands issued as part of an intrusive monitoring strategy, manufacturers should be able to discern failed electrical components, including relays, pressure switches, compressor clutches, or others that cause emissions to exceed the emission threshold. The proposal would also require manufacturers to monitor A/C system components that are used as part of the monitoring strategy of any other monitored component or system. Additionally, the amendments would make clear that in addition to the A/C system component monitoring requirements under proposed section 1968.2(f)(14), manufacturers are also subject to the requirements of the comprehensive component monitoring requirements under section 1968.2(f)(15) if the A/C system is used as part of the hybrid vehicle controls (e.g., A/C system used to cool the hybrid battery system). This proposed language would ensure that even if manufacturers are not required to monitor the A/C system under section 1968.2(f)(14), they may still be required to monitor the A/C system for faults that affect the hybrid controls under section 1968.2(f)(15).

Based on experience with the A/C system monitoring requirements on gasoline vehicles, staff expects that very few A/C components on diesel vehicles will require monitoring under this proposal, but wants to ensure that adequate safeguards exist in case they are needed.

12. DIESEL COMPREHENSIVE COMPONENT MONITORING

As discussed in section II.F.2. “Diesel Oxides of Nitrogen (NOx) Converting Catalyst Monitoring,” staff is proposing to exempt OBD II systems from illuminating the MIL for low or no reductant and wrong reductant faults if a vehicle has an inducement strategy that prevents prolonged operation of the vehicle with low, no, or incorrect reductant. However, to ensure that the inducement strategy operates as expected and is repaired in a timely manner in the event of a malfunction of any of the electronic components involved in the inducement strategy, it is imperative that these components be monitored per the OBD II regulation and the MIL be illuminated in the event of a malfunction. Staff is therefore proposing that these components be monitored per the comprehensive component requirements. Because not all manufacturers may be currently monitoring components involved with inducement strategies, staff is proposing a three year phase-in of these requirements starting with the 2019 model year.

The OBD II regulation currently requires OBD II systems 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 to address this concern.

Staff is also proposing to streamline the “test out” requirements for diesel vehicles that utilize fuel control system components with tolerance compensation features implemented in hardware or software (section 1968.2(f)(15.2.2)(F)). Currently, manufacturers are required to submit emissions data to demonstrate that both single-cylinder and multiple-cylinder compensation failure modes meet the test out requirements if applying for an exemption from monitoring. The proposed changes would allow a manufacturer to submit an engineering analysis in support of the worst case emission demonstration (e.g., single-cylinder vs multiple-cylinder) in lieu of completing and reporting emission results for both single and multiple cylinder compensation malfunctions. The severity of malfunction for the demonstration will be maintained as described in the regulation (e.g., replacement of plus-one-sigma injectors with minus-one-sigma injectors without updating the compensation value).

Similar to what staff is proposing for gasoline comprehensive component monitoring, staff is proposing specific monitoring requirements for hybrid components on diesel vehicles as well as provisions pertaining to emissions neutral diagnostics, safety-only components/systems, smart devices, and exemptions from monitoring for components with minimal emissions impact. The proposed requirements were detailed in section II.E.11. “Gasoline Comprehensive Component Monitoring.”

13. DIESEL EXCEPTIONS TO MONITORING REQUIREMENTS

Staff recognizes that in certain circumstances, manufacturers may encounter situations that warrant the use of a higher emission malfunction threshold than the threshold specified in the OBD II regulation. While the appropriate remedy would be to revise the required emission thresholds in the regulation, there is a concern that the regulation would not be amended in a timely manner when the higher threshold is needed. Section 1968.2(e)(17.1) of the OBD II regulation therefore currently allows the Executive Officer, upon request of a manufacturer or upon the best engineering judgment of the ARB, to revise the emission malfunction thresholds for gasoline monitors if the most reliable monitoring method requires a higher threshold to prevent false indications of malfunctions. The regulation also allows this provision for medium-duty diesel vehicles in section 1968.2(f)(17.1).

Manufacturers have expressed concerns that a similar provision was not established for light-duty diesel vehicles, and have stated that such vehicles may experience the same situations that warrant revising malfunction thresholds for medium-duty vehicles and consequently also need the flexibility to use a higher threshold. Staff disagrees with comparing monitoring technical feasibility of light-duty diesel vehicles with that of medium-duty diesel vehicles. When the Board adopted the LEV II emission standards in 1998, the Board rejected a proposal to establish a less stringent emission standard that could be met by higher emitting light-duty diesel vehicles. This action set the precedent that all light-duty vehicles, regardless of the fuel or technology used, must meet the same emission standards. The LEV II emission standards are based on the capabilities of gasoline engines, which in general are the lowest emitting technology currently available. Staff followed the Board direction when developing light-duty diesel requirements in that the monitoring technical feasibility of light-duty diesel vehicles is tied to the monitoring feasibility on gasoline light-duty vehicles, not medium-duty diesel vehicles, and that thus the thresholds for light-duty diesel vehicles should match what is capable for light-duty gasoline vehicles. The current OBD II regulations also embrace this precedent by requiring diesel vehicles to meet the same monitoring requirements as gasoline vehicles. However, based on this logic, it would be more appropriate to allow light-duty diesel vehicles to utilize a higher threshold for a specific diagnostic if the corresponding diagnostic on a gasoline vehicle also needs a higher threshold. Thus, staff is proposing amendments that would provide this allowance for specific diagnostics on diesel passenger cars, light-duty trucks, and MDPVs certified to a chassis dynamometer tailpipe emission standard. Further, if a higher threshold is justified, the amendments would limit the new threshold to be less than or equal to the threshold required for the corresponding diagnostic on the gasoline vehicle.

Staff is also proposing to amend the requirements for medium-duty diesel vehicles (except MDPVs) certified to a chassis dynamometer tailpipe emission standard. The OBD II regulation currently requires these vehicles to meet the monitoring requirements and malfunction criterion (with a few exceptions) applicable to passenger cars, light-duty trucks, and MDPVs certified to a chassis dynamometer tailpipe emission standard starting in the 2016 model year. First, staff inadvertently did not include the exceptions for catalyzed PM filter feedgas generation monitoring (section 1968.2(f)(9.2.4)(B)) and for tracking and reporting of the in-use monitor performance of the NOx/PM sensor performance monitor (section 1968.2(f)(5.3.1)(A)), which currently requires medium-duty vehicles certified to a chassis standard to meet the same requirements as medium-duty vehicles certified to an engine standard. Staff is therefore proposing language to clarify this. Staff also inadvertently did not previously specify that chassis-certified medium-duty diesel vehicles would also use the procedure (specified in section 1968.2(f)(4.2.5)) for determining the diesel fuel system malfunction criteria applicable to medium-duty vehicles (including MDPVs) certified to an engine dynamometer tailpipe emission standard, and is thus proposing this language, since these vehicles were required to use the same procedures before the 2016 model year in accordance with section 1968.2(g)(17.1.5). Third, as mentioned above in section II.A. “Emission Malfunction Thresholds for Low Emission Vehicle III (LEV III) Applications,” staff is proposing emission malfunction thresholds specific to LEV III applications. Staff is thus proposing similar diesel vehicle amendments to account for the new LEV III requirements in terms of revised emission thresholds and associated monitoring requirements.

Also, similar to the changes proposed for gasoline vehicles, staff is proposing to allow disablement of a monitor during conditions such as high battery system voltages, and is also proposing to allow manufacturers to be exempt from monitoring a component based on criteria related to high vehicle speeds and cold ambient temperatures. More details were provided in section II.E.13. “Gasoline Exceptions to Monitoring Requirements” above.

G. STANDARDIZATION REQUIREMENTS

1. Reference Documents

Staff is proposing amendments that would update the SAE and ISO documents that are incorporated by reference into the OBD II regulation to reflect the most recently amended versions of such documents. As is common practice with technical standards, industry periodically updates the standards to add specification or clarity.

2. Diagnostic Connector

The OBD II regulation currently requires vehicles to be equipped with a standard data link connector (DLC) that meets prescribed specifications. The specifications, which are modeled after those in SAE J1962 “Diagnostic Connector – Equivalent to ISO/DIS 15031-3:December 14, 2001,” (April 2002), include the required location of the DLC, DLC cover specifications, and power requirements. Based on many years of OBD II certification review and OBD II-based inspections in the I/M programs, staff determined that the current requirements were not specific enough, which has resulted in wide variations in DLC placement and significant staff resources in approving DLC locations and designs. Non-standardized DLC locations have in certain situations caused difficulties during ARB vehicle testing and I/M testing.

Staff has worked with industry to update the SAE J1962 specifications in order to provide better guidance to manufacturers regarding DLC design and location placement. The revisions to SAE J1962 were finalized in 2012, and the proposed regulatory changes would incorporate by reference these new specifications. Although these proposed changes may require manufacturers to make changes to the vehicle interior design if not currently in compliance with the new requirements, staff is proposing that all manufacturers comply with the updated DLC requirements by model year 2019 because of the potential for issues to arise during I/M inspections. Additionally, staff is proposing to prohibit DLC covers starting in model year 2019. DLC covers can cause difficulty in locating the DLC due to a wide variation in design across different vehicles. DLC covers have also been lost or broken during service. Staff has expended significant time reviewing cover designs during certification in an attempt to ensure DLC covers do not impede service or I/M procedures. Prohibiting DLC covers would streamline the certification process. While this proposed change may result in platform hardware changes on some vehicles, manufacturers were informed many years ago of ARB’s intent to adopt this prohibition during the development of the new SAE J1962 specifications, so staff does not believe any start date later than the 2019 model year is appropriate.

Finally, staff is proposing amendments that clarify language regarding similar connectors that are located within the vicinity of the DLC. A few manufacturers have implemented additional connectors for manufacturer-specific (i.e., non-OBD II) purposes with similar design specifications and in same vicinity as the OBD II DLC. The additional connectors have resulted in confusion in the field and during I/M inspections as to which connector was related to the OBD II system. Thus, staff is proposing language to clarify that manufacturers may not equip vehicles with additional diagnostic connectors in the driver’s side foot-well region of the vehicle interior if the additional connectors can be mated to with SAE J1962 “Type A” external test equipment. This would help avoid confusion among technicians or inspectors attempting to identify the 'correct' diagnostic connector to retrieve OBD information from the vehicle. Since this prohibition is technically covered in the current OBD II regulation, which states that the DLC is required to be "easily identified by a 'crouched' technician entering the vehicle from the driver's side," this requirement is being proposed without any lead time.

3. Readiness

Staff is proposing amendments to the readiness status requirements in the OBD II regulation. Manufacturers are presently required to incorporate readiness status indications of several major emission control systems and components into their OBD II systems, which help determine if OBD II monitors have performed their system evaluations. When an OBD II system is interrogated by an off-board tool, it reports 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 a vehicle is ready for an OBD-based inspection (i.e., that monitors have run prior to inspection) and the OBD data is valid as the basis for an 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 (including the monitors that require regeneration events) to ensure that any faults of these important emission controls are properly identified, even though they may require extended time periods to complete. Staff is therefore proposing revisions to clarify exactly which monitors are required to be included when determining readiness status to ensure consistency in implementation among all manufacturers. Manufacturers would be required to meet the new proposed requirements starting with the 2019 model year.

Staff is also proposing amendments to correct manufacturers' 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). Specifically, the proposal would require OBD II systems to include the monitor only in the readiness status for the component/system for which the monitor is primarily calibrated, intended, or expected in-use to detect faults. This proposed requirement would be required starting with the 2019 model year.

4. Data Stream Parameters

OBD II systems are required to report certain “real-time” data parameters in a standardized format that a generic scan tool can process and read. Such data are used by technicians for troubleshooting malfunctions, by inspectors for making inspection pass/fail decisions, and by ARB staff in assessing compliance with ARB requirements and determining the in-use emission performance of vehicles. Staff is now proposing several additional data stream parameters that OBD II systems would be required to make available.

<u>PEMS-related parameters</u>
For all diesel vehicles, staff is proposing that OBD II systems report the following parameters: cylinder fuel rate, engine fuel rate, vehicle fuel rate, modeled exhaust flow (mass/time), engine reference torque, engine friction - percent torque, and actual engine - percent torque. In addition to assisting technicians during service and repair, the proposed data stream parameters would make it easier to conduct valid in-use emission tests with PEMS. Thus, these parameters need to be reported accurately in the applicable electronic control module to facilitate testing. Regarding the fuel rate parameters, while the “fuel rate” parameter is already required on 2010 and subsequent model year diesel vehicles ‘if equipped,’ this proposed amendment would ensure “all” diesel vehicles support it. The torque parameters are necessary to calculate the net brake torque output from the engine. Diesel engine dynamometer-certified engines must comply with the Not-To-Exceed (NTE) emissions standards measured in g/bhp-hour. PEMS equipment requires that the torque be calculated and reported by the engine so that emissions can be reported in g/bhp-hour. Staff has learned that some manufacturers were not consistent in the torque output reported to scan tools, and certain manufacturers were including additional torque losses in the engine friction parameter that resulted in erroneous emissions calculations during PEMS testing for NTE compliance. These parameters, in addition to staff’s proposal to require manufacturers to plot the net brake torque and “calculated net brake torque” on the FTP and SET cycles (described in more detail in section II I. “Certification Documentation”), would allow staff to verify that the net brake torque as calculated by a scan tool is consistent with the net brake torque as calculated by an engine dynamometer and are needed to ensure valid PEMS emissions measurements are obtained to determine NTE compliance.

Staff is also proposing that OBD II systems provide these same parameters for all gasoline vehicles. While gasoline vehicles are currently not subject to PEMS testing, these parameters may be used by manufacturers to enable certain monitors, so access to the parameters would assist staff during certification. Some future gasoline vehicles may also be equipped with lean-burn strategies that use parameters such as vehicle fuel rate to determine fuel injection into the aftertreatment to induce rich conditions or increase exhaust temperatures. Hence, access to such parameters may also be helpful to technicians during service and repair of the gasoline vehicles. These parameters would be required on all gasoline and diesel vehicles with a phase-in starting in the 2019 model year.

Vehicle and fuel usage parameters

Staff is proposing to require vehicles to incorporate additional data parameters to characterize vehicle CO_2 emissions in the real world (section 1968.2(g)(6)). Such data would be required on new cars starting in the 2019 model year, and would be used to help verify that the advanced vehicle and powertrain technologies being deployed to meet ARB's stringent greenhouse gas emission standards actually deliver the expected greenhouse gas benefits and consumer fuel savings in the real world. These parameters would be stored within the vehicle's own engine control unit in an aggregate format— not second-by-second or even trip-specific data — to allow ARB to quantify the overall CO_2 performance of these new engine and vehicle technologies. The data would not contain any information regarding how an individual vehicle was being operated during any given time period or during any specific trips. Further, the data would specifically not include any information that could be used, directly or indirectly, to identify a vehicle's current or past location or any data that could be used to identify current or past vehicle operation in excess of speed limits or any other traffic law. The data, by design, could only be accessed from the vehicle by physically plugging a specialized tool into the diagnostic port located inside the vehicle while the vehicle is on, ensuring such data could not be broadcast, transmitted, or otherwise obtained remotely. In other words, this virtually ensures that there is some level of participation by the vehicle operator in granting access.

For all vehicles, staff is proposing that the data include the following parameters: cumulative distance traveled, cumulative fuel consumed, cumulative positive kinetic energy used, cumulative calculated engine output torque, cumulative propulsion system active time, cumulative idle propulsion system active time, cumulative city propulsion system active time, total engine run time, and total idle run time. These data are specifically targeted to quantify the CO_2 performance of the vehicle relative to how the CO_2 performance is assessed during certification. Specifically, vehicles are rated for CO_2 performance (and fuel economy) over a city-like driving cycle combined with a highway-like driving cycle, so the corresponding data would facilitate a more direct comparison with the certification data. Further, the fraction of time spent at idle can vary significantly and vehicle manufacturers are already introducing technologies such as stop-start systems that shut off the engine during some idle conditions to achieve CO_2 reductions during idle. These data would help confirm the assigned benefits are appropriate.

Additionally for plug-in hybrid electric vehicles, staff is proposing that the data include the following parameters: cumulative distance traveled in charge depleting operation with the engine off, cumulative distance traveled in charge depleting operation with the engine on, cumulative distance traveled in charge increasing operation, cumulative fuel consumed in charge depleting operation, cumulative fuel consumed in charge increasing operation, cumulative grid energy consumed in charge depleting operation with the engine off, and cumulative grid energy consumed in charge depleting operation with the engine on. Such data are essential for understanding the CO_2 emissions from plug-in hybrid electric vehicles as they are being used in the real world and to inform future rulemaking changes regarding proper credit for their GHG benefits.

For vehicles equipped with ‘active’ technologies that are assigned additional off-cycle credits towards meeting the GHG vehicle standards (e.g., haptic-feedback pedals, driver coaching, active aerodynamics), staff is proposing that these vehicles include data regarding each technology’s usage in the real world to verify that the credits assigned at the time of certification are representative of actual usage. While the data could not be used to retroactively increase or decrease the assigned credit values, the data could be used to more accurately assign credits for those technologies on future vehicles that get certified. These data would be structured similar to how “emission-increasing auxiliary emission control devices” (EI-AECDs) are currently logged in medium- and heavy-duty diesel vehicles, with some modifications. For each technology employed by a given vehicle, the manufacturer will assign a number (e.g., Active Off-Cycle Credit Technology #1, Active Off-Cycle Credit Technology #2, Active Off-Cycle Credit Technology #n) and report that assignment to ARB as part of the confidential information submitted at the time of certification. For each technology, there would be two logged items (e.g., Active Off-Cycle Credit Technology #1 counter 1 and Active Off-Cycle Credit Technology counter 2). For most items where the driver has no direct control over the activation of the technology, the data would then simply identify the cumulative amount of time the technology was utilized. For technologies that can have a varying amount of action or authority (e.g., an active ride height system that progressively increases the amount of ride height reduction based on increasing vehicle speed), the system would separately identify the cumulative time the system is active at a level representing less than 75 percent of the maximum adjustment or authority it has (counter 1) as well as the cumulative time the system is active at a level representing 75 percent or more of its maximum adjustment or authority (counter 2). For technologies where it is essential that the driver take action to achieve the benefits of the technology (e.g., driver coaching or feedback-based systems alerting the driver to take action to avoid unnecessary braking or acceleration), the data would be structured to identify both the cumulative time that the technology was enabled (counter 1) and then the number of occurrences where the system alerted the driver and the driver responded to the warning such that the benefits of the technology were achieved (counter 2). For example, a system might require the driver to select an ‘eco’ mode and when active, alert the driver whenever it sensed that an upcoming braking event would be needed to try and encourage the driver to let off the accelerator earlier and slow down by coasting rather than braking. In such a case, the system would identify the cumulative time the ‘eco’ mode was selected and the number of occurrences where the driver was alerted to an upcoming need for braking and the driver indeed responded by releasing the accelerator and coasting the vehicle rather than continuing to accelerate and then transitioning directly to braking. By design, this data structure would provide confirmation of the overall frequency of real world activation of such a technology and its likely benefit without storing any data as to when, where, or why a driver chose to enable or disable a technology or as to when, where, or why the driver chose to heed or ignore the feedback provided by the system.

Staff is proposing that all of these new data parameters be stored in NVRAM within one of the vehicle's onboard computers used for engine control. This type of memory storage would prevent the data from being erased during routine service events and ensure a sufficient amount of time/mileage is likely available. Also, by ensuring these new data would be stored/reset in the same manner as that being proposed for in-use monitor performance ratio data (as described in section II.D. "Standardized Method to Measure Real World Monitoring Performance"), staff would be able to correlate these proposed new data with data already required (i.e., in-use monitor performance ratio data) to verify compliance with the OBD II regulation itself and avoid the need for redundant data to be stored (i.e. for in-use monitor performance ratio data to be stored in both keep alive memory (KAM) and NVRAM). Staff is also proposing that a second set of all of the new parameters identified above be stored in volatile memory, with the data subject to erasure during routine service or repair events. This second set of data will reflect more recent CO_2 (and fuel economy) performance of the vehicle to better identify short term changes that may have resulted based on a recent malfunction, deterioration, or other significant change in engine operating characteristics as well as provide assistance to technicians that may be diagnosing consumer complaints of reduced or poor fuel economy.

As noted, these proposed data would primarily be used to characterize the vehicle's CO_2 emissions in the real world. As ARB and its partner federal agencies have adopted increasingly stringent CO_2 and fuel economy standards, vehicle manufacturers are introducing new engine and vehicle technologies to reduce CO_2 emissions, though the reductions assigned to these technologies are based on a limited set of certification test cycles that will likely differ, by varying amounts, from actual reductions achieved in the real world. Further, vehicle manufacturers are charging higher incremental prices to consumers for these technologies and consumers are choosing these technologies based on expectations that the fuel savings from the reduced CO_2 emissions/increased fuel economy will more than offset the higher incremental costs. If specific technologies or applications of technologies have real world benefits that are disproportionally less than represented by the results obtained during certification, California will not realize the intended GHG emission reductions nor will consumers realize the expected fuel savings to recoup the additional money paid for the vehicle. These data would help ensure that the technologies are delivering such benefits to consumers and could be used to identify vehicle models or technologies that should be explored further by ARB or its partner federal agencies for compliance with the standards. As already evidenced by the increased number of instances in the last few years where federal agencies have required vehicle manufacturers to relabel specific vehicle models with lower fuel economy than originally claimed for certification, there will be a continued need for the agencies to be vigilant in verifying CO_2 (and fuel economy) performance.

ARB also anticipates using such data for other purposes, including the development of future CO_2 tailpipe standards that would better ensure real world reductions are achieved, the evaluation of 'off-cycle' credits granted to vehicle manufacturers for specific engine and vehicle technologies that primarily work in conditions outside of those represented by the certification test cycles, the development of future plug-in hybrid electric vehicle regulations that more accurately represent the emission reductions these vehicles achieve, and improvement of GHG inventory models utilized by ARB to accurately project benefits from current and future regulatory measures being considered when planning for compliance with the State's GHG goals. As recently discussed in a 2015 National Academy of Sciences report,[6] there is a significant need for current real-world fuel economy data because many of the studies done previously are out of date and therefore may not accurately represent today's vehicle technology and vehicle use. The report goes on to recommend that "The Agencies…should conduct an ongoing scientifically-designed survey of the real-world fuel economy of light-duty vehicles. The survey should also collect information on real-world driving behavior and driving cycles. This information will be useful in determining the adequacy of the current test cycle and could inform the establishment of improved, future (post-2025) test cycles, if necessary. The survey should make use of modern information technology connecting to the onboard diagnostic systems of light-duty vehicles to make data collection simultaneously comprehensive and unobtrusive to the driver on a day-to-day basis while addressing privacy concerns." The proposed vehicle and fuel usage parameters would make such ongoing surveys possible.

These data could also be used by vehicle owners, repair technicians, and vehicle manufacturers. Vehicle owners may benefit from such data by being able to better verify the fuel economy of their vehicles. Repair technicians could use the data to help diagnose and repair faults or complaints of reduced fuel economy. Vehicle manufacturers could also use the data to obtain more accurate data about the fuel economy performance of their vehicles or to assist them in providing data from actual in-use vehicles as required by federal agencies to confirm off-cycle credit technologies are performing as expected.

As part of this proposal, it is important to note that ARB is not proposing to mandate or require drivers or vehicle owners to make such data available to ARB or anyone else. To obtain data in a timely manner, ARB or its designated contractor would solicit voluntary participation from vehicle owners to allow ARB to collect the data from their vehicles. Such a process is already extensively used by ARB when procuring privately owned vehicles or data from vehicles to verify vehicle manufacturer compliance with other ARB regulations and emission standards. Within this process, only participants that have positively responded to such a request for voluntary participation are followed up with, informed of the data and/or testing ARB will be using from their vehicle, and compensated for their efforts. This is a process similar to that currently used for in-use compliance testing efforts that target a small sample of vehicles from a specific vehicle make and model to verify a specific vehicle or powertrain technology. Vehicle manufacturers could also be required to collect and report the data to ARB from a

[6] National Research Council: "Cost Effectiveness and Deployment of Fuel Economy Technologies for Light-Duty Vehicles," Chapter 10, pages 17-19, 37. 2015 Pre-publication copy. http://www.nap.edu/catalog/21744/cost-effectiveness-and-deployment-of-fuel-economy-technologies-for-light-duty-vehicles

limited number of in-use vehicles to help verify compliance as is currently done with other ARB requirements. This method also requires permission from the vehicle owner for participation. While data collection during the biennial Smog Check inspection is also a possibility, the current inspection equipment is not capable of collecting such data, so updated equipment would need to be deployed in order for data collection to be possible. Further, since the program exempts cars for the first 6 years, by the time the data would be collected, the vehicles would already be through a significant part of the their in-use life and as such, have less usefulness in verifying that the latest technologies are indeed delivering the benefits. And lastly, since collection of such data in a future inspection program would not be necessary to properly pass or fail a vehicle, the collection could readily be structured such that it is optional and the data gathered only if the vehicle owner/driver consents to such additional data being collected.

Other parameters

Staff is also proposing that vehicles equipped with certain technologies report specified data parameters. Staff proposes that OBD II systems in gasoline and diesel vehicles equipped with NOx sensors report the “NOx sensor corrected” parameter starting in the 2019 model year. The OBD II regulation already requires diesel vehicles to output the NOx sensor output, but several manufacturers 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 have other adaption strategies that are used to adjust the raw signal. Given that the control systems would likely be acting on this corrected signal rather than the raw signal, the corrected NOx sensor parameter could provide valuable information for technicians when troubleshooting detected malfunctions. Most gasoline vehicles are currently not equipped with NOx sensors, but a few manufacturers have or are currently designing gasoline vehicles with lean-burn systems that utilize control technologies commonly found on diesels such as SCR systems and NOx traps, and thus NOx sensors. As such, staff believes that requiring such gasoline vehicles to output the NOx sensor corrected parameter would assist technicians in repairing and servicing vehicles as well as assist staff during certification review and compliance testing.

For all diesel vehicles equipped with a reductant (i.e., diesel exhaust fluid or DEF) quality sensor and/or DEF dosing system, staff is proposing that OBD II systems make available the following parameters starting in the 2019 model year: DEF sensor output, DEF dosing percent duty cycle, and DEF dosing rate. These parameters are necessary to assist staff in certification review and OBD compliance testing. Manufacturers frequently use these parameters to enable diagnostics and staff would use these parameters to verify monitors execute properly when the vehicle is driven in the reported enable conditions.

Staff is also proposing to require OBD II systems in hybrid vehicles to output new data stream parameters starting in the 2019 model year. Specifically, OBD II systems would be required to report the hybrid/EV charging state, hybrid/EV battery system voltage, and hybrid/EV battery system current parameters. These parameters would help technicians in diagnosing and repairing malfunctions in hybrid vehicles and are also necessary to assist staff in certification review and compliance testing.

Staff is also proposing all vehicles to electronically provide the odometer reading starting in the 2019 model year. This parameter would be used to help better support I/M programs, which currently require technicians to read the odometer from the dashboard and manually enter the value into the test equipment. This process, however, has led to errors in transcription in some cases.

Finally, staff is proposing to require OBD II systems to output a new data stream parameter related to the gasoline evaporative system 0.020 inch leak monitor. While ARB's OBD II regulation currently requires monitoring of 0.020 inch leaks, U.S. EPA's federal OBD regulation previously did not. Recently, U.S. EPA adopted a new 0.020 inch leak standard to apply to federal vehicles and concurrently required manufacturers to phase-in evaporative system monitoring of 0.020 inch leaks beginning in the 2016 model year. U.S. EPA is planning to utilize the 0.020 inch leak monitor in making pass and fail determinations during its in-use verification program (IUVP), and is therefore also requiring manufacturers to output a new data stream parameter to facilitate the implementation of the leak standard within IUVP. Specifically, the parameter would indicate the distance that the vehicle traveled since the 0.020 inch leak monitor (or the monitor for the smallest leak size) last ran, completed, and made a pass/fail decision (new Info Type $14 in Service $09 of SAE J1979-DA). The parameter would be reset to the maximum value (65,535 km) when fault information is cleared by a scan tool or in the event of a reprogramming event, and would be reset to zero when the evaporative system monitor ran and made a pass/fail decision. ARB staff is now proposing to require this same parameter in the OBD II regulation. Manufacturers would be required to phase-in this new parameter on vehicles that are required to meet the new leak standards and procedures specified in title 13, CCR section 1976(b)(1)(G)6,[7] which align with the U.S. EPA requirements. The proposed requirement would begin to phase-in starting in the 2018 model year – 60 percent of 2018 model year, 60 percent of 2019 model year, 80 percent of 2020 model year, 80 percent of 2021 model year, and 100 percent of 2022 model year vehicles. The proposed phase-in schedule would align with the proposed phase-in schedule for incorporating the 0.020 inch leak test into the California IUVP as part of the LEV III rulemaking update. To align with the federal regulation requirements for small volume manufacturers, staff is proposing to require small volume manufacturers to support this parameter starting in the 2022 model year.

5. Test Results

The OBD II regulation requires OBD II systems to store the most recent monitoring results for most of the major monitors and to make available to scan tools certain test information (i.e., the minimum and maximum value test limits as well as the actual test

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[7] Title 13, CCR section 1976(b)(1)(G)6 was proposed as part of the LEV III regulation update (Board hearing October 23, 2014). It is anticipated that this regulation section will be officially approved by the Office of Administrative Law by September 2015.

value) of the most recent monitoring event, which is intended to assist technicians in diagnosing and repairing malfunctions. The regulation currently exempts the gasoline fuel system monitor from storing and reporting test results and limits since gasoline fuel system monitoring was generally required to run continuously when the requirement was first adopted. However, ARB has subsequently adopted gasoline fuel system monitoring requirements for air-fuel ratio cylinder imbalance faults, where monitoring is not required to run continuously. Thus, staff is proposing to require OBD II systems in vehicles with dedicated air-fuel ratio cylinder imbalance monitors (not those that detect these faults using other existing monitors such as the misfire monitor) to store and report the test results and limits for these monitors with a three-year phase-in starting in the 2019 model year.

Although the current regulation exempts monitors that are required to run continuously from this requirement, staff believes some continuous diesel monitors should store and make available this information. These monitors include the diesel fuel system pressure control monitors, diesel EGR system low flow and high flow monitors, and diesel boost pressure control system underboost and overboost monitors. While staff recognizes that there will be a lag between the decisions currently being made and decisions that the technician is currently looking at on a scan tool for these continuous monitors, the results could still be beneficial when diagnosing intermittent malfunctions. Such malfunctions may be present long enough for technicians to see or, more likely, current scan tools will be able to continuously update test results and log them so a technician could scroll through the data to look for anomalies. Some manufacturers also indicated that for many of the continuous monitors, such as fuel pressure, a technician might be better served by watching the instantaneous fuel pressure rather than periodically updated test results. However, manufacturers often use complicated algorithms to determine if a system is passing or failing (e.g., integrated pressure error above and beyond a variable level of expected deviation from the commanded pressure) that would not be discernible to a technician visually observing instantaneous fuel pressure. Outputting the results that are already being calculated internally in the computer is feasible and could provide tangible benefits to repair technicians. Thus, staff is proposing to require such monitors to meet this requirement starting in the 2019 model year.

Finally, to make the requirement clearer, staff is proposing to specifically identify which monitors are exempt from storing and reporting the test results. These monitors generally include circuit and out-of-range monitors as well as diesel feedback control monitors.

6. CVN

To ensure that the correct software has been installed, the OBD II regulation requires manufacturers to incorporate software CAL ID and CVN in their vehicles. The CAL ID identifies the version of software installed in the vehicle while the CVN helps to ensure that the software has not been inappropriately corrupted, modified, or tampered. Both CAL ID and CVN can be used in combination to ensure the integrity of the OBD II system during I/M inspections, so the CAL ID-CVN combination must always be present. However, the OBD II regulation currently requires manufacturers to make available a CAL ID in each “diagnostic or emission critical powertrain control unit” and to calculate a CVN in all “diagnostic or emission critical electronically reprogrammable powertrain control units.” Limiting CVN information to just “electronically reprogrammable” control units was an oversight because staff intended that manufacturers make available the CVN in all control units that required a CAL ID (i.e., in all diagnostic or emission critical powertrain control units). Thus, staff is proposing to delete the existing reference to “electronically reprogrammable” so that all diagnostic or emission critical powertrain control units must support CVN, regardless of whether or not they are reprogrammable.

