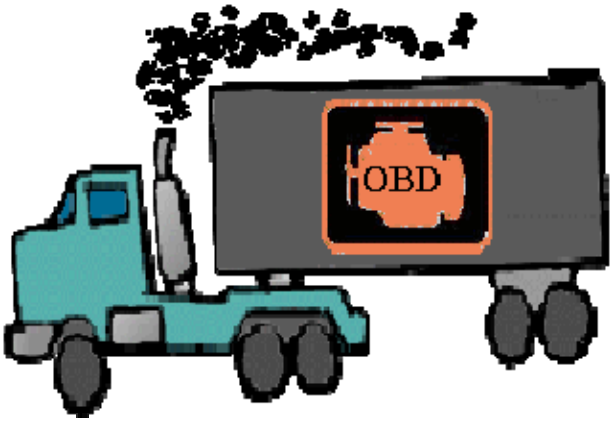
State of California
AIR RESOURCES BOARD

STAFF REPORT: INITIAL STATEMENT OF REASONS FOR PROPOSED RULEMAKING

Technical Status and Revisions to Malfunction and Diagnostic System Requirements for Heavy-Duty Engines (HD OBD) and Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines (OBD II)

Date of Release: July 5, 2012
Scheduled for Consideration: August 23, 2012



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I. SUMMARY OF STAFF PROPOSAL AND RELATED POLICY ISSUES

Background

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

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

Since amendments were last adopted for the heavy-duty OBD regulations in 2009, ARB staff has met with manufacturers to review progress in meeting the regulatory requirements and identify the need for revisions. Staff believes that modifications to the regulations are warranted and is proposing amendments to the HD OBD regulation

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

Summary of Proposed Amendments

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

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

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

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

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

Concurrently, the staff is proposing to update the medium-duty vehicle diesel-related requirements in the medium-duty OBD II regulation (section 1968.2) to be consistent

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

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

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

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

Heavy-Duty and Medium-Duty Diesel Monitors

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

Heavy-Duty SAE J1939 Protocol

Part of the HD OBD requirements includes standardization of data to be output from the engine and vehicle to off-board tools used by technicians and inspectors. The regulation currently allows engines to use SAE J1939 as the standard for the communication protocol and the diagnostic connector specifications. When the requirement was first adopted, SAE J1939 only had a single (250 kilobits per second (kbps)) baud rate and a single connector, so there was no need to identify a specific baud rate or connector version in the regulation. However, since then, SAE J1939 has added an additional baud rate (500 kbps) and a second connector variant to handle the new baud rate. Thus, to ensure that all manufacturers were using the same baud rate and connector, staff originally proposed to clarify that only the original baud rate and connector versions (i.e., the 250 kbps baud rate version) were allowed for standardized OBD communication. However, manufacturers have indicated that most of industry was already moving towards using the 500 kbps baud rate version to handle an increased number of messages and data and requested that they be allowed to use either the 250

kbps or the 500 kbps version indefinitely. While staff agrees that some changes are needed to account for the industry trend towards the 500 kbps version, staff does not believe both baud rate versions should be allowed as options indefinitely given the potential problems of allowing multiple communication variants in the field. Thus, staff is proposing to amend the HD OBD regulation to use either variant and their associated connector up through the 2015 model year and would allow only the 500 kbps variant for all 2016 and subsequent model year heavy-duty engines.

Heavy-Duty Hybrid Vehicles

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

Heavy-Duty Alternate-Fueled Engines

The regulation currently requires manufacturers to implement "full" HD OBD systems on alternate-fueled engines starting in the 2020 model year. When first adopting this requirement, ARB staff had anticipated alternate-fueled engines to constitute a very low

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

Emission and Cost Impacts

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

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

Recommendation

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

II. TECHNICAL STATUS UPDATE AND PROPOSED AMENDMENTS

A. HEAVY-DUTY HYBRID VEHICLES

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

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

Fundamentally, an integrated approach needs to be used for engine and hybrid system manufacturers to have a reasonable chance at meeting all of ARB's requirements, including the OBD requirements and tailpipe standards. Modern engine and emission control systems are extremely complex and must balance many competing factors such as durability, performance, emissions, and fuel economy. Engine manufacturers expend significant resources to find a solution that simultaneously meets all of these requirements, so it should come as no surprise that major alterations to the system such

as attaching a hybrid system that can turn the engine on and off and change the speeds and loads the engine is routinely operated at can substantially compromise the ability of the engine to continue to meet all of the requirements. Further, an integrated approach has the advantage of likely being able to maximize hybrid operation and efficiency, thereby making the system more economically viable for the long term. As such, staff is proposing an extra year of relaxation (the 2013 model year) before hybrid systems are required to be properly integrated and compliant with the OBD regulation.