The OBD II 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 DLC to a generic scan tool in accordance with the requirements in SAE J1979. The only exceptions allowed in the regulation are for extreme circumstances where the stored value has been erased and not yet had an opportunity to be calculated and re-stored. Specifically, a CVN is not required to be made immediately available to a scan tool if it is requested “immediately after” the ECU is reprogrammed or the non-volatile memory is cleared, or within 30 seconds of a volatile memory clear or battery disconnect. Several manufacturers have indicated that the existing timeframes may be insufficient to recalculate a new CVN and have it available. To address this concern and given the very limited and rare scenarios in which the timeframes apply, staff is proposing to extend the timeframe to within 120 seconds after a reprogramming event, non-volatile memory clear, volatile memory clear or battery disconnect. Additionally, staff is also proposing 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.

Staff is also proposing clarifying language that in the event the CVN is requested, except for the period after a reprogramming event or non-volatile/volatile memory clear, when the CVN had not been recalculated, the on-board computer may not respond with a message indicating that the CVN is not currently available (i.e., negative response code) or with a default value (e.g., $00). As mentioned above, the CVN should always be available in most circumstances, considering the CVN is calculated once per ignition cycle and stored until replaced by an updated CVN calculation. Negative response codes create unnecessary bus traffic, which can delay CVN being made immediately available upon request by a generic scan tool. Additionally, default values would create more confusion for technicians because the default values may be mistaken for actual CVN values, or may cause technicians to mistakenly believe that CVN is not supported when in fact it is. Staff is therefore proposing that in those situations involving a reprogramming event or non-volatile/volatile memory clear, if the CVN is requested before it has been recalculated, the on-board computer would be allowed to send a negative response code but would be prohibited from sending default values.

7. Erasure of Emission-Related Information

Staff is also proposing amendments related to the erasure of emission-related information. Currently, the OBD II regulation allows permanent fault codes to be erased when the individual control module containing the permanent fault code is reprogrammed only if the readiness status for all monitors (in all emission-related modules) is set to "not complete." Specifically, the current language of section 1968.2(g)(4.4.6)(D) reads "permanent fault codes may not be erased when the control module containing the permanent fault codes is reprogrammed unless the readiness status ... for all monitored components and systems is set to "not complete" in conjunction with the reprogramming event." The rationale for clearing all information was to reduce the opportunity for selective reprogramming events to evade indications of detected faults during I/M inspections or to avoid necessary repairs. Manufacturers, however, have not been implementing the requirement as intended. Specifically, when reprogramming the control module containing the permanent fault code, some manufacturers are only resetting the readiness status in the reprogrammed control module. In addition to arguing that they believe the regulation language allows for this, manufacturers have also argued that they do not see any benefit in requiring that readiness bits in all control modules be reset, and indicated it is highly unlikely that drivers would reprogram the control modules in an attempt to avoid proper repair of emission-related malfunctions. Staff does not agree that the existing language allows for this, though staff understands it may be difficult for drivers to use this to cheat the I/M program. Thus, while staff is proposing changes to the language to clarify the original intent of the requirement, staff believes some additional changes could be made while still meeting the original intent of the requirement. 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 readiness is reset only in those modules that support readiness bits 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 ECU that supports readiness bits for major components and five auxiliary emission-related modules that don't support readiness bits 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 II 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. Manufacturers would be required to implement this change with a three-year phase-in starting in the 2019 model year.

A similar issue exists regarding the vehicle identification number (VIN) requirements. The OBD II regulation currently requires all emission-related information (including the readiness bits) from all emission-related modules to be erased in conjunction with the reprogramming of the VIN. Specifically, the current language of section

1968.2(g)(4.8.2) reads “if the VIN is reprogrammable, all emission-related diagnostic information (i.e., all information required to be erased in accordance with SAE J1979 specifications when a Mode/Service $04 clear/reset emission-related diagnostic information command is received) shall be erased in conjunction with the reprogramming of the VIN.” Similar to the permanent fault code requirement above, staff’s intent with this requirement is to reduce the opportunity for selective reprogramming events to be used to evade detection during inspections or avoid necessary repairs. Some manufacturers, however, only reset the readiness bits in the control module containing the VIN when reprogramming the VIN, believing that the current language allows for this. Some manufacturers have also argued that the VIN is only stored in the engine control module, which should contain all the major readiness bits (aside from all comprehensive components), and that actions that affect only certain control modules should not require resetting of readiness bits or erasing of emission-related information from “all” control modules. While this may not be a significant issue for manufacturers that store the VIN in the engine control module, not all manufacturers store the VIN in that module. For those manufacturers that do not, reprogramming of the VIN might not reset the major readiness bits if only the readiness bits in the control module containing the VIN are reset. Staff believes the regulation is clear that resetting all readiness bits, not just the readiness bits in the control module containing the VIN, is required. Nonetheless, considering that vehicle owners will not likely attempt to cheat inspections by using this allowance, staff is proposing changes that clarify the original intent of the requirement and is also proposing changes similar to those proposed for erasing permanent fault codes that would limit the number of control modules involved while keeping the original intent of the requirement. Specifically, staff is proposing that if a VIN is reprogrammed, OBD II systems would be required to erase all emission-related information (including the readiness bits) only in those modules that support readiness for major components (i.e., any readiness bits other than comprehensive components). Manufacturers would be required to implement this change with a three-year phase-in starting in the 2019 model year.

Staff is also proposing amendments that specify the emission-related diagnostic information that must be erased in the event of a scan tool command or disconnection of the power to the on-board computer. As mentioned above, 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. The proposed amendments would specify that all the following information from all diagnostic or emission critical control units would be required to be erased in the event of a scan tool command or disconnection of the power to the on-board computer: readiness status, data stream information (including MIL status, number of stored confirmed fault codes, distance traveled (or engine run time for engines not utilizing vehicle speed information) while MIL activated, number of warm-up cycles since fault memory last cleared, and distance traveled (or engine run time for engines not utilizing vehicle speed information) since fault memory last cleared), freeze frame information, pending and confirmed fault codes, and test results. This amendment would be required starting with the 2019 model year.

Manufacturers have expressed concerns that if all the specified information were erased, it could result in a safety issue. Specifically, because some malfunctions are mitigated by remedial actions that are triggered by the detection of the malfunction and subsequent storage of a fault code, clearing of all emission-related diagnostic information while the vehicle is operated could result in loss of the remedial action and pose a safety issue to the driver or technician. To avoid these potential safety issues, manufacturers inhibit clearing of this information unless the vehicle is off or not in the propulsion system active state (i.e., in the “key on, engine off” position). To address these concerns, staff is proposing two alternatives to erase fault codes. The first alternative allows a manufacturer to erase all emission-related diagnostic information under conditions other than or in addition to vehicle "key on, engine off" conditions. This option would achieve staff’s objectives of coordinated code clearing, while allowing manufacturers to ensure that all diagnostic information is cleared in a way that is safe for drivers and/or technicians. The second alternative allows a manufacturer to erase the emission-related diagnostic information from some or all of the control modules that report only the comprehensive component readiness bit, provided that all emission-related diagnostic information from control units that support readiness for a readiness bit other than comprehensive components is erased and that there exist “key on, engine off” conditions in which all emission-related diagnostic information in all control units can be erased. The proposed amendments would also make clear that, except for these specific conditions, the OBD II system would not allow a scan tool to erase only a subset of the information. This option is necessary to ensure that safety-related default modes remain latched until it is safe to remove the default action (i.e., the malfunction is repaired and the appropriate actions have been taken to ensure that safety has been restored).

H. CERTIFICATION DEMONSTRATION TESTING REQUIREMENTS

The OBD II regulation requires manufacturers to conduct emission demonstration testing prior to certification of their OBD II systems to demonstrate that their OBD II systems are capable of detecting faults before the applicable emissions thresholds are exceeded for monitors that require detection of faults before emissions exceed a specific level.

<u>Demonstration testing of monitors on gasoline and diesel vehicles</u>
The OBD II regulation currently does not require demonstration testing of the gasoline evaporative system monitors since the monitors are not calibrated to emission malfunction thresholds. However, as mentioned above in section II.G.4. “Data Stream Parameters,” U.S. EPA recently adopted a new 0.020 inch leak standard in their federal OBD regulations and concurrently required manufacturers to phase-in evaporative system monitoring of 0.020 inch leaks beginning in the 2016 model year. Further, U.S. EPA amended the federal regulations to require manufacturers to test the 0.020 inch leak monitor (or the monitor that detects the smallest leak) on 2017 and subsequent model year vehicles prior to certification, to ensure that the monitor is able to detect 0.020 inch leaks, store the appropriate fault code, and illuminate the MIL, thus ensuring the use of the monitor as part of the IUVP program. During the regulatory update for

U.S. EPA's regulation, ARB indicated its intent to harmonize with U.S. EPA's amendments and thus is requiring manufacturers to perform this demonstration test on the 0.020 inch leak monitor on their demonstration test vehicles. Manufacturers would be required to perform a test with a 0.020 inch leak implanted near the fuel fill pipe side (either at the fuel cap or between the fuel cap and fuel tank) and a test with a leak implanted near the canister (either in the vapor line between the canister and fuel tank or between the canister and purge valve). Manufacturers with multiple canisters or fuel fill pipes would need to perform tests for each canister and fuel fill pipe. Manufacturers may also propose alternate locations to implant the leak, which ARB would approve based on data showing the alternate location more effectively demonstrates leaks for that particular evaporative system design. Unlike the requirements for demonstration testing for other monitors, however, manufacturers would not be required to test the leak monitor on the required test cycles stated in the demonstration testing section; manufacturers would only need to run the vehicle under driving conditions that would enable the leak monitor to run and complete. Testing may take place in a laboratory, with or without a dynamometer, or outdoors on the road. Manufacturers would also not be required to test this monitor on a durability test vehicle or vehicles aged to full useful life as required for other demonstration test vehicles, and instead are allowed to test the leak monitor on a production-representative vehicle. Manufacturers would be required to collect the standardized data required to be collected for demonstration testing only after the leak monitor has completed and illuminated the MIL. Further, manufacturers would not be required to collect emission data during this testing. Finally, to align with allowances made in the U.S. EPA's regulations for small volume manufacturers, testing of this monitor would not be required for these manufacturers until the 2022 model year.

Staff is also proposing amendments to the OBD II testing requirements for gasoline oxygen sensor emission threshold-based monitors to identify the specific failure modes required to be tested. Specifically, for conventional oxygen sensors, a 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 (i.e., asymmetric slow response malfunction). For wide range or universal sensors, a 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 symmetric response rate malfunction that results in delays during transitions from rich-to-lean and lean-to-rich sensor output (i.e., symmetric slow response malfunction). For the worst case malfunctions, manufacturers would need 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.

The regulation currently specifies the testing required for gasoline fuel system monitoring. Staff, however, inadvertently omitted testing of the air-fuel ratio cylinder imbalance monitor, which is an element of the gasoline fuel system monitoring requirements. To remedy this oversight, staff is proposing amendments that would now detail the testing requirements for this monitor. Staff is proposing that manufacturers perform a test at the rich limit and a test at the lean limit with a fault induced on the cylinder that would result in the worst case emissions for each limit. 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." Although this requirement properly applies to for testing of the main fuel system feedback monitor, it does not properly apply to testing of other fuel system monitors such as the air-fuel ratio cylinder imbalance monitor, which, by definition, is 'non-uniform' and can in some cases produce misfire. Therefore, staff is proposing to amend the regulation to limit this requirement to testing of the main fuel system feedback monitor.

Staff also inadvertently omitted requirements to conduct demonstration testing of the gasoline cold start emission reduction strategy monitor and the diesel other emission control or source system monitor, which may be calibrated to an emission malfunction threshold, and is therefore now proposing to require manufacturers to conduct these tests. Furthermore, based on manufacturers' concerns about implanting faults for cold start monitor parameters such as ignition retard and staff's past experience in reviewing these tests, staff is also proposing to allow manufacturers to conduct cold start emission reduction strategy monitor demonstration tests by using computer modifications to simulate malfunctions, provided manufacturers demonstrate such modifications produce test results equivalent to an induced hardware malfunction. This proposal would apply to testing of both the gasoline and diesel cold start emission reduction strategy monitors.

Staff is also proposing changes to align with the amendments proposed for the gasoline and diesel misfire monitoring requirements. As mentioned above for gasoline misfire monitoring (section II.E.1. "Gasoline Misfire Monitoring"), staff is proposing that manufacturers of plug-in hybrid electric vehicles detect misfire malfunctions when the percentage of misfire exceeds 2 percent in lieu of emission threshold-based malfunction criteria. Concurrently, staff is proposing changes to the demonstration requirements exempting manufacturers from conducting demonstration testing of the monitor if the vehicle uses the 2-percent malfunction threshold. However, if a manufacturer uses a threshold higher than 2-percent misfire, as staff is proposing to allow, manufacturers would be required to perform demonstration testing of the misfire monitor. Staff is also proposing to amend the misfire monitoring testing requirements for light-duty diesel vehicles. Specifically, concurrent to the proposed changes for light-duty vehicle diesel misfire monitoring (described in section II.F.3. "Diesel Misfire Monitoring"), which would require manufacturers to detect a misfire fault when the misfire level exceeds 5 percent in lieu of emission threshold-based malfunction criteria, staff is proposing to exempt manufacturers from having to perform demonstration testing of these monitors using the 5-percent misfire threshold. Instead, manufacturers would only be required to perform demonstration testing of this monitor if the manufacturer increases the threshold to a level higher than 5 percent misfire as allowed under section 1968.2(f)(3.2.5).

Staff is also proposing to clarify the test requirements for diesel fuel system monitors. For the fuel system pressure control monitor, the proposed amendments would require manufacturers to perform a test for each of the following that is applicable: (1) with a high side fault (i.e., fault that causes too much pressure) that affects all injectors equally, (2) with a low side fault (i.e., fault that causes too little pressure) that affects all injectors equally, and (3) for systems that have single component failures that could affect a single injector, with a fault that affects the worst case injector (i.e., a fault on the injector that will result in the worst case emissions). For the fuel system injection quantity and injection timing monitors, the proposal would require manufacturers to perform a test for each of the following: (1) with a high side fault (e.g., too much fuel quantity, too advanced timing) that affects all injectors equally, (2) with a low side fault (e.g., too little fuel quantity, too retarded timing) that affects all injectors equally, and (3) with a fault that affects the worst case injector (i.e., a fault on the injector that will result in the worst case emissions). These tests would help ensure that all failure modes covered by the monitor calibration requirements under section 1968.2(f)(4.2.5) are properly detected before the required emission thresholds are exceeded.

Staff is also proposing clarifying language related to components and systems used in parallel for the same purpose. The OBD II regulation currently requires that “for each of the testing requirements of section (h)(3),” all components/systems used in parallel for the same purpose (e.g., separate VVT actuators on the intake valves for Bank 1 and Bank 2) are required to be simultaneously deteriorated to the malfunction criteria limit. Manufacturers, however, have indicated that they believe this requirement would require inappropriate deterioration of some component/systems used in parallel for the same purpose but for which this requirement should not apply to (e.g., gasoline air-fuel ratio cylinder imbalance monitor). Thus, staff is proposing to clarify that certain monitors are exempted from the requirement to simultaneously deteriorate systems/components. Specifically, staff is proposing to exempt the misfire monitor and fuel system air-fuel ratio cylinder imbalance monitor on gasoline vehicles and the misfire and fuel system monitors on diesel vehicles.

Demonstration testing protocol

As mentioned above in section II.A. “Malfunction Emission Thresholds for Low Emission Vehicle III (LEV III) Applications,” staff previously believed that PM emissions from gasoline vehicles were not a significant issue compared to PM emissions from diesel vehicles given the current standards and technologies. As a result, ARB had not enforced collection of PM emissions data from gasoline demonstration test vehicles and thus currently has limited PM data for malfunctions on gasoline vehicles. However, ARB has recently adopted a lower PM tailpipe emission standards for gasoline light-duty and medium-duty vehicles as part of its LEV III program. In addition, staff is concerned that malfunctions in gasoline vehicles that utilize technologies such as direct injection could result in significant increases in PM emissions. Due to these reasons, as mentioned above in section II.A., staff is proposing to add PM thresholds for gasoline monitors (except the gasoline catalyst monitor) starting in the 2019 model year. Given that the proposed PM thresholds are established at relatively high levels, staff believes more data are needed for ARB to effectively determine more appropriate thresholds for gasoline monitors in the future. Thus, staff is proposing to require manufacturers to collect and report PM data for each monitor demonstration tested (including the gasoline catalyst monitor) starting with 2017 model year gasoline vehicles certifying to the LEV III PM standards. Although this requirement has a relative early effective date, staff believes that this should not be a testing resource issue for manufacturers since they are already equipped with the ability the collect PM emission data and few 2017 model year vehicles will be phased into the 3 mg/mi standard.

Staff is also proposing that manufacturers collect CO emission data when testing the catalyst monitor on gasoline vehicles starting with the 2017 model year. Details of the proposal were provided in section II.A. above. Further, staff is also proposing that manufacturers collect and report CO_2 emission data when testing all monitors on gasoline and diesel vehicles starting in the 2018 model year. Staff had initially planned to propose CO_2-specific emission thresholds during this rulemaking but is not proposing any CO_2 thresholds at this time. The CO_2 emission data, which manufacturers already have the capability of collecting in their test facilities and should already be collecting for the purpose of carbon balance calculations, would assist staff in determining and proposing appropriate emission malfunction thresholds based on CO_2 in future rulemaking actions.

Staff is also proposing changes to the test sequence requirements. First, staff is proposing amendments to clarify the specific process manufacturers are required to meet when conducting the demonstration tests, including clarifications of the number of allowable preconditioning cycles and the number of test cycles manufacturers are required to run prior to emission testing. These proposed changes are in response to questions posed by manufacturers regarding the test sequence process. The amendments would also clarify that manufacturers are prohibited from running additional test cycles prior to running the exhaust emission test cycle unless the manufacturer demonstrates the additional test cycles are necessary to stabilize the emission control system. This amendment is being proposed in response to manufacturers indicating that they run additional preconditioning cycles (in addition to those already allowed in the OBD II regulation) prior to running the emission exhaust test cycle because they are allowed to do so for demonstrating compliance with the tailpipe emission standards. Staff, however, does not believe these additional test cycles should automatically be allowed for OBD demonstration testing, especially given that the OBD II regulation already allows manufacturers to run preconditioning cycles to stabilize the emission control systems. Second, staff is proposing changes to the specific test cycles allowed to be used during testing. After the manufacturer conducts the preconditioning cycle(s), the OBD II regulation currently requires manufacturers to test the vehicle over the “applicable cycle” to allow the monitor being tested to detect the fault and store a pending fault code. Further, the regulation states that if the monitor is designed to run during the Unified Cycle, the manufacturer may run a second Unified Cycle prior to emission testing (to store the confirmed fault code and illuminate the MIL). While the regulation requires manufacturers to design monitoring conditions to ensure the monitors run on the FTP or Unified Cycle under section 1968.2(d)(3.1.1), manufacturers are also allowed to design monitors to run under monitoring conditions that are not encountered on the FTP or Unified Cycle (based on Executive Officer approval) under section 1968.2(d)(3.1.3). To account for this, staff is proposing that for monitors that are certified to run under these alternate monitoring conditions, manufacturers are allowed to run the monitor/vehicle under these alternate monitoring conditions prior to conducting the emission test.

Staff is proposing to amend the requirements specifying what data must be collected and reported during demonstration testing. The current regulatory language requires specific fault information (i.e., time after start when the MIL illuminated, fault code(s), freeze frame information, test results) to be collected. Staff is proposing that manufacturers also be required to collect other OBD electronic information, including readiness status, current data stream values, CAL ID, CVN, VIN, ECU Name, in-use performance ratios, and vehicle operation tracking data. Furthermore, staff is proposing that manufacturers collect all the test data immediately prior to or after each engine shut-down, such as the end of each preconditioning cycle and the end of Bag 2 and the end of Bag 3 of the FTP emission test cycle. These amendments would be required starting on 2019 model year vehicles. A complete data set for each driving cycle will better enable staff to understand the results and ensure that the standardized data are outputting expected values during the test sequence. Historically, in testing done at ARB's facility, review of such data has identified many issues with OBD system performance and providing such data to staff at the time of OBD II system certification would allow staff to identify issues much earlier.

<u>Demonstration evaluation protocol</u>
Staff is also proposing to clarify the method to convert NMHC emission results to equivalent NMOG results. If a manufacturer measures NMHC emissions instead of NMOG emissions during demonstration testing, the OBD II regulation currently requires NMHC emission results to be multiplied by 1.04 to generate an equivalent NMOG result. This calculation, however, is incorrect for diesel vehicles, where the NMHC result should be the same as the NMOG result (i.e., the NMHC result is multiplied by a factor of 1.0 to generate the NMOG result). Further, recent amendments have been made in the applicable test procedures regarding the multipliers used to convert NMHC results to NMOG results. For example, for LEV II and III applications certifying to E10 fuel (i.e., a gasoline fuel that contains greater than 10 percent ethanol), the adjustment factor manufacturers are required to use for their NMHC results is 1.10 to generate the equivalent NMOG results. Thus, staff is proposing changes to clarify these factors in the OBD II demonstration test section, indicating that manufacturers shall use the factors described in either 40 CFR section 1066.635 or the factors specified in the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles."

Lastly, staff is proposing amendments to clarify demonstration testing requirements 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 monitors are appropriately tested.

I. CERTIFICATION DOCUMENTATION

The OBD II regulation requires manufacturers to submit certification documentation for each test group or OBD group. The certification documentation contains all the information needed for ARB staff to determine if the OBD II system meets the requirements of the OBD II regulation. The regulation specifies all the information that is required to be included in the certification documentation. Based on its experience in reviewing these certification packages, staff has determined that more information is needed to facilitate the review process and is therefore proposing to require manufacturers to provide this additional information in their certification applications. This additional information includes a list of any issues found (including if any specific monitoring requirements are not met) during certification demonstration testing under section 1968.2(h), a timeline showing the start of normal production and the deadlines required for production vehicle evaluation testing, a description of the incrementing specifications for the numerator and denominator of monitors required to be tracked and reported, a list of all monitored components/systems required to track and report the in-use performance data and the corresponding fault code for each monitor, and a list of test results required to be made available and the corresponding fault code for each test result. Further, based on several proposed amendments mentioned above, staff is also proposing that manufacturers provide information about their emissions neutral diagnostics, safety-only components and systems, inducement strategies and inputs to each strategy, and all components that are not currently monitored because manufacturers met the new proposed emissions test criteria for comprehensive components (sections 1968.2(e)(15.1.2), (e)(15.2.3)(H), (f)(15.1.2), and (f)(15.2.3)(H)). This information would help ARB staff ensure that manufacturers are fully complying with the OBD II regulation.

Staff is also proposing that manufacturers provide net brake torque information as part of the certification application. As mentioned above in section II.G.4. "Data Stream Parameters," manufacturers have not been consistent in the torque output as reported by the scan tool, which has resulted in erroneous emissions calculations during PEMS testing used to verify NTE compliance. Thus, for 2019 and subsequent model year medium-duty diesel vehicles certified to an engine dynamometer tailpipe emission standard, manufacturers would be required to provide data demonstrating the net brake torque reported by the engine dynamometer and the "calculated net brake torque" during the FTP and SET cycles. Manufacturers would determine the "calculated net brake torque" using the following equation and the engine reference torque, engine friction – percent torque, and actual engine – percent torque data stream parameters:

"Calculated net brake torque" = 'engine reference torque' x ('actual engine – percent torque' – 'engine friction – percent torque')

Manufacturers may choose to collect these net brake torque data during demonstration testing under section 1968.2(h). These traces, in addition to the proposed torque-related data stream parameters described under section II.G.4., would allow staff to verify that the net brake torque as calculated by a scan tool agrees with the net brake torque as calculated by an engine dynamometer, which would help ensure that PEMS emissions measurements are valid.

Staff is also proposing that manufacturers provide information related to any adjustment factor(s) established for certification of gasoline vehicles with emission controls that experience infrequent regeneration events. Currently, only manufacturers of diesel vehicles have been establishing and using adjustment factors for certification to account for the high emissions that may be emitted during regeneration events of their emission controls (e.g., PM filter). Manufacturers of gasoline vehicles have not had to submit such data since gasoline vehicles generally have not been equipped with emission controls that experience such regeneration events. However, with the adoption of lower emission tailpipe standards related to the LEV III program, some manufacturers have been designing gasoline emission control systems that utilize emission controls traditionally used in diesel applications, such as NOx adsorbers, in order to meet these standards. Thus, staff is proposing that if gasoline vehicle manufacturers are required to submit adjustment factor-related information for certification to the tailpipe emission standards, they would also be required to include the information in the OBD II application. This information would help staff determine if future OBD II regulation amendments will be needed to account for regeneration emissions on gasoline vehicles.

Further, staff is also requiring manufacturers to provide a statement of compliance indicating that the test groups in the application comply with the requirements of OBD II regulation and indicating that the manufacturer will comply with the required deadlines for submission of results/data for production vehicle evaluation testing under sections 1968.2(j)(1) through (j)(3).

Staff is also proposing changes to the engineering units required to be used in the certification application. The regulation currently requires manufacturers to use “per crankshaft revolution” for all parameters/criteria based on changes per ignition event. Manufacturers have indicated that this is misleading and that they should be allowed to indicate ignition event-based criteria using “per stroke” because it is also used in the data stream parameter identifiers (PID) (i.e., PID uses “mg per stroke”). They also indicated “per stroke” should be used for both gasoline and diesel applications. Considering the reason for requiring specific units to be used in the application is for consistency among manufacturers, staff is thus proposing that units of” mg per stroke” be used for all fuel quantity-based ignition event criteria and units of “per stroke” be used for all other changes per ignition event based criteria for both gasoline and diesel vehicles.

J. PRODUCTION VEHICLE EVALUATION TESTING

Staff is proposing minor changes to the production vehicle evaluation testing requirements. First, for testing of the standardization requirements (section 1968.2(j)(1)), staff is proposing to require the test to verify that the vehicle can properly communicate to any SAE J1978 scan tool the MIL command status, since this would ensure the correct information is being made available, and is proposing to require this information from each diagnostic and emission critical electronic powertrain control unit to better ensure that the OBD system as a whole is working as certified. The proposed amendments would also clarify that the manufacturer is required to submit the test log file with the report to ARB, since the log file contains important data that staff could review to determine if the system is working correctly.

Staff is also proposing changes to the testing of the monitoring requirements (section 1968.2(j)(2)), which requires manufacturer to test every monitor in the OBD II system and ensure that each monitor is able to store a fault code and illuminate the MIL when a fault is detected. As mentioned above in section II.E.11. “Gasoline Comprehensive Component Monitoring,” manufacturers with emissions neutral diagnostics would be required to test these diagnostics under section 1968.2(j)(2), although instead of ensuring that the diagnostic stores a fault code and illuminates the MIL when a fault is detected, manufacturers would be required to ensure that the diagnostic triggers the emissions neutral default action when a fault is detected. This would help staff and manufacturers identify diagnostics that are unable to properly activate the emissions neutral default action, which could cause emissions to increase and/or disable other monitors. Further, because emissions neutral diagnostics that are located within control units meeting the ASIL C or D specifications may involve components that are dangerous to test, manufacturers may request approval to modify the evaluation procedure to prevent unsafe or hazardous conditions to the tester.

Staff is proposing to require manufacturers to erase all permanent fault codes that are stored during section 1968.2(j)(2) testing. Issues have arisen in the field involving OBD II systems that are unable to erase permanent fault codes under any circumstances, which could erroneously cause vehicles to fail I/M programs that base pass/fail criteria on the presence of permanent fault codes in vehicle OBD II systems. This proposal would ensure that OBD II systems properly erase permanent fault codes in accordance with the regulation. Manufacturers could conduct this check of the permanent fault code erasure at the end of all section 1968.2(j)(2) testing to reduce most, if not all additional testing needed to erase the fault codes, since these fault codes would most likely clear themselves out while other monitors are being tested.

Finally, staff is proposing to exempt manufacturers from testing monitors where the demonstration may jeopardize the safety of the tester, which is needed to ensure the safety of the individuals conducting the testing. Further, while the regulation currently requires manufacturers to submit a report that include the results for each tested monitor, staff is also proposing that manufacturers include a summary of any issues or problems identified during testing, such as identifying monitors that are unable to store a fault code or illuminate the MIL when a fault is detected. This additional information would assist staff in reviewing test results.

K. DEFICIENCIES

The OBD II regulation allows manufacturers to certify OBD II systems with “deficiencies” in cases where the manufacturer does not meet a requirement but has demonstrated a good faith effort to fully comply. However, to prevent misuse of the provision and ensure equity for manufacturers that are able to fully comply with the requirements, the manufacturer is subject to fines for more than two deficiencies for a particular OBD II system. The OBD II regulation currently specifies a $50 fine for deficiencies related to “major” monitors, which are considered significant requirements (e.g., emission threshold monitors), while $25 fines are specified for deficiencies for other non-compliances. Staff, however, inadvertently omitted the diesel cold start strategy emission reduction monitor from the list of major monitors tied to a $50 deficiency, even though this monitor is subject to emission threshold requirements. Thus, staff is proposing to include this monitor in the list of major monitors.

Staff is also proposing amendments to clarify carrying-over of deficiencies for emission threshold-based monitors. Specifically, in cases where there is an interim threshold (e.g., 3 times the standard) for a few years and then a step down to a final threshold (e.g., 1.5 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 unnecessarily delay 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 to restart the carry-over clock. 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 other cases, granting deficiencies might not be appropriate (e.g., a manufacturer has not demonstrated a good faith effort to comply) and the existing deficiency qualifications would allow staff to deny such deficiencies and prevent further carry-over. Accordingly, staff believes it is appropriate that a change in the monitoring threshold would reset the clock for a deficiency, and is proposing to amend the regulation to clarify this requirement. The amendment would not obviate the need for a manufacturer to demonstrate a good faith effort to comply or to come into compliance as expeditiously as possible; both criteria would still be required to qualify both initially and in each subsequent year for a deficiency to be granted.

L. OTHER PROPOSED AMENDMENTS TO THE OBD II REGULATIONS

The OBD II regulation currently contains requirements associated with applying infrequent regeneration adjustment factors (IRAFs) to the emission results when determining the malfunction criteria for diesel vehicles (section 1968.2(d)(6)). Some diesel emission controls effectively reduce emissions for some amount of time and then temporarily require an alternate mode of operation to renew/regenerate the component before it can resume effectively reducing emissions (e.g., PM filters, NOx adsorbers). When these infrequent, but periodic, events occur, tailpipe emissions can increase dramatically. Accordingly, the tailpipe standards and OBD II regulation require diesel engine manufacturers to account for these infrequent emission increases and include them as part of their emission measurements when determining compliance with the tailpipe standards and OBD II emission thresholds. By that same reasoning, staff believes the IRAFs should also be applied to “test-out” criteria (i.e., the emission results for criteria that allow manufacturers to be exempt from monitoring a component) to more accurately quantity the emissions effect of a component failure in the real world. Thus, staff is proposing that for 2019 and subsequent model year diesel vehicles, manufacturers would be required to apply IRAFs to emission test results for test-out criteria using the same procedure used to determine the malfunction criteria for emission threshold monitors (i.e., the procedure in CFR title 40, part 86.004-28(i)). Manufacturers would be required to conduct the testing using the same deteriorated component used to determine if the test-out criteria are met (i.e., using a component with a failure mode that would result in worst-case emissions).

Staff is also proposing clarifying language for vehicles that do not easily fall under either the gasoline or diesel requirements. Currently, alternate-fueled vehicles are required to meet the same requirements as gasoline vehicles. However, in discussions with manufacturers currently offering alternate-fueled engines, staff has found more diverse solutions than previously expected. These include alternate-fueled 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, and conversions to non-stoichiometric spark-ignition that retain diesel-like emission control solutions. Such conversions can have a much larger impact on the OBD II 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. As previously mentioned, staff is proposing a new definition for “alternate-fueled vehicle” while taking out “alternate-fueled engine” from the definition of “gasoline engine” to address this. Further, staff is also proposing to require manufacturers to propose a plan for approval of the requirements in the OBD II regulation that would apply to the alternate-fueled vehicle. These requirements would include the in-use monitor performance requirements in section 1968.2(d), the monitoring requirements in sections 1968.2(e) through (f), and the standardization requirements of section 1968.2(g). This proposed requirement (section 1968.2(d)(7.1)) would ensure that all emission control components on the engine, which may include both diesel-related and gasoline-related components, are properly monitored. Concurrently, staff is also proposing that manufacturers submit a plan for certification demonstration testing under section 1968.2(h) indicating which monitors would be tested and what fuel or fuel combinations would be used for each test.

Staff is also proposing a similar requirement for vehicles that do not run on alternate fuels but utilize both gasoline and diesel emission control technologies. To meet the more stringent standards imposed by programs such as the LEV III program or the Advanced Clear Cars program, manufacturers are increasingly designing vehicles that use technologies that do not fit under solely the conventional "gasoline" or "diesel" requirements. For example, manufacturers are designing vehicles with lean-burn systems that run on gasoline but utilize diesel emission control technologies such as SCR systems and NOx traps. With the current regulation, such vehicles would be subject to the gasoline monitoring requirements, with the diesel technologies required to be monitored under non-specific requirements such as the "other emission control or source system" requirements. Ideally, the OBD II regulation should acknowledge usage of the combined types of solutions and specify monitoring requirements instead of subjecting manufacturers to these non-specific monitoring requirements. While staff is not proposing such specific requirements at this time, staff is proposing that manufacturers submit a plan for approval of the requirements in the OBD II regulation that would apply to these vehicles, similar to the proposal mentioned above for alternate-fueled vehicles. ARB approval of the plan would be based on the appropriateness of the requirements in the gasoline and diesel sections with respect to the specific control strategies, components, and systems in the vehicle. These proposed requirements would be found in section 1968.2(d)(7.2). Concurrently, manufacturers would be required to submit a plan for certification demonstration testing under section 1968.2(h) indicating which monitors would be tested.

Staff is also proposing specific procedures for plug-in hybrid electric vehicles when determining the malfunction criteria for emission threshold monitors (section 1968.2(d)(7.3)). There have been some concerns about whether or not previous malfunction criteria/thresholds established by the manufacturer were based on conditions that represent worst case emissions. For example, manufacturers may calibrate the malfunction criterion/threshold for a monitor based on the vehicle being driven in charge sustaining operation and demonstrate that emissions are below the malfunction thresholds, but in actuality, emissions may be above the required thresholds if the vehicle was driven in charge depleting operation. Staff previously understood that charge sustaining operation generated higher emissions than charge depleting operation. However, staff has learned that in charge depleting operation, some plug-in hybrid vehicles can incur multiple cold starts in a single drive cycle and produce higher emissions when compared to a charge sustaining drive cycle. Thus, staff is proposing that starting in the 2019 model year, manufacturers would be required to calibrate the malfunction criteria for each emission threshold monitor in the driving mode (i.e., charge depleting or charge sustaining operation) that would generate the highest emissions. To maintain certification efficiency and timing, manufacturers could perform engineering analyses to determine the mode (charge sustaining or charge depleting operation) that generates the highest emissions and perform demonstration testing for only the worst case mode in lieu of performing and submitting test results for both operating modes. Manufacturers are responsible for ensuring plug-in hybrid vehicles are compliant in both modes (e.g., during confirmatory testing or enforcement testing).

M. OBD II ENFORCEMENT REGULATION

The OBD II enforcement provisions (section 1968.5) help ensure the effectiveness of the OBD II regulations and address OBD II noncompliance's in the field. The enforcement regulation details procedures for evaluating and remediating (where necessary) OBD II-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 of OBD II systems with the OBD II requirements. These include performance testing of emission threshold-related monitors, downloading of in-use monitoring performance ratio data, and evaluation of other OBD II requirements (e.g., diagnostic connector location, communication protocol standards, and MIL illumination protocol). The results of the tests are compared to the minimum performance levels prescribed in the enforcement regulation to determine compliance and appropriate corrective actions, including mandatory recall for the most egregious nonconforming OBD II systems.

Staff is proposing minor amendments to the definition of "major monitor" under section 1968.5(a)(3). Specifically, in the list of monitors considered major monitors, staff is adding reference to section 1968.2(f)(14) to account for the new proposed diesel A/C system monitoring requirements.

As stated above in section II.D. "Standardized Method to Measure Real World Monitoring Performance," staff is proposing changes to the denominator incrementing criteria for the PM filter filtering performance monitor and PM filter missing substrate monitor on light-duty diesel vehicles. Specifically, these monitors, which are currently required to increment the denominator when, among other conditions, 500 miles are accumulated, would be required to increment the denominators using only the general denominator criteria starting in the 2019 model year for passenger cars, light-duty trucks, and medium-duty vehicles certified to a chassis dynamometer tailpipe emission standard. Further, the OBD II regulation would allow manufacturers to certify these monitors to a lower interim in-use ratio of 0.100 on 2019 through 2021 model year passenger cars, light-duty trucks, and medium-duty vehicles certified to a chassis dynamometer tailpipe emission standard. The OBD II enforcement regulation currently has nonconformance criteria for monitors certified to an in-use ratio of 0.100 and does not subject these monitors to mandatory recall (sections 1968.5(b)(6)(B)(i) and (c)(3)(A)(i)), though the language only refers to monitors on 2004 through 2018 model year vehicles. Thus, staff is proposing changes to extend the applicability of these sections to monitors certified to an in-use ratio of 0.100 on 2004 through 2021 model year vehicles.

Staff is also proposing changes to the mandatory recall criteria in section 1968.5(c)(3) for several monitors. For the gasoline air-fuel ratio cylinder imbalance monitors, to align with the proposed changes made to the OBD II regulation, staff is proposing changes to the mandatory recall criteria for interim years. Details of the proposed changes were discussed in section II.E.3. "Gasoline Fuel System Monitoring."

Staff is also proposing changes to the mandatory recall criteria to align with the proposed amendments to the gasoline and diesel misfire monitoring requirements. As described above in section II.E.1. “Gasoline Misfire Monitoring,” staff is proposing to require manufacturers to detect a fault on gasoline plug-in hybrid electric vehicles if the percentage of misfire exceeds 2 percent in lieu of an emission threshold starting in the 2019 model year. For diesel misfire monitors, as described above in section II.F.3. “Diesel Misfire Monitoring,” staff is proposing to require passenger cars, light-duty trucks, and MDPVs certified to a chassis dynamometer emission standard to detect a diesel misfire fault when the percentage of misfire exceeds 5 percent with a phase-in starting in the 2019 model year. The OBD II enforcement regulation currently does not specify mandatory recall criteria applicable to these new requirements. Thus, to account for the proposed change to the misfire monitoring requirements for gasoline plug-in hybrid electric vehicles, staff is proposing to require mandatory recall for vehicles with the new proposed 2-percent misfire monitor malfunction criterion if the percentage of misfire exceeds 5 percent without the MIL being illuminated. To account for the proposed change to the misfire monitoring requirements for passenger cars, light-duty trucks, and MDPVs certified to a chassis dynamometer emission standard, 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 the OBD II enforcement regulation, starting with the 2022 model year.

Staff is also proposing to amend the mandatory recall criteria for the PM filter. The OBD II enforcement regulation currently mandates a mandatory recall if a malfunction is not detected before emissions exceed two times the malfunction criteria. During the last regulatory update of the OBD II medium-duty diesel vehicle and HD OBD requirements in 2012, staff was concerned that because of the mandatory recall criteria and the higher PM emission thresholds, it was highly likely that vehicles with no PM filters could have engine-out PM emissions that would be far below the mandatory recall emission level and thus never be subject to mandatory recall despite a completely non-functional PM filter monitor. Because the PM filter is a crucial emission control component in diesel vehicles, it would be inappropriate for the monitor to be unable to detect a completely missing PM filter and still not be subject to mandatory enforcement action. Thus, staff adopted specific mandatory recall criteria for PM filter monitors on medium-duty diesel vehicles and is now proposing to specify the same criteria for 2016 and subsequent model year passenger cars, light-duty trucks, and MDPVs certified to a chassis dynamometer tailpipe emission standard. Specifically, 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.

N. PROPOSED AMENDMENTS TO DEFINITION OF “EMISSIONS-RELATED PART”

Title 13, CCR section 1900(b)(6) currently defines “Emissions-related part” as “any automotive part, which affects any regulated emissions from a motor vehicles which is subject to California or federal emission standards. This includes, at a minimum, those parts specified in the ‘Emissions-Related Parts List,’ adopted by the State Board on November 4, 1977, as last amended May 19, 1981.” Although the “Emissions-Related Parts List” was updated on June 1, 1990, section 1900(b)(6) was never revised to incorporate the updated version of the “Emissions-Related Parts List.” Staff is therefore proposing to modify the definition of “Emissions-related part” in section 1900 to incorporate the most current version of the “Emissions-Related Parts List.”
As stated above, the definition of “emissions-related part” refers to motor vehicles subject to California or federal emissions standards. The definition of the term “emission standard” that generally applies to all on-road motor vehicles and motor vehicle engines is set forth in title 13 CCR section 1900(b)(3), and title 13 CCR sections 1900(b)(4) and (b)(5) define the terms “evaporative emission standards” and “exhaust emission standards” as subcategories of emission standards.

The terms “emission standard”, “evaporative emission standard” and “exhaust emission standard” are also set forth in provisions that are specifically applicable to heavy-duty motor vehicle engines and heavy-duty vehicles in title 13 CCR 1956.8(i)(2)-(4), 2485(h)(7)-(9), and title 17 CCR section 95302(a)(19.1)-(19.3). Title 13 CCR sections 1968.2(c) and 1971.1(c) define “emission standard”, “evaporative emission standard” and “exhaust emission standard” in the context of the OBD II regulation and the heavy-duty OBD (HD OBD) regulation, respectively.

III. ENVIRONMENTAL IMPACT ANALYSIS

A. INTRODUCTION

This chapter provides the basis for ARB’s determination that the proposed amendments are exempt from the requirements of CEQA. A brief explanation of this determination is provided in section B below. ARB’s regulatory program, which involves the adoption, approval, amendment, or repeal of standards, rules, regulations, or plans for the protection and enhancement of the State’s ambient air quality, has been certified by the California Secretary for Natural Resources under Public Resources Code section 21080.5 of the California Environmental Quality Act (CEQA) (14 CCR 15251(d)). Public agencies with certified regulatory programs are exempt from certain CEQA requirements, including but not limited to, preparing environmental impact reports, negative declarations, and initial studies. ARB, as a lead agency, prepares a substitute environmental document (referred to as an “Environmental Analysis” or “EA”) as part of the Staff Report prepared for a proposed action to comply with CEQA (17 CCR 60000-60008). If the amendments are finalized, a Notice of Exemption will be filed with the Office of the Secretary for the Natural Resources Agency and the State Clearinghouse for public inspection.

B. ANALYSIS

ARB staff has determined that the proposed amendments are categorically exempt from CEQA under the “Class 8” exemption (14 CCR 15308) because it is an action taken by a regulatory agency for the protection of the environment. Most of the proposed amendments merely provide clarifying language to the existing requirements manufacturers are currently required to meet on their vehicles without changing the requirements.

Some of the proposed amendments would delay certain deadlines for a few of the current requirements. These include delaying the dates manufacturers would have to meet the final more stringent in-use monitor performance ratio for plug-in hybrid vehicles (explained in section II.D. “Standardized Method to Measure Real World Monitoring Performance”), and the final stringent emission threshold malfunction criteria for gasoline air-fuel ratio cylinder imbalance monitoring (explained in section II.E.3. “Gasoline Fuel System Monitoring”). While these requirements are considered technically feasible, there were delays in the development of the technology which prevented manufacturers from implementing the requirements within the required deadlines. Manufacturers are expected to take advantage of these proposed extensions to improve their system strategies, develop robust monitors to meet the requirements, and design systems that improve air quality. None of these changes adversely affects emission benefits in the interim. Other proposed amendments that relax the requirements (e.g., exempting certain components from meeting certain OBD II requirements) are limited to components that either have no impact on emissions or only result in a very small (<15 percent) effect on emissions that is within the test-to-test variability of standard test cycles. These proposed amendments largely codify existing practice, such that the actual emissions difference resulting from these changes is negligible in comparison to current baseline emissions. While some of the amendments relax or delay certain requirements, the overall emission benefits of the proposal are still greater than those of vehicles currently in-use due to the more stringent requirements described below; therefore, overall these regulations continue to contribute to improvements in air quality.

The proposed amendments would also establish more stringent requirements that OBD II systems on vehicles would be required to meet. These amendments include OBD II systems detecting more failure modes that can affect emissions and providing more information from the on-board computer that would assist technicians in diagnosing and repairing emission-related malfunctions. Manufacturers would be expected to incorporate mostly software changes and a few possible hardware modifications to meet these new requirements. These amendments will encourage manufacturers to design and build more durable, cleaner vehicles to comply with the requirements. The proposed OBD II amendments will help ensure that forecasted emission reduction benefits from adopted light- and medium-duty vehicle and engine emission standards programs are achieved. The proposed amendments are necessary to accomplish this goal by achieving these emission benefits in two distinct ways: first, to avoid customer dissatisfaction caused by frequent illumination of the MIL due to emission-related malfunctions, it is anticipated that the manufacturers will produce increasingly durable, more robust emission-related components; and second, by alerting vehicle operators of emission-related malfunctions and providing precise information to the service industry for identifying and repairing detected malfunctions, thereby ensuring that emission systems will be quickly repaired. The benefits of the regulations become increasingly important as certification levels become more and more stringent, and a single malfunction has an increasingly greater impact relative to certification level.

Based on the above, ARB staff has determined that the proposed action is designed to protect the environment and overall would result in air emission benefits compared to existing regulations. ARB has determined there is no substantial evidence indicating the proposal could adversely affect air quality or any other environmental resource area, or that any of the exceptions to the exemption applies (14 CCR 15300.2); therefore, this activity is exempt from CEQA.

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. ARB is committed to making environmental justice an integral part of its activities. The Board approved its Environmental Justice Policies and Actions (Policies) on December 13, 2001, to establish a framework for incorporating environmental justice into ARB's programs consistent with the directives of State law (ARB 2001). These policies 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

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 II 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

A. COST OF PROPOSED REQUIREMENTS

The proposed revisions to the OBD II regulation consist primarily of updates to and clarification of existing requirements in addition to adding regulatory flexibility. The majority of the proposed revisions are expected to not impact costs because the changes primarily involve updating and clarifying the existing requirements or only involve software changes which are not expected to impact costs given adequate lead time such that manufacturers can bundle the required software changes when major software work otherwise is required. Some of the changes provide compliance flexibility/reduce monitoring requirements (e.g., test-out criteria for comprehensive component monitoring; relaxations for emissions neutral diagnostics, safety-only diagnostics, smart-device diagnostics, and diesel NOx catalyst reductant-related diagnostics), define the required OBD II threshold (such as the diesel misfire threshold and gasoline plug-in hybrid misfire threshold) thereby reducing calibration expenses, or eliminate monitoring, which could result in cost savings to the manufacturer. The changes that are expected to affect costs involve the addition of more stringent monitoring requirements for the PCV and CV systems on gasoline and diesel vehicles, clarification of the evaporative system purge monitoring requirements for the high-load purge lines, and the addition of new demonstration testing requirements for the air-fuel ratio cylinder imbalance monitor and cold start emission reduction strategy monitor on gasoline vehicles.

Although the proposed modifications affect both gasoline and diesel vehicles, gasoline vehicles are expected to be impacted the most from a cost standpoint since the bulk of the cost-related changes apply to gasoline vehicles. However, since sales data[8] indicate diesel vehicles consist of only 1.5 percent of the total light-duty vehicle fleet and all light-duty diesel manufacturers also produce gasoline vehicles for the majority of their total vehicle production, staff decided not to conduct a separate cost analysis for light-duty diesel vehicles. Instead, staff is estimating the costs of the proposal for light-duty vehicles based solely on gasoline vehicle costs. This simplification would result in a worst case cost estimate for diesel vehicles especially when considering that diesel vehicles would likely utilize monitoring strategies derived from the PCV system monitoring requirements for gasoline vehicles.

The goal of this analysis is to estimate the “learned-out” costs of the program to a light-duty vehicle purchaser for a “typical” vehicle. The analysis includes estimates of the incremental costs of implementing the proposed modifications to the OBD II program for an average large light-duty vehicle manufacturer. Since the internal corporate costs of implementing the modifications to the OBD program are closely guarded by individual vehicle manufacturers and can vary significantly within the industry, ARB staff made assumptions regarding the corporate structure of the typical large manufacturer. The ARB cost estimates assume that the typical light-duty vehicle manufacturer is a low-cost horizontally-integrated company, i.e., one that relies heavily on suppliers to assist in the development and production of engines. Manufacturers rely on these suppliers to produce the final components rather than source the parts through their own internal

[8] Annual Energy Outlook 2015 Table: Light-Duty Vehicle Sales by Technology Type, http://www.eia.gov/beta/aeo/#/?id=48-AEO2015&region=1-0&cases=ref2015&start=2012&end=2040&f=A&linechart=48-AEO2015.4, accessed April 24, 2015.

facilities to achieve the lowest costs. The various types of costs that are addressed in this analysis are variable costs, support costs, capital recovery costs, and dealer costs. Results of the analysis indicate the learned-out initial costs per vehicle to incorporate the proposed OBD II regulatory modifications would be $5.43. Details of the cost analysis methodology used to estimate the light-duty vehicle costs are discussed in the following sections.

Light-Duty Vehicle Cost Analysis

To conduct the cost analysis for light-duty vehicles, staff calculated the average nationwide sales numbers of a large light-duty vehicle manufacturer from available data[9]. The average large volume manufacturer is assumed to have nationwide sales of 1,150,000 in the 2025 model year when the proposed OBD II regulation changes will be fully phased in, with 70 percent of these vehicles utilizing forced induction engines. The hypothetical large light-duty vehicle manufacturer is also projected to have a product line consisting of 9 gasoline OBD II groups with 4 test groups within each OBD II group and 1 diesel OBD II group with 4 test groups. This assumption results in 40 total test groups and would require testing of 3 data demonstration vehicles per year. Although the regulatory proposal applies only to California-certified vehicles, the estimated cost of the proposal was applied to the manufacturers entire nationwide new vehicle fleet because virtually all light- and medium-duty vehicle manufacturers have chosen to design a single OBD system that meets both ARB and U.S. EPA regulations and have equipped all vehicles nationwide with the same system. Therefore, any costs incurred by the vehicle manufacturers are expected to apply to all vehicles nationwide.

Variable Costs

In this section, the cost of new parts added to light-duty vehicles, additional assembly operations, any increases in the cost of shipping parts, and any new warranty implications are addressed.

Cost of Additional Hardware

The first step in assessing costs was to define the systems and technologies likely to be used by manufacturers to meet the proposed OBD II regulatory modifications. Staff went through each of the proposed OBD II regulatory modifications to determine if additional hardware would be required to comply with the proposal. Based on discussions with individual vehicle manufacturers, it was determined that the only new hardware that are projected to be needed to comply with the proposed requirements are increased ECU memory, a pressure sensor to monitor the high-load PCV/CV hoses for boosted engines, and a redesigned high-load purge delivery system for boosted engines. Details of the modifications needed to meet proposed requirements are discussed in the individual monitor sections (sections II.E.2. “Gasoline Evaporative System Monitoring” and II.E.6. “Gasoline Positive Crankcase Ventilation (PCV) System Monitoring”) of the staff report. Once the technologies for meeting the proposed modifications were identified, the staff estimated the percentage of these technologies

[9] U.S Market Light Vehicle Deliveries – March 2015 Final Results, http://www.motorintelligence.com/fileopen.asp?File=SR_Sales112.xls, accessed April 24, 2015,

that would be required to comply with the requirements for the 2025 model year. The 2025 model year was chosen for the analysis because that is the year when all of the requirements of the OBD II regulation are fully phased in on all light-duty vehicles. Table 9 lists the technologies and application rates that staff projects will be needed for light-duty vehicles to comply with the proposed OBD II requirements, and the associated costs to the vehicle manufacturers.

Table 9: Incremental component cost of gasoline OBD II system from 2015 proposed changes

Emission Control Technology (a)	2009 tech cost estimate (2009 $)	2015 tech cost estimate (a) (2015 $)	% LDGV that will require tech for OBD	Incremental Cost only OBD (2015 $)
Increased ECU memory capability for tracking/reporting in-use monitor performance & data stream parameters	5.00	5.51	10%	$0.55
PCV system pressure sensor	n/a	5.00	63%	$3.15
Evaporative purge system - intake air system/ejector redesign	n/a	5.00	10%	$0.50
Total incremental component cost				4.20

(a) Cumulative Rate of Inflation (from 2009 to 2015) is 10.2% based on inflation calculator at http://data.bls.gov/cgi-bin/cpicalc.pl accessed on June 5, 2015.

Cost of Assembly

Other variable costs include costs of assembly, shipping, and warranty. The proposal is projected to affect the assembly of the PCV/CV system. The regulatory proposal will allow manufacturers to utilize less costly hose clamps to meet the OBD II requirements for PCV/CV system monitoring. The assembly cost savings were determined through discussions with clamp suppliers. Vehicles with boosted engines were estimated to use a total of 4 less costly hose clamps while vehicles with normally-aspirated engines were estimated to use a total of 2 less costly hose clamps. The assembly costs are summarized in Table 10.

Table 10: Incremental Assembly Costs

Assembly operation	Cost Differential 2015 $)	Number of clamps per vehicle	Percentage of LD and MD vehicles affected	Incremental Cost (2015 $)
Installing less tamper-resistant clamps (boosted engine)	-0.05	4.00	63%	-0.13
Installing less tamper-resistant clamps (normally aspirated)	-0.05	2.00	30%	-0.03
Total Incremental Assembly Cost				-0.16

Cost of Shipping

Shipping costs for OBD II vehicles are projected to be nearly the same for the proposed modifications. This is because for the majority of the vehicles, only a pressure sensor would be added to the current light- or medium-duty vehicle assembly. The cost of shipping the various sensors was estimated to add $0.33 each to the cost of the system (assuming that sensors will be shipped in bulk to the manufacturer).

Cost of Warranty

Additional warranty costs due to the OBD II regulatory proposal should also be minimal. Based upon the data from OBD II-equipped light-duty vehicles, staff project that the failure rate for the added sensors and components will range from 0.05 percent to one percent within the 50,000 mile warranty period. The only added component needed to comply with the proposed requirements that is expected to require warranty repairs is the pressure sensor for PCV/CV leak monitoring. For this sensor, staff assumed a failure rate of 0.3 percent would occur within the warranty period. This failure rate was chosen because ARB internal data has indicated PCV/CV system failures have not historically had high warranty failure claims. The labor rate for the repairs was estimated at $80/hour with an average repair time of 30 minutes. The labor rate was discounted by 20 percent from the typical retail repair rate of $100/hour[10] in California to reflect the expected reimbursement amount from the manufacturer. The replacement cost of the pressure sensor was adjusted by 20 percent to account for the added cost of purchasing the replacement parts at smaller quantities compared to the production parts, cost of shipping and handling, administration costs, and dealer costs. The warranty and shipping costs are summarized in Tables 11 and 12.

Table 11: Incremental Shipping Costs

Shipped Part	Cost of Shipping (dollars)	% of LDV that will require tech for OBD
Pressure sensor for PCV Leak	0.33	63%
Total Incremental Shipping Costs	0.21	

[10] Service Repair Facility Average Hourly Labor Rates, https://www.mechaniconduty.com/MapGraphic_email.pdf, accessed May 18, 2015.

Table 12: Incremental Warranty Costs

Warranted Repair	Cost of		Warranty	
	Part (a) (dollars)	Labor (b)(c) (dollars)	warranty rate%	Cost (dollars)
PCV system Leak	6.00	40	0.3%	0.14
Total Incremental Warranty Cost				0.14

(a) Assume cost of parts are 20% higher for warranted parts than production parts.
(b) Total diagnostic and repair time is estimated at 30 minutes.
(c) Assumes dealer labor rate for warranty repair is $80/hour.
The labor costs include diagnostic and repair time.

Support Costs
Support costs affecting the retail price of OBD II modifications are estimated to include research costs, engineering support costs, legal resources, and administrative increases.

Research Costs
Research costs include the engineering and other labor costs (e.g., technicians) needed to develop and calibrate the base OBD II algorithms. To determine the incremental research costs, staff estimated the number and types of new monitors that would be required for the proposed OBD II regulatory modifications. Staff determined that only one new monitor for PCV/CV leaks of the high-load PCV lines would be required. The diagnostic was then individually assessed for the engineering and test times needed to develop and calibrate the diagnostic.

Staff projects that the PCV/CV leak monitor would be fairly complex to develop and calibrate. Since the monitor has a rather generous phase-in where monitoring is phased in beginning in the 2023 model year and fully phased in by the 2025 model year, staff believes the majority of the monitor algorithm development and calibration can be done with existing workforce. However, staff's analysis did project that 1.49 additional engineers will be needed to develop and calibrate the PCV/CV system for the hypothetical "average" large vehicle manufacturer's 40 total test groups.

The staff assumed an eight-step process to develop the base algorithm for each diagnostic on one engine platform. The eight steps include determining the scope of monitoring (e.g., which parts of the PCV system are subject to the proposed monitoring requirements), developing failure mode effects analysis (FMEA), developing the diagnostic concept, limit/threshold part development, prototype/concept testing, validation, sensitivity analysis, and tuning guide development. It is assumed that a manufacturer will develop a single base algorithm that can be applied across every different engine variant within the manufacturer's product line-up without modifications to the algorithm. Staff also assumed that manufacturers will develop the algorithm on a pre-production vehicle that is close to production intent (i.e., hardware and emission calibrations are close to its final production version). Staff believes that developing the algorithm on a vehicle that is not near its production state will be inefficient and would unnecessarily require significant redevelopment work when applied to the production engine.

To adjust the base algorithm to work on other light-duty vehicles, each algorithm will need to be individually calibrated. Staff assumed a 3-step process to calibrate each diagnostic on subsequent vehicles. Utilizing the tuning and validation guide developed during the algorithm development process, the three steps include reviewing FMEA, testing of limit parts and nominal parts, and validation. The costs to calibrate other vehicles were discounted with factors that took into account the similarity of engine designs relative to the base engine used to develop the algorithm since the amount of engineering and testing work should be less on similar engines. The life of the diagnostic algorithm design and calibration is projected at 6 years without any major modifications. However, staff did account for minor algorithm and calibration modifications after three years. The cost of the three-year midpoint algorithm and calibration modifications was discounted by 80 percent and 70 percent, respectively. Staff also applied an additional adjustment factor to both the algorithm development and calibration costs to account for inefficiencies such as algorithm or calibration mistakes that require reworks and new staff learning curves. The inefficiency factor was set at two and therefore effectively doubles staff's cost estimates for algorithm development and calibration. Details of the research costs are summarized in Table 13 below.

Table 13: Development and Calibration Cost of OBD II Technology (Research)

Staff	Number of Staff (person years)	Staff Cost (a) (2015 $)	Testing Costs (b) (2015 $)	Equipment and Limit Parts (2015 $)	Cost/vehicle (c) (2015 $ /vehicle)
Engineer	0	0	187,118	540	0.03
	1.49	223,290	0	0	0.03
			Total		0.06

(a) Development cost includes personnel, overhead and other miscellaneous costs at a total rate of $150,000/year for an engineer and $100,000/year for a technician.
(b) Testing Costs includes Labor Costs for Technicians needed to staff the tests
(c) Assumes an average large manufacturer produces 1,150,000 vehicles per year in U.S.
Assumes costs will be spread across all vehicles whether boosted or not.
Assumes life of the monitor algorithm and calibration is good for 6 years.

Engineering Support Costs

The engineering support costs include the equipment and labor costs to conduct the certification demonstration tests and production monitoring verification tests that are required under the OBD II regulation. The proposed OBD II regulatory modifications include additional OBD II demonstration test requirements for certification on gasoline light-duty vehicles. The OBD II certification demonstration tests that have been added are EGR high flow, air-fuel ratio cylinder imbalance lean limit and rich limit, cold start emission reduction strategy performance, and one additional test for primary oxygen sensors (previously some manufacturers typically only conducted one worst-case test for primary oxygen sensors). Therefore a total of five additional demonstration tests have been added to the current demonstration test requirements. Since the hypothetical large light-duty vehicle manufacturer is presumed to have a combined total of 40 test groups, three of these test groups are required to be demonstration tested each model year.   Manufacturers tend to guard their internal costs very tightly; therefore determining manufacturers' costs for conducting the five additional demonstration tests on three test groups per year was difficult. Ultimately, staff decided to apply the costs of conducting the additional demonstration tests through outside laboratories to the engineering support costs. Since these testing costs include the total cost of conducting the tests (i.e., labor, equipment, and overhead) along with a substantial profit, the estimated costs should be significantly more than conducting the tests internally and should yield a conservative cost estimate. To determine the testing costs, staff queried several independent laboratories to determine the costs of conducting the various tests that are required for demonstration testing such as chassis dynamometer testing with emissions, chassis dynamometer testing without emissions, FTP cycle engine dynamometer testing with emissions, and SET cycle engine dynamometer testing with emissions. Since the estimated testing costs for gasoline vehicles were greater than the testing costs for diesel vehicles, only the gasoline vehicle testing costs were utilized in the analysis to provide a conservative cost estimate and for simplification reasons. For the production vehicle verification of monitoring requirements, costs for testing the additional monitors is not expected to significantly impact costs since these tests do not have to be done on the dynamometer and are often done on the road. Therefore the additional demonstration tests are the primary engineering support costs for the proposed regulatory modifications. Details of the engineering support cost analysis are summarized in Table 14 below.

Table 14: Certification Demonstration and Production Vehicle Evaluation Testing Cost of OBD II (Engineering Support)

description	# of test groups	# of vehicles to be tested	sets of test hardware per vehicle	cost per test hardware	# of faults to be tested	# of prep cycles including initial detection	Chassis dyno test cell cost per prep cycle w/o emissions (2015 $)	Chassis dyno test cell costs w/ emissions (2015 $)	Total chassis dyno test cell costs (2015 $)	Total gasoline vehicle testing Costs (a) (2015 $)	Incremental testing costs (dollars)
Cylinder imbalance DDV	40	3	1	0.00	2	2	300	1000	9600	9600	$0.01
EGR high flow DDV	40	3	1	0.00	1	2	300	1000	4800	4800	$0.00
Oxygen sensor DDV	40	3	1	0.00	1	2	300	1000	4800	4800	$0.00
Cold Start Strategy DDV	40	3	1	0.00	1	2	300	1000	4800	4800	$0.00

(a) Development cost includes personnel, overhead and other miscellaneous costs at a total rate of $150,000/year for an engineer and $100,000/year for a technician.

Legal and Administrative Costs
The additional hardware and monitors to be used on light-duty vehicles to meet the proposal are not expected to introduce increased liability issues or require administrative work that the existing workforce could not undertake. Therefore no additional costs were allocated for legal and administrative costs.

Capital Recovery Costs
Since the price of light-duty vehicles will increase due to the modifications to the OBD II regulation, it is appropriate to account for the additional interest that the vehicle manufacturer will pay for financing the cost of the engine. The cost of capital recovery (return on investment) was calculated at five percent of the total costs to the vehicle manufacturer. The capital recovery rate was chosen at five percent to be consistent with other recent ARB regulatory cost analyses. These costs are shown in Table 15 below.

Vehicle Manufacturer Costs
Vehicle manufacturers were assumed to add a nine percent profit margin to the incremental cost of the vehicle to cover profit, overhead and indirect costs that were not addressed in the above analysis. These costs are shown in Table 15 below.

Dealer Costs
Dealer costs include the cost of capital recovery and dealer profit margin. The cost of capital recovery was assumed to be five percent for the 3 months that an average vehicle is expected to sit on the dealer lot. Similar to the manufacturer capital recovery costs, the five percent rate was chosen to be consistent with other recent ARB regulatory cost analyses. The dealer profit margin was also assumed to be six percent on the incremental cost of the vehicle. These costs are shown in Table 15 below.

Table 15: Incremental Consumer Cost of Light- and Medium-Duty Vehicle OBD II System

		Cost (a) (2015 $)
Variable costs	Component	4.20
	Assembly	-0.16
	Warranty	0.14
	Shipping	0.21
Support costs	Research	0.03
	OBD Certification Testing	0.02
	Legal	0.00
	Administrative	0.00
	Development/Testing	0.03
Capital recovery (b)		0.22
Indirect Costs/ Manufacturer Profit/Overhead (c)		0.42
Dealer	Cost of capital recovery (d)	0.06
Dealer Profit (e)		0.26
Total initial incremental cost to consumers		5.43

(a) Assumes dealer profit margin is 6% of incremental cost
(b) Cost of capital recovery was calculated at 5% of the total incremental costs.
(c) Assumes CA total light- and medium-duty vehicle sales in 2025 = 1,761,493.[11]
(d) Assumes indirect costs/manufacturer profit margin/overhead is 9%.[12]
(e) Cost of capital recovery calculated at 5% assumes vehicles are in dealership for 3 months.

B. TOTAL INCREMENTAL COST OF THE PROPOSED REQUIREMENTS

The proposed OBD II revisions are not expected to reduce emissions beyond what is required of the current LEV III program. However, it will improve the realization of the LEV III program emission reduction requirements more effectively. As stated above, the proposed OBD II revisions are not expected to add significant cost to light-duty vehicles. In conducting the cost-effectiveness analysis for these proposed requirements, the staff revisited the cost estimates of the LEV III program that was reported in the 2012 LEV III staff report and updated that analysis to include the effects of the OBD II proposal. This analysis was conducted because the LEV III program assumed a fully functioning OBD II system when determining the benefits of the program. In order to ensure the assumed benefits of the LEV III program are realized, the OBD II regulation must be updated as proposed here. The proposed OBD II regulatory updates, however, result in an incremental cost not included in the total LEV III cost analysis. Additionally, as detailed above, unlike the LEV III approach, OBD staff took a different approach to

[11] Emission Factors, EMFAC 2011
[12] Martins, J. O., Scarpetta, S., Pilat, D., (1996), Mark-Up Ratios in Manufacturing Industries - Estimates for 14 OECD Countries.

estimating the indirect costs of the OBD II proposal. While the LEV III cost analysis utilized indirect cost multipliers (ICM)[13] to estimate the indirect costs, staff was not sure if using the ICMs would be applicable for the OBD II proposal since OBD II includes significant indirect costs for the modification of software algorithms and calibrations while the integration of exhaust emission control technologies tend to be less software intensive. With the approach taken to estimate the incremental cost of the OBD II proposal, the initial cost to the consumer was estimated to be $5.43 per vehicle. If the ICM approach was utilized, the ICM factor would have ranged from 1.24 for a near-term low-technology modifications to 1.19 for a long-term low-technology modification. As a comparison, the OBD II proposal's ICM would be 1.24 and is consistent with the cost estimates using the ICM approach. The proposal's cost to the consumer after purchasing the vehicle and accruing 235,000 miles over 19 years would yield an estimated additional $0.34 per vehicle cost (2015 $) for repairs of the PCV/CV system. These repairs are not expected to be needed until the vehicle is over ten years old and near the end of its useful life.

C. BENEFITS OF THE PROPOSAL

The OBD II regulatory proposal will help improve the realization of the emission benefits estimated by the LEV III program by updating the OBD II requirements to accommodate vehicles certified to LEV III standards. One of the most critical elements of the proposal is the updating of the OBD II emission thresholds to match the new emission categories and groupings that were defined in the LEV III regulation in 2012. The LEV III regulation created combined standards (i.e., NMOG+NOx) and new more stringent emission standard categories (i.e., ULEV70, ULEV50, and SULEV20). If the OBD II regulation were not updated, there would be confusion on how to apply the existing OBD II thresholds to the LEV III combined emission standards. In addition, since the existing OBD II thresholds are more stringent than the proposed thresholds for the new emission categories, manufacturers would likely have difficulty complying with the existing OBD II regulation and incur non-compliance fines.

The proposal also provides performance standards for the PCV/CV system and purge system monitors instead of the previous design criteria that were in place for these diagnostics. Providing compliance flexibility in the other areas (e.g., air-fuel ratio cylinder imbalance monitor interim thresholds, emissions-neutral default action provisions) and setting performance-based standards instead of design-based standards provides manufacturers with different ways to meet the requirements and helps reduce the cost of compliance by allowing manufacturers to choose the cheapest approach to meet the requirements. The clarification of the regulation and setting of performance-based standards also helps streamline the review process for ARB since it is easier to determine compliance with the requirements. Should the OBD II proposal

[13] Staff Report: Initial Statement of Reasons for Proposed Rulemaking, Public Hearing to Consider the "LEV III" Amendments to the California Greenhouse Gas and Criteria Pollutant Exhaust and Evaporative Emission Standards and Test Procedures and to the On-Board Diagnostic System Requirements for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles, and to the Evaporative Emission Requirements for Heavy-Duty Vehicles, December 7, 2011.

not be adopted, the review of OBD II system designs would likely result in more time-consuming determination of compliance for ARB and higher costs to manufacturers because the portions of the OBD II regulation that are expanded with clarification and flexibility features would result in more stringent requirements that manufacturers may not be able to meet and end up with non-compliance fines.

This proposal is not expected to result in direct emission benefits. However, it will greatly improve the reliability of the emission benefits expected from the LEV III program. The LEV III program emission benefits are based upon an effective OBD II and Smog Check program. While the LEV III program sets stringent tailpipe and evaporative system requirements that requires a vehicle's tailpipe emission levels to be durable for up to 150,000 miles, there is no assurance these emission levels will be maintained in use for the required mileage and beyond until the vehicle is retired. As previously mentioned in this staff report, the OBD II regulation requires all emission controls on a vehicle to be monitored for proper performance. For emission control components that can affect emissions by large amounts when they fail, the OBD II system must detect a malfunction before emissions exceed a certain emission threshold. While the OBD II system can alert the vehicle operator to a problem by requiring illumination of the MIL on the vehicle's instrument panel, it does not force the vehicle operator to repair the malfunction. The Smog Check program, however, does require the vehicle operator to repair the malfunction detected by the OBD II system. If there was no OBD II program, both Smog Check and the LEV III program would not be as effective at keeping vehicle emissions low throughout its entire life. Since the proposal consists mainly of changes to clarify the OBD II requirements and add some streamlining and flexibility features, the proposal is not expected to significantly change the emission benefits that were calculated in the 2012 LEV III staff report which is incorporated by reference herein (a copy of which may be found at http://www.arb.ca.gov/regact/obd02/obd02.htm).

The OBD II proposal is also expected to provide consumer benefits that are difficult to quantify. Since the OBD II system is constantly monitoring the emission control components on vehicles, consumers are expected to benefit from more durable vehicles because manufacturers would specify more durable emission control components in their vehicle designs to avoid customer dissatisfaction from frequent MIL illuminations resulting from premature emission control component failures. Consumers also benefit from how the OBD II system can provide vehicle repair technicians with information pinpointing the likely component causing a MIL to be illuminated. This quick identification of the malfunctioning component results in quicker diagnosis and repair of vehicles, which should also result in lower repair costs. Malfunctions found by the OBD II system when the emissions warranty or new car warranty are effective will also benefit consumers by effectively documenting the failure with a corresponding MIL and other information for easier reporting of malfunctions and subsequent reimbursement for repairs. Because the OBD II regulatory proposal affects many of the monitors that are calibrated to emission thresholds along with hybrid components, PCV/CV systems, evaporative purge systems, and other emission-related components/systems, the consumer benefits mentioned above should also apply for these emission control components and systems.

D. AFFECTED BUSINESSES

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

E. POTENTIAL IMPACTS ON BUSINESSES

With respect to businesses that manufacture light- and medium-duty vehicles, there are approximately 30 companies worldwide that manufacture California-certified light- and medium-duty vehicles. None of the 30 light- and medium-duty vehicle manufacturers are located in California. For the proposed changes, the incremental cost to light-duty and medium-duty manufacturers was estimated to be $5.11 per vehicle. The manufacturers are likely to pass on the incremental costs to consumers. There are also an estimated 1,296 new light- and medium-duty vehicle dealerships located in California.[14] Staff believes that all of the new light- and medium-duty vehicle dealerships are large businesses. All dealerships were assumed to be large businesses since the definition of a small retail business excludes businesses that have gross sales exceeding $2 million per year. Considering that the average price of a new vehicle in 2014 was $34,367[15], it would take less than 59 vehicle sales to exceed $2 million in gross sales per year.

For the new vehicle dealerships, an analysis was conducted that estimates the incremental cost of the proposed amendments to dealerships at $0.32 per vehicle. These dealerships are also likely to pass these costs on to the purchasers of new vehicles in the form of increased retail prices.

With respect to businesses that purchase light- or medium-duty vehicles, the amendments are not expected to have any material impact since the incremental per new vehicle price increase of $5.43 is insignificant on vehicles that range in price from $13,000 to well over $200,000. Considering that the average new vehicle transaction price of a new vehicle in 2014 was $34,367[16], the $5.43 incremental price increase represents a price increase of less than a 0.02 percent.

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

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[14] Annual Financial Profile of America's Franchised New-Car Dealerships, http://www.nadafrontpage.com/upload/wysiwyg/NADAData2014.pdf , accessed May 4, 2015.

[15] Annual Financial Profile of America's Franchised New-Car Dealerships 2014, https://www.nada.org/nadadata/, accessed May 15, 2015.

[16] http://mediaroom.kbb.com/2015-01-05-New-Car-Transaction-Prices-Reach-New-Record-Up-Nearly-3-Percent-In-December-2014-According-To-Kelley-Blue-Book, accessed May 19, 2015.

F. POTENTIAL IMPACTS ON SMALL BUSINESSES

Only one of the 30 manufacturers is a small business. This small manufacturer is not located in California. The impact to the small business is expected to be similar as for the large manufacturers since the small manufacturer purchases California-certified vehicles from a large manufacturer which it then modifies.

G. POTENTIAL IMPACTS ON VEHICLE OPERATORS

For light- or medium-duty vehicle operators, the proposed amendments would provide clearer OBD II regulatory requirements and streamline the OBD II certification process, which encourage manufacturers to build more durable engines and emission controls, which would result in the need for fewer repairs and savings for vehicle owners. OBD II 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 0.6 percent of the vehicles over a 23 year lifetime as a result of the proposed OBD II regulatory changes, at an average cost of $56 per repair. This is a conservative cost estimate, since OBD II systems will potentially result in savings by catching problems early before they adversely affect other components and systems in the engine that could result in more costly repairs overall. Since the emissions warranty and bumper-to-bumper warranty on new vehicles ranges from 3 years for most vehicles and up to 15 years for PZEVs, it is anticipated that there will be insignificant levels of out of warranty repairs for components impacted by the regulatory proposal during the first 6 years of vehicle ownership. The bulk of the out of warranty repairs are expected to occur near the end of the useful life of the vehicle when the vehicle is 10 years or older. Therefore, no out-of-pocket costs for repairs of components associated with the proposal are estimated during the 6-year life of a typical OBD II system design. Overall, if manufacturers and their dealers are able to pass the entire costs of the proposal on to consumers, the average price of a new vehicle is expected to increase by $5.43. When considering the average price of a typical new vehicle is $34,367, the $5.43 incremental cost increase represents a price increase of less than 0.02 percent.

H. 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 significant impact on retail prices of new vehicles. Additionally, U.S. EPA has adopted federal OBD requirements that are generally harmonized with those of ARB’s OBD II requirements. This regulatory harmonization between ARB’s and U.S. EPA’s OBD programs is not expected to change in the near future. 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 have equipped all vehicles nationwide with the same system. Therefore, any costs incurred by the vehicle manufacturers will be applicable to all vehicles nationwide and these costs are likely to be passed on to purchasers nationwide in the form of higher retail prices as explained above. Thus, any price increases of light- or medium-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.

I. POTENTIAL IMPACTS ON EMPLOYMENT

The proposed amendments are not expected to cause a noticeable change in California employment because the increased costs are not significant when compared to the overall price of the vehicle and California dealerships and service businesses can perform their normal business with existing staff.

J. POTENTIAL IMPACT ON STATE AND LOCAL AGENCIES

This rulemaking is not expected to affect any local and state agencies other than ARB or any federal funding of state programs.

In the area of costs to state government, the proposed amendments to the OBD II regulations is anticipated to require ARB to hire a minimum of four additional engineering staff persons at a cost of approximately $700,000 beginning in the 2017-2018 fiscal year and thereafter. These additional personnel would be responsible for reviewing, testing, and, determining OBD II compliance on increasingly more complex light-duty, medium-duty, and hybrid vehicles.

K. MAJOR REGULATIONS

For a major regulation proposed on or after November 1, 2013, a standardized regulatory impact analysis is required. A major regulation is one “that will have an economic impact on California business enterprises and individuals in an amount exceeding fifty million dollars ($50,000,000) in any 12-month period between the date the major regulation is filed with the Secretary of State through 12 months after the major regulation is estimated to be fully implemented, as estimated by the agency.” (Govt. Code Section 11342.548). The economic impacts of these amendments do not exceed $50 million.

For purposes of Health and Safety Code Section 57005(b), “major regulation” means any regulation that will have an economic impact (compliance cost) on the state’s business enterprises in an amount exceeding ten million dollars ($10,000,000) in any year, as estimated by the board, department, or office within the agency proposing to adopt the regulation in the assessment. This proposal does not impose compliance costs in excess of $10 million in any year on affected businesses and individuals.

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.

Staff considered two alternatives to the proposed amendments: (1) adopting no amendments; and (2) adopting less stringent amendments.

Staff determined that taking no action would primarily make it more difficult and more expensive for manufacturers to comply with the OBD II requirements and more difficult for ARB to review and approve the OBD II system design on vehicles. The proposal primarily provides clarification to the regulation and provides flexibility for manufacturers to meet the OBD II requirements. More details regarding taking no action were discussed above in section V.C. "Benefits of the Proposal." Accordingly, staff rejected the no-action alternative.

Staff also rejected the second alternative of less stringent amendments. During the regulatory development process, manufacturers proposed less stringent requirements than ultimately proposed by staff. Generally, this would result in higher in-use emissions but still would cost $57.4 million over its lifetime to implement because manufacturers would still have to perform many of these same steps that they would have had to perform to meet the proposed requirements. Staff further believes this alternative would result in manufacturers using less durable components thereby resulting in more failures and consequently higher in-use emissions.

VII. SUMMARY AND RATIONALE FOR PROPOSED AMENDMENTS

Proposed amendments to title 13, CCR section 1968.2:

Subsection (b) The "Applicability" clause of the regulation has been amended to clarify that vehicles shall be equipped with OBD II systems that the Executive Officer determined to meet the OBD II regulation.

Subsection (c) "Active off-cycle credit technology" This new proposed definition is needed to complement the new proposed requirements in subsection (g)(6).

Subsection (c) "Alternate-fueled vehicle" This new proposed definition is needed to clear up confusion about what constitutes an alternate-fueled vehicle, with the clarification mostly involving vehicles that utilize more than one type of fuel.

Subsection (c) "Auxiliary Emission Control Device (AECD)" The proposed changes to the definition are needed since "CFR" has already been defined as "Code of Federal Regulations" in a previous subsection.

Subsection (c) "Calculated load value" The proposed changes to the definition are necessary to update the name "Society of Automotive Engineers" to the official new name "SAE International" and to correct the terminology "output torque" to "engine torque" to match the terminology used in SAE J1939.

Subsection (c) “Charge depleting operation” This new proposed definition is needed to account for the new proposed language in subsections (d)(7.3) and (g)(6).

Subsection (c) “Charge increasing operation” This new proposed definition is needed to account for the new proposed language in subsection (g)(6).

Subsection (c) “Charge sustaining operation” This new proposed definition is needed to account for the new proposed language in subsection (d)(7.3).

Subsection (c) “Diagnostic or emission critical” The proposed changes to the definition of a “diagnostic or emission critical” electronic control unit are 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 and to make clear that “input component” and “output component” could include hybrid components.

Subsection (c) “Diesel engine” The proposed changes to this definition are needed for better readability.

Subsection (c) “Diesel vehicle” This new proposed definition is needed to account for the usage of “diesel vehicle” within the regulation.

Subsection (c) “Driving cycle” The proposed additional language indicating a “driving cycle” is “defined as a trip” is needed for clarification. The proposed addition of “may” in the first sentence and proposed addition of the second sentence is needed to clarify that a driving cycle does not need to include the engine shutoff period unless the monitor runs during engine-off conditions.

Subsection (c) “Emissions neutral default action” This new proposed definition is needed to complement the amendments applicable to emissions neutral diagnostics, in which the definition uses the phrase “emissions neutral default action.”

Subsection (c) “Emissions neutral diagnostic” This new proposed definition is needed to complement the amendments applicable to emissions neutral diagnostics throughout the regulation.

Subsection (c) “Engine misfire” The proposed change from “engine misfire” to “misfire” is needed to account for the usage of “misfire” within the regulation. The definition of “misfire” was moved since the definitions are listed in alphabetical order.

Subsection (c) “50ºF FTP” This new proposed definition is needed to complement the use of this test procedure in determining the emission impact of a comprehensive component under subsections (e)(15.1.2) and (f)(15.1.2)

Subsection (c) “Field reprogrammable” This new proposed definition, which was originally contained in the definition of “diagnostic or emission critical,” is needed for better readability.

Subsection (c) “Gasoline engine” The proposed changes to the definition are needed to more accurately describe the types of vehicle that would be considered a “gasoline engine”. The proposed deletion of “alternate-fueled engine” from the definition is needed because a separate new definition for “alternate-fueled vehicle” is being proposed.

Subsection (c) “Gasoline vehicle” This new proposed definition is needed to account for the usage of “gasoline vehicle” within the regulation.

Subsection (c) “Highway Fuel Economy Driving Cycle” This new proposed definition is needed to complement the use of this cycle in the monitoring system demonstration requirement for certification in subsection (h).

Subsection (c) “Highway Fuel Economy Test (HWFET)” This new proposed definition is needed complement the use of this test in determining the emission impact of a comprehensive component under subsections (e)(15.1.2) and (f)(15.1.2).

Subsection (c) “Ignition cycle” This new proposed definition is necessary to complement the ignition cycle counter requirements in subsection (d)(5.5).

Subsection (c) “Key on, engine off position” The proposed change to this definition adds the option to have vehicles that are not in the state of propulsion system active to those that are “engine off,” which is needed to account for hybrid vehicle operation.

Subsection (c) “Low Emission Vehicle I application” The proposed changes to this definition are needed to indicate that “NMOG” stands for non-methane organic gas.

Subsection (c) “Low Emission Vehicle III application” This new proposed definition and the associated subcategories are needed to complement the amendments applicable to LEV III applications throughout the regulation.

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) “Medium-duty vehicle” or “MDV” The proposed addition of “MDV” to the definition of “medium-duty vehicle” is needed to account for the usage of “MDV” in the regulation.

Subsection (c) “Mild hybrid electric vehicle” This new proposed definition is needed to complement the revised hybrid component monitoring requirements under sections (e)(15) and (f)(15).

Subsection (c) “Normal production” The proposed changes to this definition are needed to indicate that “normal production” is also used in subsection (k).

Subsection (c) “Percentage of misfire” The proposed change to “Percentage of misfire” to italics is needed for formatting reasons. The proposed change of “firing” to “intended combustion” is needed to correct an inaccuracy in how to calculate the percentage of misfire.

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) “Plug-in hybrid electric vehicle” The proposed change to this definition is needed to update the reference site where this is defined to a more appropriate citation.

Subsection (c) “Propulsion system active” The proposed change to this definition is needed to avoid confusion by indicating that remote start activations that do not cause the engine to start should not be considered “propulsion system active.”

Subsection (c) “Response rate” The proposed change to this definition is needed to clarify the difference between delayed response faults and slow response faults.

Subsection (c) “Safety-only component or system” This new proposed definition is needed to complement the amendments applicable to safety-only components or systems in subsections (e)(15), (f)(15), and (i).

Subsection (c) “Similar conditions” The proposed change to this definition is needed for formatting reasons.

Subsection (c) “Smart device” This new proposed definition is needed to complement the amendments applicable to smart devices in subsections (e)(15) and (f)(15).

Subsection (c) “Strong hybrid electric vehicle” This new proposed definition is needed to complement the revised hybrid component monitoring requirements under subsections (e)(15) and (f)(15).

Subsection (c) “Supplemental Federal Test Procedure (SFTP) Composite Emission Standard” This new proposed definition is needed to complement the use of this calculated standard in determining the emission impact of a comprehensive component under subsections (e)(15.1.2) and (f)(15.1.2).

Subsection (c) “Unified cycle” The proposed change to this definition is needed to update the reference site where the driving schedule is defined to a more appropriate citation.

Subsection (c) “Warm-up cycle” The proposed change of “engine starting” to “engine start” is necessary to be consistent with the terminology used in the definitions in subsection (c), which states “engine start.” The proposed addition of temperature values in degrees Celsius in addition to the temperature values in degrees Fahrenheit is needed for clarity.

Subsection (d)(2.1.2) The purpose of this subsection is to describe the MIL functional check requirement. 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. The proposed change to limit the time to illumination for non-analog LCD MILs is needed since the original requirement does not adequately address the fact that there may be a delay in illumination for these types of MILs.

Subsection (d)(2.2.1) The proposed change of “OBD” to “OBD II” is needed for consistency.

Subsection (d)(2.2.2) The purpose of this subsection is to describe the requirements for illuminating the MIL and storing a confirmed fault code after storage of a pending fault code. The proposed change is needed to clarify that when a confirmed fault code is stored, the pending fault code shall continue to be stored in accordance with the current requirements in subsection (g)(4.4.5).

Subsection (d)(2.2.3) The purpose of this subsection is to describe the requirements for illuminating the MIL and storing a fault code upon entering a default or "limp home" mode of operation. The proposed change to subsection (d)(2.2.3), which states that the OBD II system shall illuminate the MIL in the event a malfunction of “any on-board computer(s) or smart device” affects the performance of the OBD II system, is needed to clarify that malfunctions of the smart device itself that may prevent internal monitors from properly running are required to be detected. The proposed change to subsection (d)(2.2.3) indicating the OBD II system is required to store a “pending fault code and confirmed fault code” is needed for clarification. The proposed changes to subsection (d)(2.2.3)(A), which indicates exceptions to illuminating the MIL if the default or "limp home" mode of operation is recoverable, is needed since the subsection mistakenly forgot to mention that the exceptions also include delaying the storage of a confirmed fault code.

Subsection (d)(2.2.7) The purpose of this subsection is to describe the general requirements for storing and erasing "freeze frame" conditions. The proposed additional language, which clarify that freeze frame data that are currently stored may not be replaced with freeze frame data when another fault is subsequently detected unless as allowed for gasoline and diesel fuel system and misfire faults, is needed since this was not clear in the current regulation.

Subsection (d)(2.3) The purpose of this subsection is to describe the general requirements for extinguishing the MIL. The proposed changes to the list of exceptions to the requirements are needed to clarify the monitors that have their own protocol for extinguishing the MIL in lieu of the requirements in this subsection. The proposed changes to subsection (d)(2.3.1) 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. The proposed new subsection (d)(2.3.2) is needed to ensure consistency among manufacturers and require all of them to extinguish the MIL in the same timing.

Subsection (d)(2.4) The purpose of this subsection is to indicate the protocol for erasing confirmed fault codes. 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 subsection (c), which states “warm-up cycle.” The proposed changes indicating when manufacturers are required to erase these confirmed fault codes are necessary to ensure manufacturers are not erasing confirmed fault codes too early or too late.

Subsection (d)(2.5.2) The purpose of this subsection is to describe the requirements for erasing permanent fault codes when the fault information in the on-board computer has been cleared and the OBD II system is not commanding the MIL on. The proposed changes to the section references in subsections (d)(2.5.2)(A) and (B) are needed for formatting reasons. The proposed change of “rationality monitors” to “rationality fault diagnostics” in subsection (d)(2.5.2)(A) is needed to be consistent with the terminology used in the definitions in subsection (c), which states “rationality fault diagnostic.” The proposed new subsection (d)(2.5.2)(F) is needed to correct an oversight by allowing the engine cooling system monitors to use the criteria under subsection (d)(2.5.2)(A) instead of (d)(2.5.2)(B), since the criteria under subsection (d)(2.5.2)(B) are generally applicable to monitors that run continuously and that are not subject to the minimum ratio requirements of subsection (d)(3.2) while the engine cooling system monitors, though subject to the requirement of subsection (d)(3.2), are not required to run continuously.

Subsection (d)(2.5.3) This new proposed subsection was added to clarify the requirements for erasing a specific permanent fault code if more than one permanent fault are currently stored. This new subsection is needed to clear up confusion among manufacturers.

Subsection (d)(2.6) This new proposed subsection was added to allow for exceptions to the MIL illumination and fault code storage requirements, specifying that default strategies that meet certain criteria as well as emission neutral diagnostics are exempt. The new subsection is needed to prevent unnecessary illumination of the MIL and storage of fault codes.

Subsection (d)(3.2.1)(B) The purpose of this subsection is to specify the minimum acceptable in-use monitor performance ratio for evaporative system monitors. The proposed change of adding the reference to subsection (e)(4.2.2)(D) to subsection (d)(3.2.1)(B)(ii) is needed to account for the new proposed monitoring requirements for high-load purge flow in subsection (e)(4).

Subsection (d)(3.2.1)(D)(v) The purpose of this subsection is to specify the minimum acceptable in-use monitor performance ratio for monitors on plug-in hybrid electric vehicles that are for systems/components that require engine operation during the interim years. The proposed extension of the use of the 0.100 ratio from the 2016 model year to the 2019 model year is needed to address manufacturers' concerns about the lack of engine runtime (and thus monitoring opportunity) on plug-in hybrid electric vehicles.

Subsection (d)(3.2.1)(D)(vi) The purpose of this subsection is to specify the minimum acceptable in-use monitor performance ratio for the diesel PM filter filtering performance and missing substrate monitors during the interim years before more stringent ratios are required. The proposed allowance for 2019 through 2021 model year passenger cars, light-duty trucks, and medium-duty vehicles certified to a chassis dynamometer tailpipe emission standard to use a ratio of 0.100 for these monitors is needed to allow for interim relaxation for these monitors, which would be required to start using the more frequently incremented general denominator starting in the 2019 model year (as required in subsection (d)(4.3.2)(G)) that may result in lower ratios observed on in-use vehicles. The interim thresholds would thus allow the manufacturer to gain some experience before being held to a higher ratio.

Subsection (d)(3.2.1)(D)(vii) This new proposed subsection, which specifies an interim minimum acceptable in-use monitor performance ratio of 0.100 for the gasoline PCV and diesel CV system monitors, is needed to account for the new proposed amendments made to the monitoring requirements for these systems in subsections (e)(9) and (f)(10).

Subsection (d)(3.2.2) The purpose of this subsection is to list the monitors required to track and report in-use monitor performance data. The proposed changes to the numbering of the list are needed for formatting reasons. The proposed addition of the gasoline fuel system air-fuel ratio cylinder imbalance monitor (subsection (e)(6.3.2)) to the list is needed so that ARB can ensure that this monitor runs frequently in-use, since there have been issues in the past regarding its monitoring frequency in-use. The proposed revision of "track and report" to "track or report" is needed to clarify that manufacturers are not required to track the in-use monitor performance data for monitors not listed under subsection (d)(3.2.2).

Subsection (d)(4.3.2)(B) The purpose of this subsection is to describe the criteria for incrementing the "general denominator." The proposed addition of temperature values in degrees Celsius in addition to the temperature values in degrees Fahrenheit is needed for clarity.

Subsection (d)(4.3.2)(B)(v) This new proposed subsection, which allows manufacturers to increment the in-use monitor performance denominators on their non-hybrid vehicles based on the criteria applicable to hybrid vehicles under subsection (d)(4.3.2)(K), is needed to address manufacturers' request to use the same denominators across their product line (which include both hybrid vehicles and non-hybrid vehicles) to minimize workload and cost.

Subsection (d)(4.3.2)(C) The purpose of this subsection is to describe the criteria for incrementing the secondary air system monitor denominator(s). The proposed change to add "cumulative" to "time greater than or equal to ten seconds" is needed for clarification.

Subsection (d)(4.3.2)(D) The purpose of this subsection is to describe the criteria for incrementing the evaporative system monitor denominator(s). The proposed change to limit the evaporative system monitors to those under subsections (e)(4.2.2)(A) through (C) is needed since the high-load purge monitor (subsection (e)(4.2.2)(D)) would now be subject to the denominator criteria under new proposed subsection (d)(4.3.2)(M). The proposed change adding comprehensive component input component temperature sensor rationality monitors and engine cooling system input component rationality monitors to this subsection is needed since these monitors generally require a cold start to enable monitoring. The proposed addition of temperature values in degrees Celsius in addition to the temperature values in degrees Fahrenheit is needed for clarity.

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 "on." The proposed change to add "cumulative" to "time greater than or equal to ten seconds" is needed for clarification.

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 and not covered under subsection (d)(4.3.2)(E). The proposed change of "monitors of component" to "component monitors" is needed for better readability. The proposed deletion of "other emission control or source device" from the list of monitors required to meet the criteria under subsection (d)(4.3.2)(F) is needed to correct an error since these monitors are already listed under subsection (d)(4.3.2)(H). The proposed addition of "idle speed control system" and "idle fuel control system" to the examples of comprehensive components required to meet the criteria under this subsection is needed to clarify which criteria these monitors are required to meet, since there have been confusion among manufacturers.

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 additional language requiring the 500-mile counter to “reset to zero and begin counting again after the denominator has been incremented and no later than the start of the next ignition cycle” is needed to provide more details about when the counter is required to be reset. The proposed change to allow the diesel PM filter feedgas generation monitor (subsection (f)(9.2.4)(B)) to use the incrementing criteria under this subsection is needed since the NMHC converting catalyst feedgas generation monitor is allowed to use these criteria. The proposed change to limit application of this requirement to the 2004 through 2018 model year passenger cars, light-duty trucks, and medium-duty vehicles certified to a chassis dynamometer tailpipe emission standard for the PM filter filtering performance missing substrate monitors is needed considering the importance of the PM filter, which controls emissions throughout the driving cycle, not just once every 500 miles.

Subsection (d)(4.3.2)(H) The purpose of this subsection is to allow certain vehicles to increment the denominator based on alternate criteria in lieu of those in subsection (d)(4.3.2)(B). The proposed change of “monitors of the following components” to “following component monitors” is needed for better readability. The proposed deletions of “engine cooling system input components (sections (e)(10) and (f)(11))” and “comprehensive component input component temperature sensor rationality monitors (sections (e)(15) and (f)(15)) (e.g., intake air temperature sensor, ambient temperature sensor, fuel temperature sensor)” are needed since these monitors were moved to subsection (d)(4.3.2)(D).

Subsection (d)(4.3.2)(J) The purpose of this subsection is to allow vehicles that employ alternate engine start hardware or strategies and alternate-fuel vehicles to increment the denominator based on alternate criteria in lieu of those in subsection (d)(4.3.2)(B). 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 a separate section applies specifically to hybrids (subsection (d)(4.3.2)(K)) 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 subsection. The proposed deletion of “(e.g., dedicated, bi-fuel, or dual-fuel applications)” is needed since the phrase “alternate-fueled vehicle” is now defined in subsection (c), so the examples here are not needed anymore.

Subsection (d)(4.3.2)(K) The purpose of this subsection is to describe the requirement for incrementing the “general denominator” on hybrid vehicles. The proposed addition of temperature values in degrees Celsius in addition to the temperature values in degrees Fahrenheit is needed for clarity.

Subsection (d)(4.3.2)(L) The purpose of this subsection is to describe the requirements for incrementing the evaporative system monitor denominator(s) for 2015 and subsequent model year plug-in hybrid electric vehicles. The proposed change to limit the evaporative system monitors to those under subsections (e)(4.2.2)(A) through

(C) is needed since the high-load purge monitor (subsection (e)(4.2.2)(D)) would now be subject to the denominator criteria under new proposed subsection (d)(4.3.2)(M). The proposed change adding comprehensive component input component temperature sensor rationality monitors and engine cooling system input component rationality monitors to this subsection is needed since these monitors generally require a cold start to enable monitoring. The proposed addition of temperature values in degrees Celsius in addition to the temperature values in degrees Fahrenheit is needed for clarity. The proposed change of “start of the driving cycle” to “start of propulsion system active” is needed to account for the fact that not all driving cycles are immediately preceded by a period of non-propulsion system active as allowed in the definition of “driving cycle” in subsection (c).

Subsection (d)(4.3.2)(M) This new proposed subsection, which describes the requirements for incrementing the evaporative system high-load purge monitor denominator(s), is needed to address concerns about low monitoring frequency (and thus low in-use monitor performance ratios) due to high-load purging requiring extreme conditions to execute. This new subsection would more accurately designate conditions under which high-load purging occurs.

Subsection (d)(4.5.1) The proposed change to this subsection is needed for better readability.

Subsections (d)(4.5.3) and (d)(4.5.4) The purpose of these subsections is to describe the conditions under which incrementing of all numerators and denominators are allowed to be disabled. The proposed changes to limit the requirements in subsection (d)(4.5.3) to the 2004 through 2018 model years and to add a new subsection (d)(4.5.4) to apply to the 2019 and subsequent model years are needed to address a few issues. First, subsection (d)(4.3.2)(C) refers to the denominator-incrementing criteria solely for the secondary air system monitor, so the criteria should not be applied to all other monitors and all other monitors should still accurately increment their numerators and denominators even if the criteria applicable only to the secondary air system can no longer be determined. Second, subsection (d)(4.3.2)(D) refers to the denominator-incrementing criteria for monitors that require cold start (e.g., evaporative system leak detection 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. The proposed start date of 2019 model year for new proposed subsection (d)(4.5.4) is needed to provide enough lead time for manufacturers to meet the new requirement.

Subsection (d)(4.5.5) This new proposed subsection is needed to allow manufacturers to disable incrementing of numerators and denominators for specific monitors if a malfunction is detected for any component used to determine the denominator incrementing criteria for the monitor under subsections (d)(4.3.2)(C) through (J) and (L), since requiring them to continue incrementing in such cases would not provide useful data.

Subsection (d)(5.1) The purpose of this subsection is to indicate the specific diesel components/monitors for which the OBD II system is required to report in-use monitor performance data. The proposed separation of the gasoline and diesel monitors into subsections (d)(5.1.1) and (d)(5.1.2) is needed for better readability. The proposed changes to the monitor names in these subsections are needed to be consistent with what is required to be reported in SAE J1979. The proposed addition of "fuel system" to the list of required monitors for gasoline vehicles is needed to account for the new proposed requirement to track and report the in-use monitor performance data for the air-fuel ratio cylinder imbalance monitor.

Subsection (d)(5.5.1) The purpose of this subsection is describe the requirements for the ignition cycle counter(s). The proposed changes to subsection (d)(5.5.1)(B) allowing the reporting of two ignition cycle counters for non-plug-in hybrid electric vehicles are needed to address manufacturers' request to use the same systems across their product line (which include both plug-in hybrid electric vehicles and non-plug-in hybrid electric vehicles) to minimize workload and cost. The proposed changes to subsection (d)(5.5.2)(D) are needed for better readability.

Subsection (d)(5.6.2) The purpose of this subsection is describe the requirements for the general denominator. The proposed changes to subsection (d)(5.6.2)(B) are needed to clarify how exactly the general denominator is to be incremented for non-hybrid vehicles, hybrid vehicles, and plug-in hybrid electric vehicles. The proposed changes to subsection (d)(5.6.2)(B) requiring new incrementing criteria for the general denominator on 2019 and subsequent model year plug-in hybrid electric vehicles are needed to provide important data about how often driving cycles without engine run time are met in the real world, which would assist in determining if future regulation changes for plug-in hybrid electric vehicles are needed. The proposed changes to subsection (d)(5.6.2)(C) are needed for better readability.

Subsection (d)(6) The purpose of this subsection is to describe the requirements for malfunction criteria determination for diesel vehicles. The proposed addition of "and adjustment factors" to the title is needed to clarify that this subsection includes the requirements for determining and applying adjustment factors. The proposed change in subsection (d)(6.2.6) is needed since subsection "(d)(7)" moved to "(d)(8)." The new proposed subsection (d)(6.4), which requires 2019 and subsequent model year vehicles to adjust the emission data when trying to test out of specific diesel monitoring requirements, is needed to account for the higher emissions that are emitted during these regeneration events, which would result in emission data that are more representative of real world emissions when a malfunction occurs.

Subsection (d)(7) This new proposed subsection was added to clarify that manufacturers of alternate-fueled vehicles and vehicles that utilize both gasoline and diesel emission control technologies are required to submit a plan for meeting the OBD II requirements, since they may not cleanly fit under just the gasoline requirements or just the diesel requirements and thus would need to ensure they are meeting the correct requirements in the regulations. The proposal to require manufacturers of 2019 and subsequent model year plug-in hybrid electric vehicles to calibrate the emission malfunction threshold in the driving mode that results in worst case emissions for each monitor is needed to ensure that the monitors are able to detect faults before emissions exceed the required thresholds in-use.

Subsection (d)(9) This new proposed subsection, which describes the requirements for meeting phase-in schedules and allows manufacturers to use alternate phase-in schedules, is needed to account for the new proposed requirements in subsection (d) that include specified phase-in schedules.

Subsection (e) The purpose of this subsection is to describe the monitoring requirements for gasoline/spark-ignited engines. The proposed description of the required emission malfunction thresholds for non-LEV III applications is needed to make clear that the thresholds are already specified in the specific monitoring sections in subsection (e), which differentiates them from the proposed thresholds for LEV III applications specified in the table at the beginning of subsection (e). The proposed emission malfunction thresholds for LEV III applications are needed since the LEV III tailpipe emission standards now consist of combined NMOG+NOx standards and the current thresholds in the regulation are not appropriate for some of the LEV III applications certifying to more stringent tailpipe emission standards.

Subsection (e)(1.2.1) The purpose of this subsection is to describe the malfunction criteria for a catalyst system malfunction for LEV I applications. The proposed change of “either” to “any” is needed since “any” is more appropriate.

Subsection (e)(1.2.2) The purpose of this subsection is to describe the malfunction criteria for a catalyst system malfunction for LEV II applications and all 2009 and subsequent model year applications. The proposed replacement of “all 2009 and subsequent model year vehicles” to “all 2009 and subsequent model year non-Low Emission Vehicle III applications” is needed since new requirements are being proposed for LEV III applications in subsection (e)(1.2.3). The proposed changes of “(e)(1.2.4)” to “(e)(1.2.5)” in subsection (e)(1.2.2)(B) and of “(e)(1.2.5)” to “(e)(1.2.6)” in subsection (e)(1.2.2)(C) are needed since these sections were renumbered.

Subsection (e)(1.2.3) This new proposed subsection describing the malfunction criteria for catalyst system faults for LEV III applications is needed to ensure manufacturers use the appropriate thresholds for these monitors.

Subsection (e)(1.2.6) The proposed change of “(e)(1.2.2.)(B)” to “(e)(1.2.2)(B)” is needed to correct an error.

Subsection (e)(1.2.7) The proposed change of “(e)(1.2.3)” to “(e)(1.2.4)” is needed since this subsection was renumbered.

Subsection (e)(1.2.8) The purpose of this subsection is to describe the requirements for determining the catalyst system malfunction criteria for subsection (e)(1.2.2)(B) and (C). The proposed addition of subsection (e)(1.2.3) to this subsection is needed to account for the new proposed malfunction criteria for LEV III applications. The proposed change of "(e)(1.2.7)(C)" to (e)(1.2.8)(C)" in subsection (e)(1.2.8)(B) is needed since this subsection was renumbered.

Subsection (e)(1.3) The purpose of this subsection is to describe the requirements for defining catalyst system monitoring conditions. The proposed addition of "Additionally, manufacturers shall track and report the in-use performance of the catalyst monitor under section (e)(1.2) in accordance with section (d)(3.2.2)" is needed for clarity and better readability.

Subsection (e)(2.2.1) The purpose of this subsection is to describe the malfunction criteria for a heated catalyst system malfunction. The proposed changes to this subsection are needed to account for the new proposed malfunction criteria for LEV III applications.

Subsection (e)(3.1.1) The purpose of this subsection is to indicate that the OBD II system is required monitor the engine for misfire. The proposed replacement of "misfire causing catalyst damage and misfire causing excess emissions" with "misfire" is needed for simplicity to ensure all required misfire are detected, since subsection (e)(3) requires detection of misfire faults when the percentage of misfire exceeds a certain level in addition to misfire faults that cause emissions to exceed a specific emission threshold.

Subsection (e)(3.1.3) The purpose of this subsection is to describe the requirements for storing fault codes for multiple cylinder misfire. The proposed replacement of "manufacturer" with "OBD II system" is needed since "OBD II system" is more appropriate.

Subsection (e)(3.2.1) The purpose of this subsection is to describe the malfunction criteria for misfire causing catalyst damage. The proposed addition of "for all vehicles" to the title is needed to avoid confusion and to clarify that this requirement applies to all vehicles. The proposed additional language in subsection (e)(3.2.1)(C), which indicates that detection of only a single component failure is allowed for multiple cylinder misfire situations that result in a misfire rate greater than or equal to 50 percent, is needed for clarification since this allowance was already permitted under a separate ARB mail-out.

Subsection (e)(3.2.2) The purpose of this subsection is to define the malfunction criteria for misfire causing emissions to exceed an emission threshold. The proposed change of the subsection title from "misfire causing emissions to exceed 1.5 times the FTP standards" to "misfire causing emissions to exceed an emission threshold" is needed for clarification, since there are some emission thresholds that are not 1.5 times the FTP standards. The proposed changes to subsection (e)(3.2.2)(A) are needed to account for the new proposed malfunction criteria for plug-in hybrid electric vehicles in new subsection (e)(3.2.3) and to account for the new proposed malfunction criteria for LEV III applications. The proposed additional language in subsection (e)(3.2.2)(C), which indicates that detection of only a single component failure is allowed for multiple cylinder misfire situations that result in a misfire rate greater than or equal to 50 percent, is needed for clarification since this allowance was already permitted under a separate ARB mail-out.

Subsection (e)(3.2.3) This new proposed subsection describing the required malfunction criteria for plug-in hybrid electric vehicles is needed to address concerns that these vehicles will not obtain enough 1000-revolution periods in-use (due to less engine runtime) to detect misfire malfunctions under the current requirements and as part of staff's efforts to streamline requirements in the regulation.

Subsection (e)(3.3.3) The purpose of this subsection is to describe the conditions in which manufacturers may reduce misfire detection capability related to cold start emission reduction strategies. The proposed addition of temperature values in degrees Celsius in addition to the temperature values in degrees Fahrenheit is needed for clarity.

Subsection (e)(3.3.4)(B) The purpose of this subsection is to describe the conditions under which a manufacturer may disable misfire monitoring. The proposed addition of temperature values in degrees Celsius to the temperature values in degrees Fahrenheit is needed for clarity.

Subsection (e)(3.3.6) The purpose of this subsection is to describe conditions under which misfire monitoring shall occur for vehicles that employ engine shutoff strategies that do not require the vehicle operator to restart the engine to continue driving. The proposed change of including vehicles with start-stop systems as an example is needed to clear up confusion about the vehicles to which this subsection applies. The proposed change to require 2019 and subsequent model year hybrid vehicles to enable monitoring no later than the end of the second crankshaft revolution after engine fueling begins for the initial start and after each time fueling resumes is needed since the period of re-enablement should be similar to that required for non-hybrid vehicles after engine start.

Subsection (e)(3.4.1)(B)(i) The purpose of this subsection is to describe the conditions under which a confirmed fault is required to be stored for misfire faults. The proposed changes to this subsection are needed for clarity.

Subsection (e)(3.4.2) The purpose of this subsection is to describe MIL illumination and fault code storage criteria for misfire causing emissions to exceed an emission threshold. The proposed change of the subsection title from "misfire causing emissions to exceed 1.5 times the FTP standards" to "misfire causing emissions to exceed an emission threshold" is needed to match the title used in subsection (e)(3.2.2). The proposed change to subsection (e)(3.4.2)(B)(ii) is needed to clarify that when a confirmed fault code is stored, the pending fault code shall continue to be stored in accordance with the current requirements in subsection (g)(4.4.5).

Subsection (e)(3.4.3) This new proposed subsection, which describes the MIL illumination and fault code storage criteria for plug-in hybrid electric vehicles, is needed to complement the new proposed malfunction criteria for plug-in hybrid electric vehicles described in new proposed subsection (e)(3.2.3).

Subsection (e)(3.4.4)(B) The purpose of this subsection is to describe the requirements for storing and erasing freeze frame conditions. The proposed change adding “misfire” to “fault code” is needed for clarity.

Subsection (e)(3.4.5) The purpose of this subsection is describe the storage of misfire conditions for similar conditions determination. The proposed addition of subsection (e)(3.4.3) is needed to account for the new proposed subsection (e)(3.4.3) for plug-in hybrid electric vehicles.

Subsection (e)(4.1) The purpose of this subsection is to describe the general requirements for evaporative system monitoring. The proposal 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 vehicles is needed since some alternate-fueled vehicles are subject to the evaporative emission standards (and thus to the evaporative system monitoring requirements) but have evaporative systems that are different from those on gasoline engines, which means the current monitoring requirements are not applicable.

Subsection (e)(4.2.2) The purpose of this subsection is to indicate the malfunction criteria for evaporative system monitors. The proposed addition of “Except as specified in section (e)(4.2.2)(D)” to subsection (e)(4.2.2)(A) is needed to account for the separate malfunction criterion related to high-load purge flow monitoring in new proposed subsection (e)(4.2.2)(D). The proposed addition of “(i.e., to the enclosed area of the air intake system)” to subsection (e)(4.2.2)(A) is needed for clarity. The new proposed subsection (e)(4.2.2)(D) is needed to differentiate high-load purge flow monitors from “normal” purge flow monitors, since high-load purge flow monitors would be subject to some different requirements than “normal” purge flow monitors.

Subsection (e)(4.2.7) This new proposed subsection was added to describe the malfunction criteria for vehicles with multiple fuel tanks, canisters, and/or purge valves, since the current regulation does not account for these types of systems and the current requirements may not be appropriate for such large systems.

Subsection (e)(4.2.8) The purpose of this subsection is to describe specific criteria applicable to the purge flow monitors required under subsections (e)(4.2.2)(A) and (D). The proposed change in subsection (e)(4.2.8)(A) of “both purge flow paths” to “all purge flow paths” is needed to correct an error, since vehicles may have more than two purge flow paths and should monitor all these purge flow paths. The proposed changes in subsection (e)(4.2.8)(A) of “low pressure” and “high pressure” to “low-load” and “high-load," respectively, are needed for consistency. The other proposed changes in subsection (e)(4.2.8)(A) and (e)(4.2.8)(A)(i) are needed to make clear the monitoring requirements and applicable test-out criteria for each purge flow monitor. The new proposed subsection (e)(4.2.8)(A)(ii), which allows manufacturers to be exempt from monitoring purge flow through the high-load purge line if certain conditions are met, is needed since manufacturers may have difficulty in monitoring these lines. The new proposed subsection (e)(4.2.8)(B), which allows manufacturers to design monitoring strategies that do not directly confirm evaporative purge delivery to the engine, is needed to allow manufacturers flexibility when designing monitoring strategies. The new proposed subsection (e)(4.2.8)(C), which allows manufacturers to not detect all malfunctions that affect high-load purging up to a certain date, is needed to ensure that malfunctions that can result in gross high-load purge emissions are detected going forward.

Subsection (e)(4.3.1) The purpose of this subsection is to describe the requirements for defining monitoring conditions for the purge flow monitors and 0.040 inch leak monitor. The proposed addition of subsection (e)(4.2.2)(D) is needed to account for the separate subsection for high-load purge monitors.

Subsection (e)(4.3.2) The purpose of this subsection is to describe the requirements for defining monitoring conditions for the 0.020 inch leak monitor. The proposed addition of "Additionally, manufacturers shall track and report the in-use performance of the evaporative system monitors under section (e)(4.2.2)(C) in accordance with section (d)(3.2.2)" is needed for clarity and better readability.

Subsection (e)(5.2.1) The purpose of this subsection is to define terms used in subsection (e)(5). The proposed division of the subsection into subsections (e)(5.2.1)(A) and (B) is needed for better readability. The proposed change of "sections (e)(5.2.3) and (5.2.4)" to "section (e)(5.2.3)" in subsection (e)(5.2.1)(A) is needed to since these sections have been renumbered. The proposed move of the definition of "normal operation" from subsection (e)(5.2.3)(B) to new proposed subsection (e)(5.2.1)(B) is needed since this subsection is a more appropriate location for this definition.

Subsection (e)(5.2.2) The purpose of this subsection is to describe the secondary air system monitor malfunction criteria for LEV I applications. The proposed change of "(e)(5.2.2)(B) and (e)(5.2.4)" to "(e)(5.2.2)(B) and (C)" is needed since subsection (e)(5.2.4) was moved up to (e)(5.2.2)(C) and renumbered for better readability.

Subsection (e)(5.2.3)(B) The purpose of this subsection is to describe the malfunction criteria for secondary air system monitors on 2006 and subsequent model year non-LEV I applications. The proposed change of "(e)(5.2.3)(C) and (e)(5.2.4)" to "(e)(5.2.3)(C) and (D)" is needed to account for the new proposed changes and renumbering of these subsections. The proposed deletion of the definition of "normal operation" is needed since this definition was moved to subsection (e)(5.2.1)(B). The other proposed changes to subsection (e)(5.2.3)(B) are needed to account for the new proposed malfunction criteria for LEV III applications.

Subsection (e)(5.2.3)(D) The purpose of this subsection is to describe the malfunction criteria if no failure of the secondary air system would result in emissions exceeding the required emission thresholds. The proposed change of “1.5 times any of the applicable standards” to “the thresholds specified in section (e)(5.2.3)(B)(i)” is needed to account for the new proposed malfunction criteria for LEV III applications. The proposed addition of “during normal operation” is needed for clarification. The proposed deletion of “For vehicles subject to the malfunction criteria in section (e)(5.2.3)(B), this monitoring for no detectable amount of air flow shall occur during normal operation of the secondary air system” is needed since the language is now redundant.

Subsection (e)(5.3.2)(B) The purpose of this subsection is to describe the requirements for defining secondary air system monitoring conditions. The proposed addition of “Additionally, manufacturers shall track and report the in-use performance of the secondary air system monitors under section (e)(5.2) in accordance with section (d)(3.2.2)” is needed for clarity and better readability.

Subsection (e)(6.1) The proposed changes are needed for formatting reasons.

Subsection (e)(6.2.1)(A) and (B) The purpose of these subsections is to define the malfunction criteria for fuel system monitoring. The proposed addition of the language “any of the following occurs” in subsection (e)(6.2.1) is needed for clarify. The proposed changes to subsections (e)(6.2.1)(A) and (e)(6.2.1)(B) are needed to account for the new proposed malfunction criteria for LEV III applications.

Subsection (e)(6.2.1)(C) The purpose of this subsection is to define the malfunction criteria for the air-fuel ratio cylinder imbalance monitor. The proposed changes to subsection (e)(6.2.1)(C) are needed to account for the new proposed malfunction criteria for LEV III applications and to distinguish these malfunction criteria from those for non-LEV III applications. The proposed changes to subsection (e)(6.2.1)(C)(i), which extend the use of the thresholds in subsection(e)(6.2.1)(C)(i)a. by one year and delay the final threshold in subsection (e)(6.2.1)(C)(i)b. by one year, are needed to address manufacturers’ issues with meeting the final threshold according to the previous required timeline. The proposed changes to subsection (e)(6.2.1)(C)(i)c., which allows engines first certified in the 2011 through 2014 model year and carried over to the 2015 model year to meet the previous interim thresholds in 2015, is needed so that manufacturers would not have to spend resources to have all engines meet the final thresholds in 2015. The proposed interim thresholds in subsection (e)(6.2.1)(C)(ii) for LEV III applications are needed to address manufacturers’ concerns about meeting the requirements and to allow manufacturers more time to meet the final thresholds.

Subsection (e)(6.2.3) The purpose of this subsection is to indicate under what conditions the OBD II system is not required to detect a malfunction of the fuel system feedback control based on a secondary oxygen (or equivalent) sensor. The proposed change of “section (e)(6.2.1)” to “section (e)(6.2.1)(B)” is needed to refer to the correct subsection.

Subsection (e)(6.2.4) The purpose of this subsection is to describe the malfunction criteria for failure to enter closed-loop operation. The proposed change of “within a manufacturer specified time interval” to “within an Executive Officer approved time interval” is needed to clarify that this time interval set by the manufacturer is required to be approved by the Executive Officer.

Subsection (e)(6.2.5) The purpose of this old subsection is to describe when manufacturers may adjust the malfunction criteria or limits. The proposed deletion of this subsection is needed since it is not necessary, considering the new proposed subsection (e)(6.3.5) allows for disablement of the fuel system monitor during conditions such as those described in old subsection (e)(6.2.5) that will not provide for robust detection of malfunctions.

Subsection (e)(6.2.6) The purpose of this new proposed subsection is to indicate the conditions under which fuel system monitoring shall occur for vehicles that employ engine shutoff strategies that do not require the vehicle operator to restart the engine to continue driving. The proposed new subsection is needed to ensure that the fuel system monitor is re-enabled as soon as possible when the engine restarts after engine shutoff.

Subsection (e)(6.2.7) The purpose of this new proposed subsection is to describe the requirements for how a manufacturer calibrates the air-fuel ratio cylinder imbalance monitor malfunction criteria. This proposed new subsection is needed to address manufacturers’ confusion about how to calibrate the monitor.

Subsection (e)(6.3.1) The purpose of this subsection is to describe the conditions under which fuel system monitoring shall occur. The proposed change of “(e)(6.3.2)” to “(e)(6.3.5)” is needed since (e)(6.3.5) is the correct subsection to reference. The proposed changes detailing the specific monitors and sections that are required to meet this subsection are needed since the previous language implied that all fuel system monitors were required to meet the requirements of this subsection, when in fact some monitors like the air-fuel ratio cylinder imbalance monitor are required to meet the requirements of other subsections, not (e)(6.3.1).

Subsection (e)(6.3.2) The purpose of this subsection is to describe the conditions under which air-fuel ratio cylinder imbalance monitoring shall occur. The proposed changes requiring the OBD II system to track and report the in-use performance of the air-fuel ratio cylinder imbalance monitor is needed due to issues with the monitor running infrequently in-use, so there should be assurance that the in-use monitoring performance data of this monitor are tracked and reported with a phase-in starting in the 2019 model year.

Subsection (e)(6.3.3) This new proposed subsection, which defines the monitoring conditions for monitors that detect failures to enter closed-loop operation, is needed since the previous language requiring these monitors to meet the requirements under subsection (e)(6.3.1) was not correct.

Subsection (e)(6.3.4) This new proposed subsection, which defines the monitoring conditions for fuel system monitors on vehicles that employ engine shutoff strategies that do not require the vehicle operator to restart the engine to continue driving, is needed to complement the new proposed monitoring requirements under subsection (e)(6.2.6).

Subsection (e)(6.3.5) This new proposed subsection, which allows the OBD II system to disable continuous fuel system monitors under certain conditions, is needed to allow manufacturers to disable monitoring under conditions in which robust detection of fuel system faults is at issue.

Subsection (e)(6.4) The purpose of this subsection is to describe the requirements for MIL illumination and fault code storage for fuel system malfunctions. The proposed change of “section (6.2.1)(C)” to “section (e)(6.2.1)(C)” is needed for better readability. The proposed additional language, which makes clear that the stored fault code shall pinpoint the likely cause of the malfunction to the extent allowed by the monitoring strategy, is needed to address confusion about the fault code storage requirements. The proposed additional language, which makes clear that the OBD II system does not need to store a fault code that specifically identifies an air-fuel ratio cylinder imbalance fault if hardware needs to be added to achieve this, is needed since manufacturers are allowed to detect this fault with other existing monitors (e.g., the misfire monitor).

Subsection (e)(6.4.2) This purpose of this subsection is to describe the criteria for illuminating the MIL and storing a confirmed fault code for fuel system malfunctions. The proposed change of “either” to “any” is needed since the use of “any” is more appropriate. The proposed change is needed to clarify that when a confirmed fault code is stored, the pending fault code shall continue to be stored in accordance with the current requirements in subsection (g)(4.4.5).

Subsection (e)(6.4.4)(B) The purpose of this subsection is to describe the requirements for storing and erasing "freeze frame" conditions for the fuel system monitor. The proposed change in subsection (e)(6.4.4)(B) adding “fuel system” to “fault code” is needed for clarity.

Subsection (e)(7.2.1)(A) The purpose of this subsection is to describe the malfunction criteria for primary oxygen sensor monitoring. The proposed change of “1.5 times any of the applicable FTP standards” to “the emission thresholds in sections (e)(7.2.1)(A)(i) or (ii) below” is needed for clarification, since there are some emission thresholds that are not 1.5 times the FTP standards. The proposed changes to the description of the response rate faults are needed to clarify the difference between delayed response faults and slow response faults. The proposed new subsections (e)(7.2.1)(A)(i) and (ii) are needed to account for the new proposed malfunction criteria for LEV III applications and to distinguish these malfunction criteria from those for non-LEV III applications.

Subsection (e)(7.2.2)(B) The purpose of this subsection is to describe the malfunction criteria for primary oxygen sensor monitoring. The proposed deletion of “either” is needed for clarity.

Subsection (e)(7.2.2) The purpose of this subsection is to describe the malfunction criteria for secondary oxygen sensor monitoring. The proposed changes to subsection (e)(7.2.2)(A) are needed to account for the new proposed malfunction criteria for LEV III applications and to distinguish these malfunction criteria from those for non-LEV III applications. The new proposed subsection (e)(7.2.2)(E), which requires manufacturers to detect faults when the fuel system stops using the sensor as a feedback input, is needed to ensure that secondary oxygen sensors that are used as part of a fuel system feedback control system are monitored.

Subsection (e)(7.3.1)(A) The purpose of this subsection is to describe the requirements for defining primary sensor monitoring conditions. The proposed addition of “Additionally, manufacturers shall track and report the in-use performance of the primary sensor monitors under sections (e)(7.2.1)(A) and (D) in accordance with section (d)(3.2.2)” is needed for clarity and better readability.

Subsection (e)(7.3.2) The purpose of this subsection is to describe the requirements for defining secondary sensor monitoring conditions. The proposed addition of “manufacturers shall track and report the in-use performance of the secondary sensor monitors under (e)(7.2.2)(A) and (C) in accordance with section (d)(3.2.2)” in subsection (e)(7.2.3)(A) is needed for clarity and better readability. The proposed change of “(e)(7.3.2)(C)” to (e)(7.3.2)(D)” in subsection (e)(7.3.2)(B) is needed since this subsection was renumbered. The new proposed subsection (e)(7.3.2)(C), which describes the monitoring conditions for the secondary sensor feedback monitor, is needed to complement the new monitoring requirements under subsection (e)(7.2.2)(E).

Subsection (e)(7.4) 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 and each distinct malfunction is needed for emphasis since some manufacturers have been inappropriately storing the same fault code for different malfunctions, even though subsection (g)(4.4) currently requires manufacturers to pinpoint the likely cause of a malfunction. The proposed addition of language related to sensors with sensing elements externally connected to a sensor control module is needed to address confusion about the fault code storage requirements for these components.

Subsection (e)(8.2) The purpose of this subsection is to describe the malfunction criteria for the EGR system monitor. The proposed changes in subsections (e)(8.2.1) through (e)(8.2.4) separating the requirements for failures resulting in a “decrease” in EGR flow and an “increase” in EGR flow is needed for clarity and better readability. The proposed changes in subsections (e)(8.2.1) and (e)(8.2.2) are needed to account for the new proposed malfunction criteria for LEV III applications and to distinguish these malfunction criteria from those for non-LEV III applications. The proposed change in subsection (e)(8.2.3) related to the monitoring requirements for feedback controlled EGR systems is needed since the current language only stated the requirements for non-feedback controlled EGR systems. The new proposed subsection (e)(8.2.4), which requires manufacturers to detect a functional “too high flow” fault of the EGR system if a fault that causes an increase in flow does not cause emissions to exceed a specific threshold, is needed to completely cover all faults of the EGR system and be consistent with what is required for other component/system monitors.

Subsection (e)(8.3.1) The purpose of this subsection is to describe the requirements for defining EGR system monitoring conditions. The proposed addition of “Additionally, manufacturers shall track and report the in-use performance of the EGR system monitors under section (e)(8.2) in accordance with section (d)(3.2.2)” is needed for clarity and better readability.

Subsection (e)(9.1.1) The purpose of this subsection is to describe the general requirements for monitoring the PCV system. The proposed change of “required to be equipped with PCV systems” to “subject to crankcase emission control requirements” is needed since the new language more accurately identifies the systems that are required to meet these monitoring requirements.

Subsection (e)(9.2) The purpose of this subsection is to describe the malfunction criteria for PCV system malfunctions. The proposed deletion of “either” in subsection (e)(9.2.2) is needed for clarity. The other proposed changes to subsection (e)(9.2) are needed to address issues with the current PCV monitoring requirements, to reduce staff review of PCV systems by streamlining the requirements, and to ensure the integrity of the overall PCV system.

Subsection (e)(10.1.3) This new proposed subsection, which indicates that manufacturers are required to propose a monitoring plan for vehicles equipped with a component other than a thermostat that regulates the ECT, is needed since the thermostat monitoring requirements detailed under subsection (e)(10) would not be applicable to these vehicles.

Subsection (e)(10.1.4) This new proposed subsection, which indicates that manufacturers are required to propose a monitoring plan for vehicles equipped with a system other than the cooling system and ECT sensor to indicate operating temperatures for emission control purposes, is needed since the current monitoring requirements detailed under subsection (e)(10) would not be applicable to these vehicles and to ensure that the alternate system is sufficiently monitored.

Subsection (e)(10.2.1) The purpose of this subsection is to describe the malfunction criteria for the thermostat monitor. The proposed addition of "or time-equivalent calculated value" to subsection (e)(10.2.1)(A) is needed to address manufacturers' request to use this parameter in lieu of time. The proposed addition of temperature values in degrees Celsius in addition to the temperature values in degrees Fahrenheit in subsection (e)(10.2.1)(A) is needed for clarity. The new proposed subsection (e)(10.2.1)(B), which requires vehicles to detect a fault if the coolant temperature drops below the threshold temperature after reaching it, is needed to ensure that all thermostat malfunctions that result in disablement of other OBD II monitors are detected by the OBD II system. The proposed changes to subsection (e)(10.2.1)(C) are needed to complement the change in subsection (10.2.1)(A) referencing "time equivalent calculated value." The proposed addition of "For monitoring of malfunctions under section (e)(10.2.1)(A)" in subsection (e)(10.2.1)(D) is needed to clarify that the requirement under this subsection applies only to malfunctions identified under (e)(10.2.1)(A). The proposed changes to subsection (e)(10.2.1)(E) making clear that this subsection applies to the thermostat monitoring requirements under sections (e)(10.2.1)(A) and (B) are needed for clarification.

Subsection (e)(10.2.2)(B) The purpose of this subsection is to describe the malfunction criteria for the ECT sensor monitor. The proposed addition of temperature values in degrees Celsius in addition to the temperature values in degrees Fahrenheit is needed for clarity.

Subsection (e)(10.3.1) The purpose of this subsection is to describe the conditions under which thermostat monitoring shall occur. The proposed changes in subsection (e)(10.3.1)(A) are needed for formatting reasons due to the changes mentioned here. The proposed new subsection (e)(10.3.1)(B), which details monitoring condition requirements for thermostat malfunctions where the coolant temperature drops below the threshold temperature after it is reached, is needed to complement the new monitoring requirements in subsection (e)(10.2.1)(B). The proposed changes to subsection (e)(10.3.1)(D) and new proposed subsection (e)(10.3.1)(E) are needed to make the requirement easier to understand and clearly indicate under what conditions the thermostat monitor can be disabled. The proposed addition of temperature values in degrees Celsius in addition to the temperature values in degrees Fahrenheit is needed for clarity.

Subsection (e)(11.1.1) The purpose of this subsection is to describe the general requirements for cold start emission reduction strategy monitoring. The proposed change of "elements" to "elements/components" is needed since "component" as well as "element" is used throughout in subsection (e)(11). The proposed deletion of "etc." is needed for better readability.

Subsection (e)(11.1.3) This new proposed subsection, 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 (e)(11.2) The purpose of this subsection is to describe the malfunction criteria for cold start emission reduction strategy monitors. The proposed addition of “element” and “component” throughout the subsection is needed these are the terminology used throughout the subsection. The proposed changes to subsection (e)(11.2.2)(B) are needed to account for the new proposed malfunction criteria for LEV III applications and to distinguish these malfunction criteria from those for non-LEV III applications. The proposed addition of “while the cold start strategy is active” to subsection (e)(11.2.2)(B) is needed to clarify that the monitor is required to detect faults that occur while the cold start strategy is active, as already stated under subsection (e)(11.1.1), due to manufacturers’ confusion.

Subsection (e)(12.1) The purpose of this subsection is to describe the general requirements for A/C system component monitoring. The proposed additional language “As applicable, the A/C system shall also be subject to the comprehensive component monitoring requirements in section (e)(15)” is needed to clarify that A/C system components that are used as part of any of the cooling systems on hybrid vehicles may be subject to the comprehensive component monitoring requirements in subsection (e)(15) in addition to the monitoring requirements under subsection (e)(12).

Subsection (e)(12.2.1) The purpose of this subsection is to describe the malfunction criteria for A/C system monitoring. The proposed changes to this subsection are needed to account for the new proposed malfunction criteria for LEV III applications, to distinguish these malfunction criteria from those for non-LEV III applications, and for better readability.

Subsection (e)(12.2.2) The purpose of this subsection is to describe conditions under which manufacturers are exempt from monitoring the A/C system component under subsection (e)(12). The proposed change of “causes emissions to exceed 1.5 times any of the appropriate applicable emission standards as defined above in section (e)(12.2.1) nor is used as part of the diagnostic strategy for any other monitored system or component” to “meets any of the criteria in section (e)(12.2.1)” is needed for simplicity.

Subsection (e)(13) The proposed addition of “lift” to the original title “Variable Valve Timing and/or Control (VVT) System Monitoring” is needed make clear that the monitoring requirements under subsection (e)(13) also apply to systems that control valve lift, since manufacturers were confused about what systems would be considered VVT systems.

Subsection (e)(13.1) The purpose of this subsection is to describe the general requirements for VVT system monitoring. The proposed addition of language to this subsection is needed to address confusion about what specific failure modes manufacturers would be required to detect for target error and slow response malfunctions.

Subsection (e)(13.2) The purpose of this subsection is to describe the malfunction criteria for VVT system monitors. The proposed changes to subsections (e)(13.2.1) and (e)(13.2.2) and new proposed subsections (e)(13.2.1)(A) and (B) are needed to account for the new proposed malfunction criteria for LEV III applications and to distinguish these malfunction criteria from those for non-LEV III applications. The proposed changes to subsections (e)(13.2.1) and (e)(13.2.2) indicating systems with discrete operating states are not required to detect faults prior to emissions exceeding the thresholds are needed since it may be impossible to detect faults on such systems before the emission thresholds are exceeded. The proposed change to subsection (e)(13.2.3) replacing “1.5 times any of the applicable standards” to “the threshold specified in sections (e)(13.2.1) and (e)(13.2.2)” is needed for clarification, since there are some emission thresholds that are not 1.5 times the FTP standards. The proposed addition of “of the electronic components” in subsection (e)(13.2.3) is needed to clarify that the functional monitoring requirements are just limited to electronic components of the VVT systems.

Subsection (e)(13.3) The purpose of this subsection is to describe the conditions under which VVT system monitoring shall occur. The proposed changes to this subsection are needed for better readability.

Subsection (e)(14.1.2) The purpose of this subsection is to describe the label requirements related to DOR systems. The proposed change to this subsection is needed to account for the change to the SAE J1930 document name.

Subsection (e)(14.2) The purpose of this subsection is to describe the malfunction criteria for DOR system monitors. The proposed changes to subsections (e)(14.2.1) and (e)(14.2.2) are needed to account for the new proposed malfunction criteria for LEV III applications, to establish new malfunction criteria for LEV III applications since the previous requirements refer to NMOG credit based on NMOG standards while LEV III applications are subject to NMOG+NOx standards, and to distinguish these malfunction criteria from those for non-LEV III applications.

Subsection (e)(15.1.1) The purpose of this subsection is to describe the general requirements for comprehensive component monitoring. The proposed changes related to the smart device are needed to clarify what is required to be monitored for smart devices and clarify that fault code pinpointing is not needed for faults internal to the smart device. The proposed change to condition (1) to “can affect emissions in excess of the criteria described in section (e)(15.1.2)” is needed to streamline the requirements and to establish clear, specific criteria for determining if the component has an emissions impact and thus need to be monitored. The additional language related to vehicles compensating or adjusting for deterioration or malfunction of the component/system is needed to make clear that such components/systems are subject to default action provisions specified elsewhere.

Subsection (e)(15.1.2) The proposed changes to this subsection, which sets specific criteria for determining the emission impact of a comprehensive component, are needed to streamline the requirements and to establish clear, specific criteria for determining if the component has an emissions impact and thus need to be monitored.

Subsection (e)(15.1.3) This new proposed subsection, which exempts manufacturers from monitoring safety-only components or systems, is needed to address manufacturers' concerns, since these components/systems are only used for safety purposes and thus impact powertrain performance (and possibly emissions) very infrequently, so that there is not much benefit in requiring these components to be monitored.

Subsection (e)(15.1.5) The purpose of this subsection is to require manufacturers to monitor for malfunctions of electronic powertrain input or output components/systems associated with components that affect emissions. The proposed change of "hybrids" to "hybrid vehicles" is needed to match the terminology used under subsection (c). The proposed change of "(e)(15.1.5)" to (e)(15.1.6)" is needed since this subsection was renumbered.

Subsection (e)(15.1.6) The purpose of this subsection is to describe the general requirements for hybrid components. The proposed change of "hybrids" to "hybrid vehicles" is needed to match the terminology used under subsection (c). The proposed changes to this subsection are needed to account for the new detailed hybrid component monitoring requirements described under new proposed subsection (e)(15.2.3).

Subsection (e)(15.2.1)(A) The purpose of this subsection is to describe the malfunction criteria for input component monitors. The proposed addition of "(or for digital inputs, lack of communication to the on-board computer)" is needed to ensure such malfunctions, including those related to smart devices, are detected. The proposed change of "a lack of circuit continuity" to "circuit faults" is needed for clarity.

Subsection (e)(15.2.1)(B) The purpose of this subsection is to require input component monitors to store different fault codes for each distinct malfunction. The proposed change allowing input components monitored solely by emissions neutral diagnostics to be exempt from meeting this subsection is needed since these diagnostics are already exempt from illuminating the MIL and meeting the fault code requirements under subsection (e)(15.4.4), so fault isolation provides no benefit. The proposed language indicating that two-sided rationality diagnostics are not required to set separate fault codes for rationality high and rationality low faults is needed for clarity, since separate fault codes provide no benefit. The proposed separate requirements for "analog inputs" and "digital inputs" in subsections (e)(15.2.1)(B)(i) and (ii) are needed to clarify the requirements for fault code storage.

Subsection (e)(15.2.1)(C) The purpose of this subsection is to define the malfunction criteria for the camshaft and crankshaft misalignment monitor. The separation of the language into subsections (e)(15.2.1)(C)(i) and (ii) is needed for better readability. The proposal under subsection (e)(15.2.1)(C)(i) to require 2009 through 2018 model year vehicles with VVT cam phasing systems to detect a misalignment of one sprocket cog is needed to make clear that this requirement does not apply to systems that are not cam phasing systems. The new proposed subsection (e)(15.2.1)(C)(iii) applicable to all 2019 and subsequent model year vehicles with VVT systems and a timing belt or chain is needed to make clear that VVT systems that are not cam phasing systems would not have to meet the one tooth misalignment requirements in subsection (e)(15.2.1)(C)(i), since that would require additional hardware, but would need to detect the smallest number of teeth/cog misalignment possible with the existing hardware.

Subsection (e)(15.2.1)(D) This new proposed subsection, which requires the monitoring of input components that are directly or indirectly used for any emission control strategies that are otherwise covered in the regulation, is needed to clarify and ensure that all malfunctions that impact emissions are covered under the regulation.

Subsection (e)(15.2.2)(A) The purpose of this subsection is to define the malfunction criteria for output component/system monitors. The proposed change of “functional monitoring” to “functional check” is needed to be consistent with the terminology used in the definitions in subsection (c), which states “functional check.” The proposed change of “output components/systems” to “the output component/system” is needed for better readability.

Subsection (e)(15.2.2)(C) This new proposed subsection, which requires the monitoring of output components that are directly or indirectly used for any emission control strategies that otherwise covered in the regulation, is needed to clarify and ensure that all malfunctions that impact emissions are covered under the regulation.

Subsection (e)(15.2.3) This new proposed subsection, which describes the monitoring requirement for hybrid components, is needed to provide more detail and clarify the malfunctions that manufacturers are required to detect on hybrid vehicles.

Subsection (e)(15.3.1)(B) The purpose of this subsection is to describe the conditions under which input component rationality monitors shall run. The proposed changes of “rationality monitoring” to “rationality fault diagnostics” are needed to be consistent with the terminology used in the definitions in subsection (c), which states “rationality fault diagnostic.”

Subsection (e)(15.3.2) The purpose of this new proposed subsection is to describe the conditions under which output component functional monitoring shall occur. The proposed changes of “functional monitoring” to “functional checks” in subsections (e)(15.3.2)(B) and (e)(15.3.2)(C) are needed to be consistent with the terminology used in the definitions in subsection (c), which states “functional check.”

Subsections (e)(15.3.3) The purpose of this new proposed subsection is to describe the conditions under which hybrid component monitoring shall occur, which will complement the new proposed monitoring requirements under subsection (e)(15.2.3).

Subsection (e)(15.4.1) The purpose of this subsection is to describe the general requirements for MIL illumination and fault code storage for comprehensive component monitors. The proposed addition of "and (15.4.4)" is needed to account for the new requirement for emissions neutral diagnostics in new subsection (e)(15.4.4), which would not be required to meet the criteria under subsection (e)(15.4.1). The proposed additional language indicating that additional fault code requirements are provided for input components, output components, and hybrid component sections in the specified subsections is needed for clarity and to ensure manufacturers meet the appropriate fault code requirements.

Subsection (e)(15.4.2) The purpose of this subsection is to describe the criteria under which a comprehensive component monitor is exempt from illuminating the MIL. The proposed change limiting the application of this subsection to non-LEV III applications is needed to phase-out this requirement and to account for the new proposed criteria under subsection (e)(15.1.2), which would allow comprehensive components to be exempt from being monitored altogether if certain criteria are met. The proposed addition of "both conditions (A) and (B) below are met" is needed to address confusion about which conditions need to be met in order to be exempt from illuminating the MIL.

Subsection (e)(15.4.4) This new proposed subsection, which exempts MIL illumination and fault code storage for components/systems monitored solely by emissions neutral diagnostics, is needed since requiring these components/systems to illuminate the MIL and store a fault code when a fault occurs would provide no benefit since the fault would activate an action that would not affect emissions or the OBD II system performance.

Subsection (e)(16.1) The purpose of this subsection is to describe the general requirements for other emission control or source system monitoring. The proposed addition of "(e)(16.4)" is needed to account for the requirements in new proposed subsection (e)(16.4).

Subsection (e)(16.4) This new proposed subsection, which requires the monitoring of emission control strategies that are not covered in other parts of the regulation, is needed to clarify and ensure that all malfunctions that impact emissions are covered under the regulation.

Subsection (e)(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 clarity and to avoid confusion. The proposed addition of "Tier 2" and its associated CFR reference to subsection (e)(17.1.3) is needed to avoid confusion, since this subsection only applies to those certified to the "Federal Bin 3 or Bin 3 emission standards" adopted as part of the Tier 2 program, not any other program. The new proposed subsection (e)(17.1.5), which allows SULEV20 vehicles to use higher interim emission malfunction thresholds for the interim years, is needed to address manufacturers' concerns about meeting the proposed final thresholds considering the low SULEV20 tailpipe emission standards.

Subsection (e)(17.3) The purpose of this subsection is to allow manufacturers to disable monitoring during certain conditions if specific criteria are met. The proposed change of "twenty" to "20" is needed for formatting reasons. The proposed addition of temperature values in degrees Celsius in addition to the temperature values in degrees Fahrenheit is needed for clarity.

Subsection (e)(17.5.2) The purpose of this subsection is to allow manufacturers to disable monitors for high battery or system voltage conditions. The proposed change to allow manufacturers to disable monitoring if the battery reaches a voltage that causes the instrument cluster to completely shut down is needed since such a shutdown may prevent the electrical charging system/alternator warning light from illuminating when the high battery voltage occurs.

Subsection (e)(17.6) This purpose of this subsection is to allow manufacturers to disable monitors affected by PTO activation under certain conditions. The proposed change to allow manufacturers to disable monitoring but delay clearing of all readiness status until 750 minutes of cumulative PTO operation had occurred (and if the monitor had not run) is needed to address manufacturers' concerns about the previous language which required immediate clearing of the readiness status once PTO is activated. The proposal would allow vehicles with frequent PTO activation to output a valid readiness status that would allow for vehicle inspection of emissions and proper OBD II operation in all situations except where a sufficiently long period of time has passed since the monitor(s) last ran.

Subsection (e)(17.8) 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 (e)(17.9) 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 vehicle speed is greater than 82 miles-per-hour. This proposed allowance is needed to address manufacturers' concerns about expending resources to monitor such components that only affect emissions during extreme conditions.

Subsection (f) The purpose of this subsection is to describe the monitoring requirements for diesel/compression-ignition engines. The proposed description of the required emission malfunction thresholds for non-LEV III applications is needed to make clear that the thresholds are already specified in the specific monitoring sections in subsection (f), which differentiates them from the proposed thresholds for LEV III applications specified in the table at the beginning of subsection (f). The proposed emission malfunction thresholds for LEV III applications are needed since the current thresholds in the regulation are not appropriate for some of the LEV III applications certifying to more stringent tailpipe emission standards.

Subsection (f)(1.2.2) The purpose of this subsection is to define the malfunction criteria for NMHC catalyst conversion efficiency monitors. The proposed changes to subsection (f)(1.2.2)(A)(i) are needed to account for the new proposed malfunction criteria for LEV III applications and to distinguish these malfunction criteria from those for non-LEV III applications. The proposed addition of “full useful life” to the applicable FTP NMHC standards is needed to provide relaxation equivalent to those already provided for gasoline catalyst monitors under subsection (e)(1).

Subsection (f)(1.2.3)(B) The purpose of this subsection is to define the malfunction criteria for NMHC catalyst feedgas generation monitors. The proposed additions of “NMHC, NOx (or NMOG+NOx, if applicable), CO, or PM” are needed to avoid confusion, since some manufacturers mistakenly believed the test-out criteria were only applied to NMHC emissions, and to account for the NMOG+NOx standards required by LEV III.

Subsection (f)(1.2.3)(D) The purpose of this subsection is to define the malfunction criteria for catalysts located downstream of an SCR system. The proposed change, which align the test-out criteria with those required for other diesel monitors (e.g., NMHC catalyst feedgas generation in subsection (g)(1.2.3)(B)), is needed for consistency.

Subsection (f)(1.3.1) The purpose of this subsection is to describe the conditions under which NMHC catalyst monitoring shall occur. The proposed addition of “Additionally, manufacturers shall track and report the in-use performance of the NMHC converting catalyst monitors under sections (f)(1.2.2) and (f)(1.2.3) in accordance with section (d)(3.2.2)” is needed for clarity and better readability.

Subsection (f)(2.2.2)(A) The purpose of this subsection is to define the malfunction criteria for NOx catalyst conversion efficiency monitors. The proposed changes to subsection (f)(2.2.2)(A)(i) are needed to account for the new proposed malfunction criteria for LEV III applications and to distinguish these malfunction criteria from those for non-LEV III applications. The proposed addition of “full useful life” to the applicable FTP standards in subsection (f)(2.2.2)(A)(i) is needed to provide relaxation equivalent to those already provided for gasoline catalyst monitors under subsection (e)(1).

Subsection (f)(2.2.3)(B) The purpose of this subsection is to define the malfunction criteria for insufficient reductant malfunctions. The proposed additional language "Except as provided for in section (f)(2.2.3)(G)" is needed to account for the new subsection (f)(2.2.3)(G) which allows manufacturers to be exempt from the monitoring requirements of subsection (f)(2.2.3)(B) if certain conditions are met.

Subsection (f)(2.2.3)(C) The purpose of this subsection is to define the malfunction criteria for improper reductant malfunctions. The proposed additional language "Except as provided for in section (f)(2.2.3)(H)" is needed to account for the new subsection (f)(2.2.3)(G) which allows manufacturers to be exempt from the monitoring requirements of subsection (f)(2.2.3)(C) if certain conditions are met.

Subsection (f)(2.2.3)(D) The purpose of this subsection is to define the malfunction criteria for the reductant injection system feedback or feed-forward control monitors. The proposed addition of examples of the types of feedback or feed-forward control is needed to provide clarification and to ensure these controls are monitored.

Subsection (f)(2.2.3)(G) This new proposed subsection, which exempts manufacturers from monitoring for insufficient reductant if the vehicle has an inducement strategy and monitor all inputs to the inducement strategy, is needed to address manufacturers' concerns about illuminating the MIL for insufficient reductant faults when there isn't actually a "malfunction" of any component.

Subsection (f)(2.2.3)(H) This new proposed subsection, which exempts manufacturers from monitoring for improper reductant if the vehicle has an inducement strategy and monitor all inputs to the inducement strategy, is needed to address manufacturers' concerns about illuminating the MIL for improper reductant faults when there isn't actually a "malfunction" of any component.

Subsection (f)(2.3.1) The purpose of this subsection is to describe the conditions under which NOx catalyst monitoring shall occur. The proposed addition of "Additionally, manufacturers shall track and report the in-use performance of the NOx converting catalyst monitors under section (f)(2.2.2) in accordance with section (d)(3.2.2)" is needed for clarity and better readability.

Subsection (f)(2.4.2) The proposed change of "a" to "an" in this subsection is needed to correct a grammatical error.

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 passenger cars and light-duty trucks, and MDPVs certified to a chassis dynamometer tailpipe emission standard to meet subsection (f)(3.2.2) with a phase-in starting in the 2019 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) is needed to address manufacturers' concerns about difficulties in establishing a correlation between a specific misfire level and a tailpipe emission threshold. The proposed deletion of subsections (f)(3.2.2)(A)(i) and (ii) and proposed additional language in subsection (f)(3.2.2)(A) indicating the malfunction criterion for all diesel vehicles is needed for formatting reasons, since light-duty and medium-duty vehicles now would be subject to the same 5-percent misfire malfunction criterion. The proposed deletion of subsections (f)(3.2.2)(B)(i) and (ii) and proposed additional language "in 1000 revolution increments" in subsection (f)(3.2.2)(B) is needed for formatting reasons, since light-duty and medium-duty vehicles now would be subject to the same 1000-revolution requirement.

Subsection (f)(3.2.5) The purpose of this subsection is to allow manufacturers to increase the 5-percent misfire malfunction criteria if certain criteria are met. The proposed change of "(f)(3.2.2)(A)(ii)" to "(f)(3.2.2)(A)" is needed to point to the correct subsection reference since the subsections were renumbered. The proposed changes to allow light-duty vehicle 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 light-duty vehicle manufacturers should their systems be abnormally robust to an emission increase due to misfire, to account for the new proposed malfunction criteria for LEV III applications, to distinguish these malfunction criteria from those for non-LEV III applications, and to distinguish the criteria between light-duty vehicles and medium-duty vehicles certified to an engine dynamometer tailpipe emission standard.

Subsection (f)(3.3.3) The purpose of this subsection is to describe the conditions under which diesel misfire monitoring shall occur. The proposed changes in subsection (f)(3.3.3)(A) describing the conditions under which misfire monitor shall occur on light-duty vehicles are needed to harmonize with the monitoring conditions required for medium-duty diesel vehicles certified to an engine dynamometer tailpipe emission standard under subsection (f)(3.3.3)(B), to allow light-duty manufacturers enough lead time before they are required to monitor for misfire under all positive torque engine speed conditions, and to ensure misfires that occur during the higher operating ranges are detected. The proposed changes to the required monitoring conditions in subsection (f)(3.3.3)(B)(ii) clarifying that the phase-in percentages are based on the sales volume for all "medium-duty diesel vehicles except MDPVs certified to a chassis dynamometer tailpipe emission standard" are needed to avoid confusion about how to calculate the phase-in percentages.

Subsection (f)(3.4.2)(A) This purpose of this subsection is to describe the criteria for illuminating the MIL and storing a confirmed fault code for the diesel misfire monitor. The proposed change to subsection (f)(3.4.2)(A)(ii) is needed to clarify that when a confirmed fault code is stored, the pending fault code shall continue to be stored in accordance with the current requirements in subsection (g)(4.4.5).

Subsection (f)(3.4.2)(B)(ii) The purpose of this subsection is to describe the requirements for storing and erasing "freeze frame" conditions. The proposed addition of "fuel system" malfunction and the proposed additional language related to 2004 through 2018 model year vehicles are needed to address manufacturers' request to have similar requirements as those of the gasoline fuel system and misfire monitors starting in the 2019 model year. The proposed change adding "misfire" to "fault code" is needed for clarity.

Subsection (f)(4.2.1)(A)(i) The purpose of this subsection is to define the malfunction criteria for fuel system pressure control monitors. The proposed changes to this subsection are needed to account for the new proposed malfunction criteria for LEV III applications and to distinguish these malfunction criteria from those for non-LEV III applications.

Subsection (f)(4.2.2)(A)(i) The purpose of this subsection is to define the malfunction criteria for fuel injection quantity monitors. The proposed changes to this subsection are needed to account for the new proposed malfunction criteria for LEV III applications and to distinguish these malfunction criteria from those for non-LEV III applications.

Subsection (f)(4.2.5) The purpose of this subsection is to describe the requirements for determining the fuel system monitor malfunction criteria for medium-duty vehicles (including MDPVs) certified to an engine dynamometer tailpipe emission standard. The proposed deletion of "for medium-duty vehicles (including MDPVs) certified to an engine dynamometer tailpipe emission standard" in subsection (f)(4.2.5) is needed since passenger cars, light-duty trucks, and MDPVs certified to a chassis dynamometer tailpipe emission standard would now be required to meet this subsection. The proposed changes in subsection (f)(4.2.5)(A) requiring 2004 through 2018 model year light-duty vehicles to meet this subsection is needed to allow for lead time before these vehicles would be required to meet the more stringent requirements under subsections (f)(4.2.5)(B) and (C). The proposed changes in subsections (f)(4.2.5)(B) and (C) requiring 2019 and subsequent model year light-duty vehicles to meet these subsections are needed to clear up confusion about how the monitors are supposed to be calibrated and to provide reasonable coverage of fuel system failures in-use.

Subsection (f)(4.3.3) The purpose of this subsection is to describe the conditions under which fuel system injection quantity and timing monitoring shall occur. The proposed addition of "Additionally... manufacturers shall track and report the in-use performance of the fuel system monitors under sections (f)(4.2.2) and (f)(4.2.3) in accordance with section (d)(3.2.2)" is needed for clarity and better readability.

Subsection (f)(4.4.2)(B) The purpose of this subsection is to describe the criteria for illuminating the MIL and storing a confirmed fault code for the diesel fuel pressure control monitor. The proposed change of "either" to "any" is needed for clarity. The proposed change to this subsection is needed to clarify that when a confirmed fault code is stored, the pending fault code shall continue to be stored in accordance with the current requirements in subsection (g)(4.4.5).

Subsection (f)(4.4.2)(D)(ii) The purpose of this subsection is to describe the requirements for storing and erasing "freeze frame" conditions. The proposed change adding “fuel system” to “fault code” is needed for clarity.

Subsections (f)(5.2.1) and (5.2.2) The purpose of these subsections is to define the malfunction criteria for upstream and downstream air-fuel ratio sensor, NOx sensors, and PM sensors monitors. The proposed changes to these subsections are needed to account for the new proposed malfunction criteria for LEV III applications and to distinguish these malfunction criteria from those for non-LEV III applications. The proposed deletions of “either” in subsection (f)(5.2.1)(A)(ii), (f)(5.2.1)(B)(ii), and (f)(5.2.2)(B) are needed for clarity.

Subsection (f)(5.3.1)(A) The purpose of this subsection is to describe the conditions under which exhaust gas sensor performance monitoring shall occur. The proposed addition of “Additionally... manufacturers shall track and report the in-use performance of the exhaust gas sensor monitors under sections (f)(5.2.1)(A)(i), (5.2.1)(B)(i), (5.2.2)(A), and (5.2.2)(D) in accordance with section (d)(3.2.2)” is needed for clarity and better readability. The proposed addition of “(except MDPVs certified to a chassis dynamometer tailpipe emission standard)” is needed to make clear which specific medium-duty vehicles are required to track and report the in-use performance of the exhaust gas sensor monitors starting in the 2016 model year. The proposed addition of “2019 and subsequent model year passenger cars, light-duty trucks, and MDPVs certified to a chassis dynamometer tailpipe emission standard” 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 2019 model year.

Subsection (f)(5.3.1)(B) The purpose of this subsection is to describe the conditions under which manufacturers shall monitor exhaust gas sensor monitoring capability. 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” 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 (f)(5.4) 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 subsection (g)(4.4) currently requires manufacturers to pinpoint the likely cause of a malfunction. The proposed addition of language related to sensors with sensing elements externally connected to a sensor control module is needed to address confusion about the fault code storage requirements for these components

Subsection (f)(6.2.1)(A) The purpose of this subsection is to define the malfunction criteria for the EGR system monitor. The proposed changes to subsection (f)(6.2.1)(A)(i) are needed to account for the new proposed malfunction criteria for LEV III applications and to distinguish these malfunction criteria from those for non-LEV III applications.

Subsection (f)(6.2.6)(C) The purpose of this subsection is to define the test-out criteria for monitoring of the EGR catalyst. The proposed changes, which align the test-out criteria with those required for other diesel monitors (e.g., NMHC catalyst feedgas generation in subsection (g)(1.2.3)(B)), are needed for consistency.

Subsection (f)(6.3.1) The purpose of this subsection is to describe the conditions under which EGR system low flow and high flow monitoring shall occur. The proposed addition of “Additionally, manufacturers shall track and report the in-use performance of the EGR system monitors under sections (f)(6.2.1) and (f)(6.2.2) in accordance with section (d)(3.2.2)” to subsection (f)(6.3.1)(A) is needed for clarity and better readability.

Subsection (f)(6.3.2) The purpose of this subsection is to describe the monitoring conditions for EGR system slow response monitoring. The proposed addition of “Additionally, manufacturers shall track and report the in-use performance of the EGR system monitors under section (f)(6.2.3) in accordance with section (d)(3.2.2)” is needed for clarity and better readability.

Subsection (f)(6.3.4) The purpose of this subsection is to describe the conditions under which EGR system cooler performance monitoring shall occur. The proposed addition of “Additionally, manufacturers shall track and report the in-use performance of the EGR system monitors under section (f)(6.2.5) in accordance with section (d)(3.2.2)” is needed for clarity and better readability.

Subsection (f)(7.2.1)(A)(i) The purpose of this subsection is to define the malfunction criteria for boost pressure control system monitors. The proposed changes to this subsection are needed to account for the new proposed malfunction criteria for LEV III applications and to distinguish these malfunction criteria from those for non-LEV III applications.

Subsection (f)(7.2.3) The purpose of this subsection is to describe the malfunction criteria for boost pressure control system slow response monitors. The proposed changes dividing up subsections (f)(7.2.3)(A) and (f)(7.2.3)(B) into two subsections each are needed for better readability. The proposed changes adding “specified in section (f)(7.2.1)(A)” in subsections (f)(7.2.3)(A)(ii) and (f)(7.2.3)(B)(ii) are needed to make clear that the emission thresholds are referenced in subsection (f)(7.2.1)(A), since these subsections (ii) have been split from subsection (i) where subsection (f)(7.2.1)(A) was originally referenced.

Subsection (f)(7.3.2) The purpose of this subsection is to describe the conditions under which boost pressure control system slow response monitoring shall occur. The proposed addition of “Additionally... manufacturers shall track and report the in-use performance of the boost pressure control system monitors under section (f)(7.2.3) in accordance with section (d)(3.2.2)” is needed for clarity and better readability.

Subsection (f)(7.3.3) The purpose of this subsection is to describe the conditions under which boost pressure control system charge air cooler performance monitoring shall occur. The proposed addition of “Additionally, manufacturers shall track and report the in-use performance of the boost pressure control system monitors under section (f)(7.2.4) in accordance with section (d)(3.2.2)” is needed for clarity and better readability.

Subsection (f)(8.2.1)(A) The purpose of this subsection is to define the malfunction criteria for NOx adsorber monitors. The proposed changes to subsection (f)(8.2.1)(A)(i) are needed to account for the new proposed malfunction criteria for LEV III applications and to distinguish these malfunction criteria from those for non-LEV III applications.

Subsection (f)(8.3.1) The purpose of this subsection is to describe the conditions under which NOx adsorber monitoring shall occur. The proposed addition of “Additionally, manufacturers shall track and report the in-use performance of the NOx adsorber monitors under section (f)(8.2.1) in accordance with section (d)(3.2.2)” is needed for clarity and better readability. The proposed change of “sections” to “section” is needed to correct an error, since there is only one subsection referenced.

Subsection (f)(9.2.1)(A) The purpose of this subsection is to define the malfunction criteria for PM filter filtering performance monitors. The proposed changes to subsection (f)(9.2.1)(A)(i) are needed to account for the new proposed malfunction criteria for LEV III applications and to distinguish these malfunction criteria from those for non-LEV III applications. The proposed changes to subsection (f)(9.2.1)(A)(iii)a. and b. adding the clause “except MDPVs certified to a chassis dynamometer tailpipe emission standard” are needed to clarify the specific medium-duty diesel vehicles that are required to be included when determining the percentage based on the manufacturer’s projected California sales volume.

Subsection (f)(9.2.2)(A) The purpose of this subsection is to define the malfunction criteria for PM filter frequent regeneration monitors. The proposed changes to subsection (f)(9.2.2)(A)(i) are needed to account for the new proposed malfunction criteria for LEV III applications and to distinguish these malfunction criteria from those for non-LEV III applications.

Subsection (f)(9.2.4)(A) The purpose of this subsection is to define the malfunction criteria for catalyzed PM filter monitors. The proposed changes splitting up subsections (f)(9.2.4)(A) into three subsections is needed for better readability. The proposed changes to subsection (f)(9.2.4)(A)(i) are needed to account for the new proposed malfunction criteria for LEV III applications and to distinguish these malfunction criteria from those for non-LEV III applications. The proposed change adding “specified in section (f)(9.2.4)(A)(i)” in subsection (f)(9.2.4)(A)(ii) is needed to make clear the emission thresholds are referenced in subsection (f)(9.2.4)(A)(i). The proposed change in subsection (f)(9.2.4)(A)(iii) indicating this subsection allows for PM filters to be exempt from the monitoring “requirements of sections (f)(9.2.2)(A)(i) and (ii)” if certain criteria are met is needed to clarify which specific sections apply. The proposed additions of “NMHC, NOx (or NMOG+NOx, if applicable), CO, or PM” to subsection (f)(9.2.4)(A)(iii) are needed to avoid confusion, since some manufacturers mistakenly believed the test-out criteria were only applied to NMHC emissions, and to account for the NMOG+NOx standards required by LEV III.

Subsection (f)(9.2.4)(B) The purpose of this subsection is to define the malfunction criteria for catalyzed PM filter feedgas generation monitors. The proposed change indicating that the 2016 and subsequent model year medium-duty vehicles required to implement this monitor do not include MDPVs certified to a chassis dynamometer tailpipe emission standard) is needed to clarify the specific medium-duty vehicles required to meet this requirement in 2016. The proposed changes requiring 2019 and subsequent model year passenger cars, light-duty trucks, and MDPVs certified to a chassis dynamometer tailpipe emission standard to monitor the catalyzed PM filter for feedgas generation faults is needed to ensure monitoring of all components that generate feedgas for the SCR system. The proposed additions of “NMHC, NOx (or NMOG+NOx, if applicable), CO, or PM” are needed to avoid confusion, since some manufacturers mistakenly believed the test-out criteria were only applied to NMHC emissions, and to account for the NMOG+NOx standards required by LEV III.

Subsection (f)(9.2.5) The proposed deletion of “either” is needed for clarity.

Subsection (f)(9.3.1) The purpose of this subsection is to describe the monitoring conditions under which PM filter monitoring shall occur. The proposed change to require the filtering performance monitor (subsection (f)(9.2.1)) to run once per driving cycle instead of every time the monitoring conditions are met is needed to address manufacturers’ concerns about durability issues with the PM sensor if the monitor was to run multiple times per driving cycle. The proposed deletion of monitors “through (9.2.6)” from this subsection is needed since these monitors and the required monitoring conditions were moved to new proposed subsection (e)(9.3.2). The proposed addition of “Additionally... manufacturers shall track and report the in-use performance of the PM filter monitors under section (f)(9.2.1) in accordance with section (d)(3.2.2)” is needed for clarity and better readability.

Subsection (f)(9.3.2) This new proposed subsection, which describes the conditions under which PM filter monitoring of malfunctions identified sections (f)(9.2.2) through (9.2.6) shall occur, was added to distinguish the required monitoring conditions for these monitors from those required for the PM filter filtering performance monitor under subsection (f)(9.3.1).

Subsection (f)(9.3.3) The purpose of this subsection is to describe the conditions under which the PM filter feedback control monitoring shall occur. The proposed change of “(f)(9.3.3)” to “(f)(9.3.4)” is needed to reference the correct section.

Subsection (f)(10) The purpose of this subsection is to describe the requirements for crankcase ventilation system monitoring. The proposed deletion of “either” in subsection (f)(10.2.2) is needed for clarity. The other proposed changes to subsection (f)(10) are needed to address issues with the current CV monitoring requirements, to reduce staff review of CV systems by streamlining the requirements, and to ensure the integrity of the overall CV system.

Subsection (f)(10.4) The purpose of this subsection is to describe the general requirements for MIL illumination and fault code storage for CV system monitors. The proposed change of “intake air mass flow rationality monitoring” to “intake air mass flow rationality faults” is needed since “faults” is the correct terminology to use.

Subsection (f)(11.1.3) This new proposed subsection, which indicates that manufacturers are required to propose a monitoring plan for vehicles equipped with a component other than a thermostat that regulates the ECT, is needed since the thermostat monitoring requirements detailed under subsection (f)(11) would not be applicable to these vehicles.

Subsection (f)(11.1.4) This new proposed subsection, which indicates that manufacturers are required to propose a monitoring plan for vehicles equipped with a system other than the cooling system and ECT sensor to indicate operating temperatures for emission control purposes, is needed since the current monitoring requirements detailed under subsection (f)(11) would not be applicable to these vehicles and to ensure that the alternate system is sufficiently monitored.

Subsection (f)(11.2.1) The purpose of this subsection is to describe the malfunction criteria for the thermostat monitor. The proposed additions of “or time-equivalent calculated value” to subsections (f)(11.2.1)(A), (C), and (D) are needed to address manufacturers’ request to use this parameter in lieu of time. The proposed addition of temperature values in degrees Celsius in addition to the temperature values in degrees Fahrenheit in subsections (f)(11.2.1)(A)(ii) and (f)(11.2.1)(D) is needed for clarity. The proposed changes to subsection (f)(11.2.1)(E) make clear that this subsection applies to the thermostat monitoring requirements under sections (f)(11.2.1)(A) and (B) are needed for clarification.

Subsection (f)(11.2.2)(B) The purpose of this subsection is to define the malfunction criteria for the time to reach the closed-loop enable temperature monitor. The proposed change of the title from “time to reach closed-loop enable temperature” to “time to reach enable temperature for emission control strategies” is needed since this title is more appropriate in describing the types of malfunctions required to be detected. The proposed change to subsection (f)(11.2.2)(B)(i) indicating the manufacturer is required to detect a fault if the ECT sensor does not reach the “highest stabilized minimum temperature" required to begin closed-loop, feedback, or feed-forward operation of all emission control strategies is needed to clarify the strategies manufacturers are required to monitor and the malfunction threshold. The proposed change to subsection (f)(11.2.2)(B)(i) deleting "The time interval shall be a function of starting ECT and/or a function of intake or ambient temperature" is needed since this sentence was moved to subsection (f)(11.2.2)(B)(ii). The proposed change to subsection (f)(11.2.2)(B)(iii) including "feed-forward" operation is needed to complement the changes in subsection (f)(11.2.2)(B)(i). The proposed change of "emission-related engine controls" to "any emission control strategies" in subsection (f)(11.2.2)(B)(iii) is needed for clarity.

Subsection (f)(11.3.1) The purpose of this subsection is to describe the conditions under which thermostat monitoring shall occur. The proposed changes in subsection (f)(11.3.1)(A) referencing sections (f)(11.3.1)(C) through (E) instead of sections (f)(11.3.1)(B) and (C) are needed for formatting reasons due to the changes mentioned here. The proposed addition of temperature values in degrees Celsius in addition to the temperature values in degrees Fahrenheit in subsection (f)(11.3.1)(C) is needed for clarity. The proposed changes to subsection (f)(11.3.1)(D) and proposed additional subsection (f)(11.3.1)(E) are needed to make the requirements easier to understand and clearly indicate under what conditions the thermostat monitor can be disabled. The proposed change of subsection (f)(11.3.1)(E) to (f)(11.3.1)(F) is needed for formatting reasons.

Subsection (f)(11.3.2)(D) The purpose of this subsection is to describe the conditions for suspending or disabling the ECT sensor monitor. The proposed change of "time to reach closed-loop enable temperature diagnostic" to "diagnostic(s) required to detect malfunctions specified under section (f)(11.2.2)(B)" is needed to clarify the specific monitor(s) to which this subsection applies.

Subsection (f)(12.1) The purpose of this subsection is to describe the general requirements for cold start emission reduction strategy monitoring. The proposed changes in subsection (f)(12.1.1) are needed for better readability. The new proposed subsection (f)(12.1.2), 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)(12.2.2) The purpose of this subsection is to define the malfunction criteria for cold start emission reduction strategy monitors. The proposed addition of "while the cold start strategy is active" to subsection (f)(12.2.2) is needed to clarify that the monitor is required to detect faults that occur while the cold start strategy is active, as already stated under subsection (f)(12.1.1), due to manufacturers' confusion. The proposed changes to subsection (f)(12.2.2)(A) are needed to account for the new proposed malfunction criteria for LEV III applications and to distinguish these malfunction criteria from those for non-LEV III applications.

Subsection (f)(13) The proposed addition of “lift” to the original title “Variable Valve Timing and/or Control (VVT) System Monitoring” is needed make clear that the monitoring requirements under subsection (f)(13) also apply to systems that control valve lift, since manufacturers were confused about what systems would be considered VVT systems.

Subsection (f)(13.1) The purpose of this subsection is to describe the general requirements for VVT system monitoring. The proposed addition of language to this subsection is needed to address confusion about what specific failure modes manufacturers would be required to detect for target error and slow response malfunctions.

Subsection (f)(13.2) The purpose of this subsection is to describe the malfunction criteria for VVT system monitors. The proposed changes to subsections (f)(13.2.1) and (f)(13.2.2) and new proposed subsections (f)(13.2.1)(A)(i) and (ii) are needed to account for the new proposed malfunction criteria for LEV III applications and to distinguish these malfunction criteria from those for non-LEV III applications. The proposed changes to subsections (f)(13.2.1) and (f)(13.2.2) indicating systems with discrete operating states are not required to detect faults prior to emissions exceeding the thresholds is needed since it may be impossible to detect faults on such systems before the emission thresholds are exceeded. The proposed additions of “the threshold is” to subsections (f)(13.2.1)(A) and (B) are needed for better readability. The proposed addition of “of the electronic components” in subsection (f)(13.2.3) is needed to clarify that the functional monitoring requirements are just limited to electronic components of the VVT systems.

Subsection (f)(13.3) The purpose of this subsection is to describe the conditions under which VVT system monitoring shall occur. The proposed changes to this subsection are needed for better readability.

Subsection (f)(14) This new proposed subsection, which describes the A/C system component monitoring requirements for diesel/compression-ignition engines, is needed since diesel vehicles should be subject to A/C system monitoring requirements, considering these vehicles are subject to the SC03 emission standards and may have increased emissions due to A/C system-related malfunctions.

Subsection (f)(15.1.1) The purpose of this subsection is to describe the general requirements for comprehensive component monitoring. The proposed change to diesel vehicles to monitor all components used as part of an inducement strategy is necessary to ensure that the inducement strategy is working properly in-use and that any malfunction that prevents the inducement strategy from activating properly is detected. The proposed changes related to the smart device are needed to clarify what is required to be monitored for smart devices and clarify that fault code pinpointing is not needed for faults internal to the smart device. The proposed change to condition (1) to "can affect emissions in excess of the criteria described in section (f)(15.1.2)" is needed to streamline the requirements and to establish clear, specific criteria for determining if the component has an emissions impact and thus needs to be monitored. The additional language related to vehicles compensating or adjusting for deterioration or malfunction of the component/system is needed to make clear that such components/systems are subject to default action provisions specified elsewhere.

Subsection (f)(15.1.2) The proposed changes to this subsection, which sets specific criteria for determining the emission impact of a comprehensive component, are needed to streamline the requirements and to establish clear, specific criteria for determining if the component has an emissions impact and thus needs to be monitored.

Subsection (f)(15.1.3) This new proposed subsection, which exempts manufacturers from monitoring safety-only components or systems, is needed to address manufacturers' concerns, since these components/systems are only used for safety purposes and thus impact powertrain performance (and possibly emissions) very infrequently, so that there is not much benefit in requiring these components to be monitored.

Subsection (f)(15.1.5) The purpose of this subsection is to state that manufacturers shall monitor for malfunctions of electronic powertrain input or output components/systems associated with components that only affect emissions. The proposed change of "hybrids" to "hybrid vehicles" is needed to match the terminology used under subsection (c). The proposed change of "(f)(15.1.5)" to (f)(15.1.6)" is needed since this subsection was renumbered.

Subsection (f)(15.1.6) The purpose of this subsection is to describe the general requirements for hybrid components. The proposed change of "hybrids" to "hybrid vehicles" is needed to match the terminology used under subsection (c). The proposed changes to this subsection are needed to account for the new detailed hybrid component monitoring requirements described under new proposed subsection (f)(15.2.3).

Subsection (f)(15.2.1)(A) The purpose of this subsection is to describe the malfunction criteria for input component monitors. The proposed addition of "(or for digital inputs, lack of communication to the on-board computer)" is needed to ensure such malfunctions, including those related to smart devices, are detected. The proposed change of "a lack of circuit continuity" to "circuit faults" is needed for clarity.

Subsection (f)(15.2.1)(B) The purpose of this subsection is to require input component monitors to store different fault codes for each distinct malfunction. The proposed change allowing input components monitored solely by emissions neutral diagnostics to be exempt from meeting this subsection is needed since these diagnostics are already exempt from illuminating the MIL and meeting the fault code requirements under subsection (f)(15.4.5), so fault isolation provides no benefit. The proposed language indicating two-sided rationality diagnostics are not required to set separate fault codes for rationality high and rationality low faults is needed for clarity, since separate fault codes provide no benefit. The proposed separate requirements for "analog inputs" and "digital inputs" in subsections (f)(15.2.1)(B)(i) and (ii) are needed to clarify the requirements for fault code storage.

Subsection (f)(15.2.2)(A) The purpose of this subsection is to define the malfunction criteria for output component/system monitors. The proposed change of "functional monitoring" to "functional check" is needed to be consistent with the terminology used in the definitions in subsection (c), which states "functional check." The proposed change of "output components/systems" to "the output component/system" is needed for better readability.

Subsection (f)(15.2.2)(B)(iv) The purpose of this subsection is to define the malfunction criteria for idle fuel control system monitors. 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 (f)(15.2.2)(F) The purpose of this subsection is to define the malfunction criteria for monitoring the fuel control system components for proper compensation. The proposed changes to subsection (f)(15.2.2)(F)(i) are needed for clarity and better readability. The proposed additions of "NMHC, NOx (or NMOG+NOx, if applicable), CO, or PM" to subsection (f)(15.2.2)(F)(ii) are needed to avoid confusion and to account for the NMOG+NOx standards required by LEV III. The proposed changes to subsection (f)(15.2.2)(F)(ii) related to the worst case failure mode are needed for clarity.

Subsection (f)(15.2.3) This new proposed subsection, which describes the monitoring requirement for hybrid components, is needed to provide more detail and clarify the malfunctions that manufacturers are required to detect on hybrid vehicles.

Subsection (f)(15.3.1)(B) The purpose of this subsection is to describe conditions under which rationality monitors of input component monitors shall occur. The proposed changes of "rationality monitoring" to "rationality fault diagnostics" are needed to be consistent with the terminology used in the definitions in subsection (c), which states "rationality fault diagnostic." The proposed deletion of ":" is needed to correct an error.

Subsection (f)(15.3.2) The purpose of this subsection is to describe the conditions under which monitors of output component/system monitors shall occur. The proposed changes of "functional monitoring" to "functional check" in subsections (f)(15.3.2)(B) and (15.3.2)(C) are needed to be consistent with the terminology used in the definitions in subsection (c), which states "functional check."

Subsections (f)(15.3.3) The purpose of this new proposed subsection is to describe the conditions under which hybrid component monitoring shall occur, which will complement the new proposed monitoring requirements under subsection (f)(15.2.3).

Subsection (f)(15.4.1) The purpose of this subsection is to describe exceptions to the general requirements for MIL illumination and fault code storage for comprehensive component monitors. The proposed addition of "and (15.4.5)" is needed to account for the new requirement for emissions neutral diagnostics in new subsection (f)(15.4.5), which would not be required to meet the criteria under subsection (f)(15.4.1). The proposed additional language indicating that additional fault code requirements are provided for input components, output components, and hybrid component sections in the specified sections is needed for clarity and to ensure manufacturers meet the appropriate fault code requirements.

Subsection (f)(15.4.2) The purpose of this subsection is to describe the criteria under which a comprehensive component monitor is exempt from illuminating the MIL. The proposed change limiting the application of this subsection to non-LEV III applications is needed to phase-out this requirement and to account for the new proposed criteria under subsection (f)(15.1.2), which would allow comprehensive components to be exempt from being monitored altogether if certain criteria are met. The proposed addition of "both conditions (A) and (B) below are met" is needed to address confusion about which conditions need to be met in order to be exempt from illuminating the MIL.

Subsection (f)(15.4.5) The new proposed subsection (f)(15.4.5), which exempts MIL illumination and fault code storage for components/systems monitored solely by emissions neutral diagnostics, is needed since requiring these components/systems to illuminate the MIL and store a fault code when a fault occurs would provide no benefit since the fault would activate an action that would not affect emissions or the OBD II system performance.

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 changes, which allow manufacturers to revise the malfunction criteria for certain monitors on passenger cars, light-duty trucks, and MDPVs certified to a chassis dynamometer tailpipe emission standard if certain conditions are met, are needed since ARB's stance has always been that monitoring technical feasibility (and thus thresholds) of light-duty diesel vehicles is tied to the monitoring feasibility and thresholds on light-duty gasoline vehicles, and the regulation currently allows the malfunction criteria on gasoline light-duty vehicles to be modified under subsection (e)(17.1). The proposed additions of "Tier 2" and its associated CFR reference to subsection (f)(17.1.2) are needed to avoid confusion, since this subsection only applies to those certified to the "Federal Bin 3 or Bin 3 emission standards" adopted as part of the Tier 2 program, not any other program. The proposed changes dividing subsection (f)(17.1.6) into subsections (A) and (B) are needed to account for the new proposed malfunction criteria for LEV III applications and to distinguish these malfunction criteria from those for non-LEV III applications. The proposed changes to subsection (f)(17.1.6)(A)(i) is needed for formatting reasons and to acknowledge new proposed subsections (f)(17.1.6)(A)(iv) and (v). The new proposed subsections (f)(17.1.6)(A)(iv) and (v) are needed to clarify which requirements medium-duty diesel vehicles (except MDPVs) certified to a chassis dynamometer tailpipe emission standard are required to use, because of manufacturers' confusion.

Subsection (f)(17.1.7) This new proposed subsection, which allows SULEV20 vehicles to use higher interim emission malfunction thresholds for the interim years, is needed to address manufacturers' concerns about meeting the proposed final thresholds considering the low SULEV20 tailpipe emission standards.

Subsection (f)(17.3) The purpose of this subsection is to allow manufacturers to disable monitoring during certain conditions if certain criteria are met. The proposed change of "twenty" to "20" is needed for formatting reasons. The proposed addition of temperature values in degrees Celsius in addition to the temperature values in degrees Fahrenheit is needed for clarity.

Subsection (f)(17.5.2) The purpose of this subsection is to allow manufacturers to disable monitors for high battery or system voltage conditions. The proposed change to allow manufacturers to disable monitoring if the battery reaches a voltage that causes the instrument cluster to completely shut down is needed since such shutdown may prevent the electrical charging system/alternator warning light from illuminating when the high battery voltage occurs.

Subsection (f)(17.6.1) The purpose of this subsection is to allow manufacturers to disable monitors affected by PTO activation under certain conditions. The proposed change of "(g)(17.6.2)" to "(f)(17.6.2)" is needed to correct the subsection reference.

Subsection (f)(17.7) 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 (f)(17.8) 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 vehicle speed is above 82 miles-per-hour. 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)(1) The purpose of this subsection is to indicate the SAE International and ISO documents incorporated by reference in the regulation. The proposed change of "Society of Automotive Engineers" is needed to update the name to the official new name “SAE International.” The proposed updates to the SAE International 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 OBD II systems.

Subsection (g)(2) The purpose of this subsection is to specify the requirements for the diagnostic connector. The proposed changes to subsection (g)(2.1) limiting the requirements to the 2004 through 2018 model year and specifying that the connector has to meet the “Type A” specifications of the April 2002 version of SAE J1962 are needed for clarification and account for the new proposed requirements for 2019 and subsequent model year vehicles in subsection (g)(2.2). The new proposed subsection (g)(2.2) is needed to account for the new diagnostic connector requirements incorporated in the July 2012 version of SAE J1962. The new proposed subsection (g)(2.4), which clarifies that additional identical connectors are prohibited from being located in the same area as the standardized OBD II connector, is needed to avoid confusion among technicians and inspectors attempting to identify the correct connector to retrieve OBD II information from.

Subsection (g)(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 (g)(4.2.1) The purpose of this subsection is to describe the data stream parameters all vehicles are required to make available to a scan tool. The proposed separation of the language into subsections (A) through (D) is needed for better readability. The proposed subsection (e)(4.2.1)(B), which requires “type of fuel currently being used” to be made available, has been moved up from subsection (e)(4.2.7) to group required data stream parameters for “all vehicles” in one subsection. The new proposed subsection (g)(4.2.1)(C) requiring new data stream parameters to be made available by all vehicles is needed for make it easier to conduct valid in-use emission tests with PEMS and to assist staff in certification and OBD II compliance testing.

Subsection (g)(4.2.2) The purpose of this subsection is to describe the data stream parameters all vehicle so equipped are required to make available to a scan tool. The proposed separation of the language into subsections (A) through (C) is needed for better readability. The proposed additional language of “(short term, long term, and secondary)” to “fuel trim” in subsection (g)(4.2.2)(A) is needed to address manufacturers’ confusion about the specific data stream parameter they are required to support and report. The proposed subsection (g)(4.2.2)(B) has been moved up from subsection (g)(4.2.6) to group required data stream parameters for “all vehicles so equipped” in one subsection. The new proposed subsection (g)(4.2.2)(C) requiring the “NOx sensor corrected” parameter to be made available on vehicles so equipped is needed to assist technicians in helping diagnose malfunctions.

Subsection (g)(4.2.5) The purpose of this subsection is to require diesel vehicles to make certain data stream parameters available to a scan tool. The proposed changes to a few parameter names in subsection (g)(4.2.5)(D) are needed to address manufacturers' confusion about the specific data stream parameter they are required to support and report. The new proposed subsection (g)(4.2.5)(D)(i) requiring diesel vehicles to make available DEF-related parameters is needed to assist staff in certification and OBD II compliance testing.

Subsection (g)(4.2.6) The old subsection (g)(4.2.6) was deleted since the content was moved up to subsection (g)(4.2.2)(A). The new proposed subsection (g)(4.2.6), which requires hybrid vehicles to report several hybrid-related data stream parameters, is needed to assist technicians in diagnosing malfunctions.

Subsection (g)(4.2.7) The old subsection (g)(4.2.7) was deleted since the content was moved up to subsection (g)(4.2.1)(A). The new proposed subsection (g)(4.2.7), which requires vehicles required to meet the requirements of title 13, CCR section 1976(b)(1)(G)6 to make available the "distance traveled since evap monitoring decision," is needed to align the requirements with those required by U.S. EPA.

Subsection (g)(4.2.8) The purpose of this new subsection is to require manufacturers to report the most accurate values for certain parameters. This new subsection is needed to facilitate accurate PEMS testing.

Subsection (g)(4.3.1) The purpose of this subsection is to describe the standardization requirements for "freeze frame" information. The proposed change of "(e)(3.4.3)" to "(e)(3.4.4)" is needed since the subsection was renumbered.

Subsection (g)(4.3.2) The purpose of this subsection is to describe the required data stream parameters that must be included in the freeze frame conditions. The proposed changes to the subsection references are needed to align with the changes made to subsection (g)(4.2).

Subsection (g)(4.3.3) The proposed change of "(g)(4.2.1)" to "(g)(4.2.1)(A)" is needed for formatting reasons.

Subsection (g)(4.4.2) The purpose of this subsection is to describe the standardization requirements for fault codes. The proposed deletions in this subsection and the proposed language indicating "Except as otherwise specified in sections (e)(and (f)" are necessary since these requirements are already described in subsections (e)(15) and (f)(15) and are thus redundant in this subsection.

Subsection (g)(4.4.6)(D) The purpose of this subsection is to describe the standardized requirements for permanent fault codes. The proposed changes to this subsection, which requires manufacturers to reset readiness bits in certain modules that report supported readiness bits when the control module containing the permanent fault code is reprogrammed, are needed since manufacturers were misreading the regulation language and not implementing the requirement as intended.

Subsection (g)(4.4.6)(E) The purpose of this subsection is to describe the standardized requirements for permanent fault codes. The proposed changes of “OBD system” to “OBD II system” are needed for clarity.

Subsection (g)(4.5) The purpose of this subsection is to describe the standardization requirements for test results. The proposed changes to this subsection are needed for better readability, to make the requirements easier to understand, and avoid confusion among manufacturers by identifying the specific monitors that are required to be report test results. The new proposed subsection (g)(4.5.4)(C), which requires gasoline vehicles to report test results for dedicated gasoline fuel system air-fuel ratio cylinder imbalance monitors, is needed since this monitor does not run continuously like other gasoline fuel system monitors and the test result information would assist technicians in repairing vehicles.

Subsection (g)(4.7) The purpose of this subsection is to describe the standardization requirements for CVN. The proposed deletion of “electronically reprogrammable” in subsection (g)(4.7.1) is needed to correct a mistake. The proposed deletion of language from subsection (g)(4.7.3) is needed since this language was moved to new proposed subsection (g)(4.7.4). The new proposed subsection (g)(4.7.4) is needed to clarify the requirements for making CVN immediately available through the DLC and to prevent manufacturers from inappropriately responding with negative response codes (e.g., extended message timing for replies) or default values. The proposed change in subsection (g)(4.7.5) is needed to reference the most recent version of the standardized format manufacturers are required to use.

Subsection (g)(4.8.2) The purpose of this subsection is to describe the standardization requirements for the VIN. The proposed change to this subsection, which requires manufacturers to reset readiness bits in those modules that report any supported readiness bits except the bit for the comprehensive components when the VIN is reprogrammed, is needed since manufacturers were misreading the regulation language and not implementing the requirement as intended.

Subsection (g)(4.10) This new proposed subsection, which describes the emission-related diagnostic information required to be erased if commanded by a scan tool or if the power to the on-board computer is disconnected, is needed to reduce the opportunity for selective reprogramming events to be used to evade detection during inspections or avoid necessary repairs. The new proposed subsection (g)(4.10.2) describes the conditions under which all diagnostic information shall be erased from all control units, which is needed to ensure consistency in the way that diagnostic information is erased when commanded by a scan tool. The new proposed subsection (g)(4.10.3) provides manufacturers with an allowance to obtain Executive Officer approval to employ alternate conditions for erasure of all diagnostic information from all control units with a scan tool, which is needed in cases of safety or component protection. The new proposed subsection (g)(4.10.4) provides manufacturers with an allowance to obtain Executive Officer approval for use of alternate conditions for erasure of only diagnostic information in control units that support the comprehensive components readiness bit, and only if all diagnostic information in control units that support readiness bits other than comprehensive components are erased, which is needed in order to ensure consumer and technician safety when a safety-related or component-protection default action is taken in response to a malfunction of a component.

Subsection (g)(5.1) The purpose of this subsection is to describe the standardization requirements for in-use performance ratio tracking. The proposed change requiring monitors of "section (f)" in addition to section (e) to meet this subsection is needed to correct an oversight, since there are monitors in subsection (f) that are required to report in-use performance ratio data.

Subsection (g)(5.2.1)(B) The purpose of this subsection is to describe the numerical value specifications for the in-use performance ratio data. The proposed changes to this subsection, which would prohibit manufacturers from storing the numbers in KAM and to require them to store the numbers in NVRAM starting in the 2019 model year, are needed to help verify advanced vehicle and powertrain technologies being deployed to meet ARB's stringent GHG emission standards deliver the expected GHG benefits and consumer fuel savings in the real world.

Subsection (g)(6) The purpose of this subsection is to describe the engine run time tracking requirements. The change of the title "Engine Run Time Tracking Requirements" to "Vehicle Operation Tracking Requirements" is needed since the new tracking requirements being proposed under this subsection include parameters that are not related to engine run time. The new proposed subsections (g)(6.3) through (g)(6.5), (g)(6.6.2), and (g)(6.8), which require manufacturers to track and report additional information, are needed to help verify advanced vehicle and powertrain technologies being deployed to meet ARB's stringent GHG emission standards deliver the expected GHG benefits and consumer fuel savings in the real world. The proposed changes of "(g)(6.4.2)" to "(g)(6.7.2)" in subsections (g)(6.7.2)(A)(ii) and (g)(6.7.3) are needed since these subsections were renumbered.

Subsection (g)(7.1) The purpose of this subsection is to allow medium-duty diesel vehicles with engines certified on an engine dynamometer to meet alternate standardization requirements. The proposed change of "engine run time tracking data" to "vehicle operation tracking data" is needed to account for the proposed title change in subsection (g)(6).

Subsection (g)(7.3) This new proposed subsection, which describes the requirements for meeting phase-in schedules and allows manufacturers to use alternate phase-in schedules, is needed to account for the new proposed requirements in subsection (g) that include specific phase-in schedules.

Subsection (g)(7.4) This new proposed subsection, which exempts emissions neutral diagnostics from meeting certain requirements of subsection (g), is needed to complement the proposed changes related to emissions neutral diagnostics throughout the regulation.

Subsection (g)(7.5) This new proposed subsection, which exempts small volume manufacturers from making available the “distance traveled since evap monitoring decision” data parameter until the 2022 model year, is needed to align the requirements with those required by U.S. EPA.

Subsection (h)(1.3) This new proposed subsection, which requires manufacturers of alternate-fueled vehicles to submit a demonstration testing plan for Executive Officer approval, is needed since these vehicles may utilize both gasoline and diesel emission control technologies and thus may not cleanly fit under just the gasoline requirements or just the diesel requirements. The proposal would ensure they are meeting the correct testing requirements in the regulations.

Subsection (h)(1.5) This new proposed subsection, which requires manufacturers of vehicles that are equipped with components/systems defined by any of the monitoring requirements in sections (e) and (f), is needed since these vehicles may utilize both gasoline and diesel emission control technologies and thus may not cleanly fit under just the gasoline requirements or just the diesel requirements. The proposal would ensure they are meeting the correct testing requirements in the regulations.

Subsection (h)(2.3) The purpose of this subsection is to describe the test vehicle requirements for demonstration testing. The proposed change allowing manufacturers to use a production representative vehicle for testing the gasoline evaporative system monitor is needed since the purpose of demonstration testing this monitor is to ensure the monitor is able to detect a 0.020-inch diameter leak without regards to emissions measurements, so testing with a certification emission durability test vehicle or a representative high mileage vehicle is not necessary.

Subsection (h)(3) The proposed changes to this subsection are needed for better readability.

Subsection (h)(3.1) The purpose of this subsection is to describe the testing requirements for gasoline exhaust gas sensor monitors. The proposed changes to subsection (h)(3.1.1) related to the primary oxygen sensor are needed to allow manufacturers to test only certain response rate malfunctions (e.g., worst case malfunctions) to limit the number of tests performed. The rest of the proposed changes to subsection (h)(3.1) are needed for clarity.

Subsection (h)(3.2) The purpose of this subsection is to describe the testing requirements for gasoline EGR system monitors. The proposed changes requiring manufacturers to test the EGR system “at each flow limit” instead of “at the low flow limit" is needed to correct an oversight, since the EGR system monitoring requirements under subsection (e)(8) require manufacturers to monitor for both EGR system "low flow" and "high flow" malfunctions before emissions exceed specific emission thresholds.

Subsection (h)(3.3) The purpose of this subsection is to describe the testing requirements for the gasoline VVT system monitors. The proposed changes to this subsection are needed for clarity.

Subsection (h)(3.4) The purpose of this subsection is to describe the testing requirements for gasoline fuel system monitors. The proposed addition in subsection (h)(3.4.1) and the proposed deletion in subsection (h)(3.4.5) are needed since the language at issue does not apply to all fuel system monitors, such as the air-fuel ratio cylinder imbalance monitor. The proposed changes of "(e)(6.2.1)" to "(e)(6.2.1)(A)" in subsection (h)(3.4.1) and of "(e)(6.2.1)" to "(e)(6.2.1)(B)" in subsection (h)(3.4.2) are needed to refer to the correct subsection. The new proposed subsection (h)(3.4.3) describing the testing requirements for the air-fuel ratio cylinder imbalance monitor is needed since such language was mistakenly left out. The rest of the proposed changes to subsection (h)(3.4) are needed for clarity.

Subsection (h)(3.5) The purpose of this subsection is to describe the testing requirements for gasoline misfire monitors. The proposed change of "(e)(3.2.2)" to "(e)(3.2.2)(A)" is needed to refer to the correct subsection. The proposed change exempting manufacturers of plug-in hybrid electric vehicles from testing the monitor if it meets subsection (e)(3.2.3)(A) instead of subsection (e)(3.2.3)(B) is needed since the misfire monitor malfunction criteria for these vehicles in subsection (e)(3.2.3)(A) is no longer tied to an emission threshold. The rest of the proposed changes to subsection (h)(3.5) are needed for clarity.

Subsection (h)(3.6) The purpose of this subsection is to describe the testing requirements for secondary air system monitors. The proposed deletion of the language related to the functional check is needed since this requirement is already covered under subsection (h)(3.12). The rest of the proposed changes to this subsection are needed for clarity.

Subsection (h)(3.7) The purpose of this subsection is to describe the testing requirements for gasoline catalyst monitors. The proposed change to this subsection is needed for clarity.

Subsection (h)(3.8) The purpose of this subsection is to describe the testing requirements for heated catalyst monitor. The proposed change to this subsection is needed for clarity.

Subsection (h)(3.9) This new proposed subsection, which describes the testing requirements for cold start emission reduction strategy monitors, is needed since such language was mistakenly left out during a past OBD II regulatory update.

Subsection (h)(3.10) The purpose of this subsection is to describe the testing requirements for other system monitors. The proposed change of the title to "emission control or source systems" is needed to match the title with that under subsection (e)(16).

Subsection (h)(3.11) This new proposed subsection, which requires testing of the evaporative system 0.020-inch leak monitor starting in the 2017 model year, is needed to align with the testing requirements required by U.S. EPA and to ensure that the monitor is able to detect leaks as small as 0.020-inch in diameter.

Subsection (h)(3.12) 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, but that manufacturers are required to provide data showing that only a functional check is required for the component/system.

Subsection (h)(3.13) This new proposed subsection, which describes the requirements for components or systems used in parallel for the same purpose, is needed since these requirements are currently required for testing diesel monitors under subsection (h)(4.14) but were mistakenly not applied to testing of gasoline monitors under subsection (h)(3). The proposed language indicating that this subsection does not apply to testing of the gasoline misfire and fuel system air-fuel ratio cylinder imbalance monitors under subsections (h)(3.4.3) and (h)(3.5) is needed to address confusion about which monitors are required to meet this subsection.

Subsection (h)(3.15) This new proposed subsection, which delays testing of the evaporative system monitor under subsection (h)(3.11) until the 2022 model year, is needed to align the start date with that required by U.S. EPA's requirements.

Subsection (h)(4) The proposed changes to this subsection are needed for better readability.

Subsection (h)(4.1) The purpose of this subsection is to describe the testing requirements for NMHC catalyst monitors. The proposed change of "(f)(1.2.2)" to "(f)(1.2.2)(A)" is needed to refer to the correct subsection. The rest of the proposed changes to subsection (h)(4.1) are needed for clarity.

Subsection (h)(4.2) The purpose of this subsection is to describe the testing requirements for NOx catalyst monitors. The proposed change of "(f)(2.2.3)(A)" to "(f)(2.2.3)(A)(i)" is needed to refer to the correct subsection. The rest of the proposed changes to subsection (h)(4.2) are needed for clarity.

Subsection (h)(4.3) The purpose of this subsection is to describe the testing requirements for diesel misfire monitors. The proposed deletion of "(3.2.2)(A)(i)" is needed since these subsections no longer apply due to proposed changes to subsection (e)(3.2). The rest of the proposed changes to subsection (h)(4.3) are needed for clarity.

Subsection (h)(4.4) The purpose of this subsection is to describe the testing requirements for diesel fuel system monitors. The proposed changes of the subsections referenced are needed to refer to the correct subsections. The proposed changes describing the tests manufacturers are required to run for the diesel fuel system monitors are needed to address confusion about the failure modes required to be tested. The rest of the proposed changes to subsection (h)(4.4) are needed for clarity.

Subsection (h)(4.5) The purpose of this subsection is to describe the testing requirements for diesel exhaust gas sensor monitors. The proposed changes to subsection (h)(4.5) are needed for clarity.

Subsection (h)(4.6) The purpose of this subsection is to describe the testing requirements for diesel EGR system monitors. The proposed changes of the subsections referenced are needed to refer to the correct subsections. The rest of the proposed changes to subsection (h)(4.6) are needed for clarity.

Subsection (h)(4.7) The purpose of this subsection is to describe the testing requirements for boost pressure control system monitors. The proposed changes of the subsections referenced are needed to refer to the correct subsections. The rest of the proposed changes to subsection (h)(4.7) are needed for clarity.

Subsection (h)(4.8) The purpose of this subsection is to describe the testing requirements for NOx adsorber monitors. The proposed change of "(f)(8.2.1)" to "(f)(8.2.1)(A)" is needed to refer to the correct subsection. The rest of the proposed changes to subsection (h)(4.8) are needed for clarity.

Subsection (h)(4.9) The purpose of this subsection is to describe the testing requirements for PM filter monitors. The proposed changes of the subsections referenced are needed to refer to the correct subsections. The rest of the proposed changes to subsection (h)(4.9) are needed for clarity.

Subsection (h)(4.10) The purpose of this subsection is to describe the testing requirements for diesel cold start emission reduction strategy monitors. The proposed language allowing manufacturers to use computer modifications instead of a hardware change to simulate the cold start strategy malfunction is needed since malfunctions of some elements of the cold start emission reduction strategy can only be simulated using computer modifications. The rest of the proposed changes to subsection (h)(4.10) are needed for clarity.

Subsection (h)(4.11) The purpose of this subsection is to describe the testing requirements for diesel VVT system monitors. The proposed changes are needed for clarity.

Subsection (h)(4.12) This new proposed subsection, which describes the testing requirements for other emission control or source system monitors, is needed since such language was mistakenly left out during the last OBDII regulatory update.

Subsection (h)(4.13) This purpose of this subsection is to indicate that demonstration testing is not required for functional monitors. The proposed change of "functional test" to "functional check" is needed to be consistent with the terminology used in the definitions in subsection (c), which states "functional check." The rest of the proposed changes are needed for clarity.

Subsection (h)(4.14) The purpose of this subsection is to describe the requirements for components or systems used in parallel for the same purpose. The proposed language indicating that this subsection does not apply to testing of the diesel misfire and fuel system monitors under subsections (h)(4.3) and (4.4) is needed to address confusion about which monitors are required to meet this subsection.

Subsection (h)(5.1) The purpose of this subsection is to describe the requirements for preconditioning during demonstration testing. The proposed changes to this subsection are needed to address confusion about the language and to make clear the requirements for allowable preconditioning cycles. The new proposed subsection (h)(5.1.4), which exempts manufacturers from meeting the preconditioning requirements when testing the gasoline evaporative system monitor, is needed since the purpose of demonstration testing this monitor is to ensure the monitor is able to detect a 0.020-inch diameter leak without regards to emissions measurements, so preconditioning is not necessary.

Subsection (h)(5.2) The purpose of this subsection is to describe the demonstration test sequence. The proposed changes to this subsection are needed to address confusion about the language and to make clear the required test sequence and the allowable test cycles for demonstration testing. The proposed language in subsections (h)(5.2.1) and (h)(5.2.2) allowing manufacturers to run the monitor during "alternate monitoring conditions approved under section (d)(1.3.1)" is needed since this was mistakenly left out of the language; the purpose of these subsections is to run the monitor on the test cycle it is designed to run on, and subsection (d)(1.3.1) allows manufacturers to design monitors to run on these alternate conditions if it doesn't run on the FTP cycle or Unified cycle. The proposed changes in subsection (h)(5.2.3), which prohibit manufacturers from running additional test cycles prior to the exhaust emission test cycle unless proven to be necessary, are needed to address issues with manufacturers inappropriately running additional preconditioning test cycles prior to the emission exhaust test cycle. The manufacturers indicated the additional test cycles were allowed for demonstrating compliance with the tailpipe emission standards, but ARB staff does not believe them to be automatically appropriate for OBD demonstration testing. The new proposed subsection (h)(5.2.4), which exempts manufacturers from meeting the test sequence requirements when testing the gasoline evaporative system monitor, is needed since the purpose of demonstration testing this monitor is to ensure the monitor is able to detect a 0.020-inch diameter leak without regards to emissions measurements.

Subsection (h)(5.3) This new proposed subsection describes the emission data and the test data manufacturers are required to collect during demonstration testing. The proposed changes to the standardized data required to be collected during testing is needed to help staff in determining if problems exist and to ensure that the standardized data is outputting expected values during the test sequence. The proposed changes requiring manufacturers of LEV III gasoline applications to collect PM emission test data starting in the 2017 model year is needed to account for the lower PM tailpipe emission standards being phased in with the LEV III program as well as the increased use of specific technologies on gasoline vehicles that could have a big effect on PM emissions. The proposed change to require manufacturers of 2017 and subsequent model year gasoline vehicles to collect CO emission test data during testing of all monitors, including the catalyst monitor (which does not have a CO emission malfunction threshold), is needed to help staff determine if CO emissions are an issue due to catalyst malfunctions. The proposed change requiring manufacturers to collect CO_2 emission data from gasoline and diesel vehicles starting in the 2018 model year is needed to assist staff in determining future OBD II emission thresholds based on CO_2 emissions. The proposed change in subsection (h)(5.3.2)(B) requiring the manufacturers to collect the test data immediately prior to or after each engine shut-down starting in the 2019 model year is needed so that staff could better understand the scenario of events and ensure that the standardized data is outputting expected values during the test sequence. The proposed new subsection (h)(5.3.3) allowing manufacturers testing the gasoline evaporative system monitor to use alternate requirements for test data collection is needed since the purpose of demonstration testing this monitor is to ensure the monitor is able to detect a 0.020-inch diameter leak, so emission test data and test data collected at multiple points in the test cycles are not necessary.

Subsection (h)(6.2) The purpose of this subsection is to allow manufacturers to use NMHC emission results in lieu of NMOG emission results when comparing the emission data to the OBD II thresholds. The proposed changes to how the NMOG results are required to be calculated based on the NMOG results are needed to correct an error regarding how to perform the calculation for diesel vehicles and to incorporate the most recently approved calculation methods adopted by ARB in the test procedure "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles." The rest of the proposed changes are needed for clarity.

Subsection (h)(6.4) 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 to subsections (h)(6.4.1) and (h)(6.4.2) 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 these procedures. The rest of the proposed changes are needed for clarity.

Subsection (h)(6.7) This new proposed subsection, which exempts manufacturers from meeting the evaluation protocol requirements of subsection (h)(6) when testing the gasoline evaporative system monitor, is needed since the purpose of subsection (h)(6) is to evaluate the emission test data while the proposed changes to subsection (h) would exempt manufacturers from collecting emission data when testing this monitor.

Subsection (i)(2.1) The purpose of this subsection is to describe the information required to be submitted as part of the certification application. The proposed changes, which clarify that information about monitors carried out by smart devices must be included in the application, is needed to assist staff during certification review.

Subsection (i)(2.2) The purpose of this subsection is to describe the summary table requirements for certification documentation. The proposed changes to subsection (i)(2.2) are needed to reference the most recent version of the standardized format manufacturers are required to use. The proposed change in subsection (i)(2.2) clarifying that the information on the table must include information about components/systems monitored by a smart device is needed to assist staff during certification review. The proposed change of "rationality checks" to "rationality fault diagnostics" in subsection (i)(2.2.1)(I) is needed to be consistent with the terminology used in the definitions in subsection (c), which states "rationality fault diagnostic." The new proposed subsection (i)(2.2.1)(J) requiring information about emissions neutral diagnostics to be included in the summary table is needed to assist staff in reviewing the OBD II applications. The proposed changes to (i)(2.2.2)(H) requiring manufacturers to use "mg per stroke" for all fuel quantity-based per ignition event criteria and "per stroke" for all other changes per ignition event-based criteria are needed since "mg/stroke" is already more commonly used and to be consistent among manufacturers to assist staff during certification review.

Subsection (i)(2.4) The purpose of this subsection is to require manufacturers to include information/data related to certification demonstration testing in the certification documentation. The proposed changes to this subsection are needed since the information required to be collected during demonstration testing (in accordance with subsection (h)) have been moved to subsection (h)(5.3). The proposed change requiring manufacturers to include a summary of any issues found during demonstration testing is needed to assist staff during certification review.

Subsection (i)(2.5.1) The purpose of this subsection is to require manufacturers to submit data supporting the misfire monitor in the certification documentation. The proposed change to subsection (i)(2.5.1)(B) is needed to clarify that the misfire monitor data demonstrating the probability of detection of misfire events is detailed in ARB Mail-Out MSC #06-23 to ensure manufacturers use the correct format. The proposed change to subsection (i)(2.5.1)(C) requiring manufacturers to indicate the number of 1000-revolution intervals that were completed and in which the misfire threshold was exceeded is needed to align with the required standardized format made available as part of ARB Mail-Out MSC #06-23. The proposed change in subsection (i)(2.5.1)(C) including “most recent” to “standardized format” is needed to reference the most recent version of the standardized format manufacturers are required to use. The proposed change to subsection (i)(2.5.1)(C) requiring manufacturers to submit these data for any plug-in hybrid electric vehicle subject to the requirements of subsection (e)(3.2.3)(A) is needed to assist staff during certification and to ensure that manufacturers are able to detect misfire at the required level on these vehicles. The proposed change to subsection (i)(2.5.1)(D) is needed to correct the spelling of “though” to “through.”

Subsection (i)(2.5.2) The purpose of this subsection is to require manufacturers to submit specific data supporting the diesel misfire monitor in the certification documentation. The proposed change deleting “medium-duty” is needed to account for the proposed changes to subsection (f)(3.2.2), which now require light-duty vehicles (in addition to the currently required medium-duty vehicles) to meet the requirements of subsection (f)(3.2.2). The proposed change to subsection (i)(2.5.2)(B) is needed to correct the spelling of “revolution.” The proposed change in subsection (i)(2.5.2)(B) including “most recent” to “standardized format” is needed to reference the most recent version of the standardized format manufacturers are required to use. The proposed change to subsection (i)(2.5.2)(B) requiring manufacturers to submit these data for any diesel vehicle subject to the requirements of subsection (f)(3.2.2) is needed to assist staff during certification and to ensure that manufacturers are able to detect misfire at the required level on these vehicles.

Subsection (i)(2.12) The purpose of this subsection is to require manufacturers to provide information regarding the diagnostic connector in the certification documentation. The proposed changes to this subsection, which clarify that the diagnostic connector information should be representative of every model covered by the application and allow manufacturers to submit one set of information to cover a group of models, is needed for staff to ensure that vehicles are meeting the requirements across the product line.

Subsection (i)(2.14) The purpose of this subsection is to require manufacturers to submit a cover letter with specific information as part of the certification documentation. The proposed change to require manufacturers to specify “all other known issues” that apply to the test group(s) in the cover letter is needed to assist staff during certification review.

Subsection (i)(2.16) The purpose of this subsection is to require manufacturers to submit the monitor checklists as part of the certification documentation. The proposed change to this subsection is needed to reference the most recent version of the standardized format manufacturers are required to use.

Subsection (i)(2.17) This new proposed subsection, which requires manufacturers to include information about the in-use monitor performance data as part of the certification documentation, is needed to assist staff during certification review.

Subsection (i)(2.18) This new proposed subsection, which requires manufacturers to include information about the test results in the certification documentation, is needed to assist staff during certification review.

Subsection (i)(2.19) This new proposed subsection, which requires manufacturers to submit a timeline showing the start of normal production and the time the vehicles are first introduced into commerce as well as the production vehicle evaluation testing deadlines, is needed so that staff can ensure the data required to be submitted as part of the production vehicle evaluation testing requirements are submitted within the required time.

Subsection (i)(2.20) This new proposed subsection, which requires manufacturers to submit information related to their emissions neutral diagnostics as part of the certification documentation, is needed to assist staff during certification review.

Subsection (i)(2.21) This new proposed subsection, which requires manufacturers to submit information related to their safety-only components/systems as part of the certification documentation, is needed to assist staff during certification review.

Subsection (i)(2.22) This new proposed subsection, which requires manufacturers to submit a statement of compliance indicating the test groups in the application meet the requirements of section 1968.2, among other things, is needed to assist staff during certification review.

Subsection (i)(2.23) This new proposed subsection, which requires manufacturers to submit information about adjustment factors for gasoline vehicles with emission controls that experience infrequent regeneration events, is needed to help staff determine if regeneration emissions are an issue on gasoline vehicles and if future regulatory changes will be needed to account for regeneration emissions on gasoline vehicles.

Subsection (i)(2.24) This new proposed subsection, which requires manufacturers of medium-duty diesel vehicles certified to an engine dynamometer tailpipe emission standard to submit information related to the net brake torque during the FTP and SET cycles, is needed to ensure that manufacturers are consistent in the reporting of torque output from the scan tool to avoid erroneous emissions calculations during PEMS testing.

Subsection (i)(2.25) This new proposed subsection, which requires manufacturers to submit information related to all inducement strategies and their inputs, is needed to assist staff during certification review.

Subsection (i)(2.26) This new proposed subsection, which requires manufacturers to submit a list of comprehensive components that are not OBD II monitored due to meeting the proposed test-out criteria in subsections (e)(15.1.2), (e)(15.2.3)(H), (f)(15.1.2), and (f)(15.2.3)(H) and associated information, is needed to assist staff during certification review.

Subsection (i)(2.27) This new proposed subsection, which requires manufacturers to submit information about components that are not OBD II monitored due to meeting the exemption criteria under subsections (e)(17.8), (e)(17.9), (f)(17.7), or (f)(17.8), are needed to assist staff during certification review.

Subsection (i)(2.28) This new proposed subsection, which requires manufacturers to submit information about the active off-cycle credit technologies used by the vehicle, is needed to complement the proposed changes to subsection (g)(6) and to assist staff during certification review.

Subsection (j)(1.2) The purpose of this subsection is to describe the requirements for selecting test vehicles for the verification of standardized requirements. The proposed changes to this subsection are needed for clarity.

Subsection (j)(1.4.2) The purpose of this subsection is to describe the information the vehicles are required to properly communicate to a SAE J1978 scan tool. The proposed change to subsection (j)(1.4.2)(D) requiring vehicles to properly communicate the ECU name (if applicable) and the proposed change to subsection (i)(1.4.2)(E) requiring vehicles to properly communicate the MIL command status are needed to ensure the correct information is being made available. The proposed change to subsection (i)(1.4.2)(E) requiring the information from each diagnostic and emission critical electronic powertrain control unit is needed for better assurance that the OBD II system as a whole is working as certified.

Subsection (j)(1.5.2) The purpose of this subsection is to require manufacturers to submit the report of the results within three months of any passing test conducted for the standardization requirements. The proposed change requiring manufacturers to submit the test log file in addition to the report is needed since these are important data that staff uses to determine if the system is working correctly.

Subsection (j)(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 the subsection is needed for clarity.

Subsection (j)(2.3.1) The purpose of this subsection is to require manufacturers to test every monitor and ensure each monitor detects a fault, stores a confirmed fault code, and illuminates the MIL. The proposed change related to emissions neutral diagnostics, requiring manufacturers to test each emissions neutral diagnostic and ensure the applicable emissions neutral default action is activated, is needed since these diagnostics do not store confirmed fault codes or illuminate the MIL when a fault is detected. The proposed language requiring manufacturers to ensure all monitors (except the emissions neutral diagnostics) are able to store and erase permanent fault codes is needed to help staff ensure that vehicles are appropriately meeting the permanent fault code requirements of the OBD II regulation.

Subsection (j)(2.3.4) The purpose of this subsection is to describe the requirements for implanting malfunctions for verification of monitoring requirements. The proposed change allowing manufacturers to request Executive Officer approval for alternate evaluation procedures to test emissions neutral diagnostics is needed to address the difficulty and potentially unsafe conditions associated with testing diagnostics located within a control unit meeting the ASIL C or D specifications.

Subsection (j)(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 of monitors where demonstration may jeopardize the safety of the tester is needed to ensure the safety of the individuals conducting the testing.

Subsection (j)(2.4) The purpose of this subsection is to require manufacturers to submit a report of results for testing conducted pursuant to subsection (j)(2). The proposed change requiring manufacturers to include a summary of any problems identified during testing is needed to assist staff in reviewing the test results.

Subsection (j)(3.1) The purpose of this subsection is to describe the general requirements for collecting and reporting in-use monitoring performance data. The proposed changes to this subsection are needed for clarity.

Subsection (j)(3.2) The purpose of this subsection is to describe the information manufacturers are required to include as part of the in-use monitoring performance data submitted to ARB. The proposed change requiring manufacturers to include the model year, manufacturer, vehicle model, and test group in the data is needed to align with the standardized format made available as part of ARB Mail-Out #06-23. The proposed change including “most recent” to “standardized format” is needed to reference the most recent version of the standardized format manufacturers are required to use. The proposed change requiring manufacturers to include a summary of any problems identified in the data is needed to assist staff in reviewing the data.

Subsection (k)(3) The purpose of this subsection is to detail fine amounts for deficiencies. The proposed change including subsection (f)(12) (for diesel cold start emission reduction strategy monitoring) as a $50 deficiency is needed since this was mistakenly left out of a prior OBDII regulatory update.

Subsection (k)(4) The purpose of this subsection is to describe the requirements for applying deficiencies. The proposed change to divide this subsection into several subsections is needed for better readability. The proposed changes to subsection (k)(4.1) are needed for clarity. The new proposed subsection (k)(4.3) describing how deficiencies are applied for emission threshold monitors with interim and final thresholds is needed to clarify the deficiency requirements and to address manufacturers' confusion about how deficiencies are applied during the model years that interim thresholds and final thresholds are required in the regulation.

Subsection (k)(6.1) The purpose of this subsection is to describe the requirements for requesting a retroactive deficiency. The proposed change indicating that retroactive deficiencies apply to "all affected vehicles within the model year" instead of "the start of the production" is needed since not all vehicles since the start of production may have this issue (and thus this deficiency) if the manufacturer implements running changes on the assembly line fixing the issue on some vehicles.

<u>Proposed amendments to title 13, CCR section 1968.5:</u>

Subsection (a)(3) The definition of "Major Monitor" has been amended to account for the new proposed monitoring requirements in section 1968.2(f)(14) for the A/C system on diesel vehicles.

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 2018 to 2021 is needed to account for the proposed changes to 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 2019 through 2021 model year passenger cars, light-duty trucks, and medium-duty vehicles certified to a chassis dynamometer tailpipe emission standard.

Subsection (b)(6)(B)(ii) The purpose of this subsection is to describe the criteria for determining nonconformance for OBD II ratio testing of monitors certified to ratios specified in section 1968.2(d)(3.2.1)(A) through (C). The proposed changes to this subsection are needed for clarity.

Subsection (c)(3)(A) The purpose of this subsection is to describe the mandatory recall criteria. The proposed change of "that" to "any of the following" is needed for better readability.

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 2018 to 2021 is needed to account for the proposed changes to 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 2019 through 2021 model year passenger cars, light-duty trucks, and medium-duty vehicles certified to a chassis dynamometer tailpipe emission standard. The proposed changes indicating that nonconformance's regarding monitors listed under subsection (b)(6)(B)(i)a. through e. would be determined in accordance with subsection (c)(4) are needed to clarify that these monitors are not subject to automatic mandatory recall in accordance with subsection (c)(3), which the original language mistakenly implied.

Subsection (c)(3)(A)(ii) The purpose of this subsection is to describe the mandatory recall criteria for OBD II emission testing. The proposed changes to the examples in the parentheticals mentioning the monitors for misfire causing catalyst damage and the evaporative system are needed to account for other major monitors that do not require detection of faults before a specific emission threshold is exceeded. The new proposed subsection (c)(3)(A)(ii)b., which specifies higher interim recall criteria for LEV III ULEV70 and ULEV50 applications, is needed to allow manufacturers some relaxations for the first few years these applications are certified to the proposed emission thresholds in section 1968.2. The new proposed subsections (c)(3)(A)(ii)c. and d. specifying the mandatory recall criteria for the gasoline air-fuel ratio cylinder imbalance monitors are needed to account for the proposed changes to the emission thresholds for these monitors in section 1968.2(e)(6.2.1)(C).

Subsection (c)(3)(A)(iii) The purpose of this subsection is to describe the mandatory recall criteria for misfire monitors. The proposed addition of the phrase "not covered under subsection (c)(3)(A)(ii) above" is to make clear that the criteria under subsection (c)(3)(A)(iii) apply to misfire monitors that are not emission threshold monitors, which would be covered under subsection (c)(3)(A)(ii). The new proposed subsection (c)(3)(A)(iii)b. is needed to account for the proposed changes to the gasoline misfire monitoring requirements in section 1968.2(e)(3.2.3) for plug-in hybrid electric vehicles. The proposed changes to subsection (c)(3)(A)(iii)c. are needed to account for the proposed changes applicable to passenger cars, light-duty trucks, and MDPVs certified to a chassis dynamometer tailpipe emission standard made to the diesel misfire monitor requirements in section 1968.2(f)(3).

Subsection (c)(3)(A)(vi) The purpose of this subsection is to describe the mandatory recall criteria for the PM filter monitor. The proposed changes to this subsection are needed to account for passenger cars, light-duty trucks, and MDPVs certified to a chassis dynamometer tailpipe emission standard.

Subsection (c)(3)(B) The purpose of this subsection is to describe the conditions in which vehicles would not be subject to mandatory recall. The proposed changes to this subsection are needed for clarity.

Proposed amendments to title 13, CCR section 1900:

Subsection (b)(6) It is necessary to modify this subsection to incorporate the currently applicable version of the incorporated document.

VIII. PUBLIC PROCESS FOR DEVELOPMENT OF PROPOSED ACTION (PRE-

REGULATORY INFORMATION)

ARB had originally begun the OBD II regulatory update process in the beginning of 2010, and had several meetings with vehicle manufacturers to discuss the development of proposed amendments for the OBD II regulations. However, it was decided in 2011 that the OBD II rulemaking update was to be delayed and that the ARB staff concentrate on developing amendments for the HD OBD regulations. ARB staff revisited the OBD II rulemaking update in the beginning of 2014, and since then have continued to make considerable effort to inform, involve, and update stakeholders (mainly vehicle and engine manufacturers) of its progress in development of the proposed amendments to the OBD II regulations.

ARB held a public workshop in El Monte on October 30, 2014 to discuss the proposal and to seek comments. Interested stakeholders participated in the workshop in person or via webinar. The workshop notice and workshop presentation were posted on the OBD Program website (http://www.arb.ca.gov/msprog/obdprog/obdprog.htm) prior to the workshop. The workshop announcement was distributed to the OBD listserv subscribers, which as of May 2015 numbered approximately 3500 subscribers. Additionally, draft regulatory language was sent to members of the Alliance of Automobile Manufacturers and the Global Automakers, which represent the main stakeholders affected by the proposed rulemaking. ARB staff also presented and sought comments regarding elements of the upcoming proposed amendments to the OBD II regulation during the SAE OBD symposiums held in September 2013 (Indianapolis, Indiana, USA), September 2014 (Anaheim, California, USA), and March 2015 (Stuttgart, Germany), which were attended by vehicle and engine manufacturers, scan tool manufacturers, and individuals involved in various other aspects of the automotive industry.

Additionally, throughout the rulemaking process, ARB staff held around 15 meetings, including 2 in-person meetings, with the Alliance and Global Automakers as well as numerous meetings and correspondences (comprising of teleconferences, in-person meetings, and e-mail correspondences) with individual manufacturers. The proposal was developed in close collaboration with these stakeholders. As a result of the comments received throughout the regulatory process, staff made significant changes to the proposed amendments to the OBD II regulations, which are reflected in the final proposal.

IX. REFERENCES, TECHNICAL, THEORETICAL, AND/OR EMPIRICAL STUDY, REPORTS, OR DOCUMENTS RELIED UPON

DOCUMENTS INCORPORATED BY REFERENCE

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

1. “Emissions-Related Parts List,” June 1, 1990

2. California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission

Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light Duty Trucks, and Medium Duty Vehicles," as amended December 6, 2012

3. "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," as amended May 30, 2014

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

5. ISO 15765-4:"Road Vehicles – Diagnostics Communications over Controller Area Network (DoCAN) – Part 4: Requirements for emission-related systems – Amendment 1," February 2013

6. ISO 26262-5: "Road Vehicles – Functional Safety – Part 5: Product Development at the Hardware Level," November 2011

7. SAE J1699-3 – "Vehicle OBD II Compliance Test Cases," May 2012

8. SAE 1850 "Class B Data Communications Network Interface," June 2006

9. SAE J1930-DA "Electrical/Electronic Systems Diagnostic Terms, Definitions, Abbreviations, and Acronyms Web Tool Spreadsheet," March 2014

10. SAE J1962 "Diagnostic Connector – Equivalent to ISO/DIS 15031-3:December 14, 2001," July 2012

11. SAE J1979 "E/E Diagnostic Test Modes," August 2014

12. SAE J1979-DA "Digital Annex of E/E Diagnostic Test Modes," June 2014

13. SAE J2012 "Diagnostic Trouble Code Definitions – Equivalent to ISO/DIS 15031-6," March 2013

14. SAE J2012-DA "Digital Annex of Diagnostic Trouble Code Definitions and Failure Type Byte Definitions," January 2013

15. SAE J1939 "Recommended Practice for a Serial Control and Communications Vehicle Network," August 2013

16. SAE J1939-01 "On-Highway Equipment Control and Communications Network," November 2012

17. SAE J1939-11 “Physical Layer, 250K bits/s, Twisted Shielded Pair,” September 2012

18. SAE J1939-13 “Off-Board Diagnostic Connector,” October 2011

19. SAE J1939-15 “Reduced Physical Layer, 250K bits/sec, UN-Shielded Twisted Pair (UTP),” May 2014

20. SAE J1939-21 “Data Link Layer,” December 2010

21. SAE J1939-31 “Network Layer,” April 2014

22. SAE J1939-71 “Vehicle Application Layer,” April 2014

23. SAE J1939-73 “Application Layer – Diagnostics,” July 2013

24. SAE J1939-81 “Network Management,” June 2011

25. SAE J1939-84 “OBD Communications Compliance Test Cases For Heavy Duty Components and Vehicles,” February 2015

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Staff Report: “Initial Statement of Reasons for Proposed Rulemaking, Public Hearing to Consider the “LEV III” Amendments to the California Greenhouse Gas and Criteria Pollutant Exhaust and Evaporative Emission Standards and Test Procedures and to the On-Board Diagnostic System Requirements for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles, and to the Evaporative Emission Requirements for Heavy-Duty Vehicles,” December 7, 2011.

Annual Energy Outlook 2015 Table: Light-Duty Vehicle Sales by Technology Type. http://www.eia.gov/beta/aeo/#/?id=48-AEO2015&region=1-0&cases=ref2015&start=2012&end=2040&f=A&linechart=48-AEO2015.4 (accessed April 24, 2015).

U.S. Market Light Vehicle Deliveries – March 2015 Final Results. http://www.motorintelligence.com/fileopen.asp?File=SR_Sales112.xls (accessed April 24, 2015).

Annual Financial Profile of America’s Franchised New-Car Dealerships. http://www.nadafrontpage.com/upload/wysiwyg/NADAData2014.pdf (accessed May 4, 2015).

Annual Financial Profile of America’s Franchised New-Car Dealerships 2014. https://www.nada.org/nadadata/ (accessed May 15, 2015).

CPI Inflation Calculator. http://data.bls.gov/cgi-bin/cpicalc.pl (accessed June 5, 2015).

Service Repair Facility Average Hourly Labor Rates. https://www.mechaniconduty.com/MapGraphic_email.pdf (accessed May 18, 2015).

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Emission Factors, EMFAC 2011.

Press Releases: New-Car Transaction Reaches New Record, Up Nearly 3 Percent in December 2014, According To Kelly Blue Book. http://mediaroom.kbb.com/2015-01-05-New-Car-Transaction-Prices-Reach-New-Record-Up-Nearly-3-Percent-In-December-2014-According-To-Kelley-Blue-Book (accessed May 19, 2015)

National Research Council: "Cost Effectiveness and Deployment of Fuel Economy Technologies for Light-Duty Vehicles," Chapter 10, pages 17-19, 37. 2015 Pre-publication copy. http://www.nap.edu/catalog/21744/cost-effectiveness-and-deployment-of-fuel-economy-technologies-for-light-duty-vehicles .