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

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

system manufacturers cannot by themselves be expected to know how every engine diagnostic works and make sure they design their system accordingly.

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

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

requirements. Any integrated approach would, by definition, resolve such issues regardless of whether the solution used standardized or proprietary control messages.

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

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

Hybrid manufacturers have indicated that the proposed changes provided above are not enough, indicating that their lack of experience with designing OBD systems makes it difficult to meet the required HD OBD implementation dates. They further indicated that hybrid vehicles comprise less than 1 percent of the heavy-duty market, and that the requirements would impose a huge burden on the hybrid manufacturers. Thus, they proposed delaying HD OBD compliance for heavy-duty hybrid vehicles beyond the 2013

model year. Staff, however, disagrees that more lead time is the appropriate solution. The requirements for hybrids to comply have been clearly identified in the regulation since 2009 and little progress has been made since then, so providing even more lead time is not likely to change the situation. In contrast, requiring manufacturers to begin compliance in the short-term to remain eligible for funding through ARB's hybrid and zero-emission truck and bus voucher incentive project (HVIP) will likely provide sufficient motivation to manufacturers to make real progress. Avoiding further delays in compliance will also better ensure that near-term hybrid vehicles (that are largely subsidized by ARB through the HVIP) actually achieve and maintain benefits over the life of the vehicles.

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

B. ALTERNATE-FUELED ENGINES

The heavy-duty OBD regulation currently allows alternate-fueled engines to delay implementation of "full" OBD systems until the 2020 model year, with 2013 through 2019 model year alternate-fueled engines required to comply with the less comprehensive EMD requirements and basic monitoring of all NOx aftertreatment components. This late start date of 2020 was adopted in 2006 as part of the initial HD OBD regulation with the expectation that alternate-fueled heavy-duty engines would make up a small portion of the market share and, based on light-duty experience with alternate fuel conversions of gasoline vehicles, that the engines would primarily be OBD-compliant gasoline or diesel engines that are converted to an alternate-fueled engine and continue to have functional full OBD systems. Recent information, however, has indicated that some of these assumptions by staff were incorrect. Several manufacturers have indicated that alternate-fueled engine sales are not insignificant, with at least one engine manufacturer announcing plans to offer significantly more alternate-fueled engines in the near future. Recent discussions with other regulating

agencies indicate they are considering near or mid-term measures to greatly increase the market share of alternate-fueled engines. Additionally, in discussions with manufacturers currently offering alternate-fueled engines, staff has found more diverse solutions than previously expected. These include alternate fuel conversions that remain compression-ignited and retain the diesel emission control solution, conversions that change from compression-ignition to spark-ignition and change over to more gasoline-like emission control solutions, conversions to non-stoichiometric spark-ignition that retain diesel-like emission control solutions, etc. Such conversions can have a much larger impact on the OBD system than simpler conversions staff were familiar with, resulting in several unmonitored major emission control components in addition to the normal impacts of altering correlation to emission thresholds and monitoring frequency. Therefore, staff is proposing to move up the required start date for full OBD monitoring from the 2020 model year to the 2018 model year.

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

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

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

C. DEFINITIONS

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

For purposes of consistency and clarity, ARB staff is also adding the terms “exhaust

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

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

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

The HD OBD regulation currently allows manufacturers to erase a confirmed fault code or a previously MIL-on fault code if the identified malfunction has not been again detected in at least 40 engine warm-up cycles and the MIL is presently not illuminated for that malfunction. The regulation currently defines "warm-up cycle" as "sufficient

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

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

D. MIL ILLUMINATION AND FAULT CODE STORAGE PROTOCOL

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

Staff is also proposing minor amendments to the erasure protocol for confirmed or previously MIL-on fault codes in the HD OBD regulation. The regulation currently states that the OBD system "may" erase the fault code if the fault isn't again detected "in at

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

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

E. STANDARDIZED METHOD TO MEASURE REAL WORLD MONITORING PERFORMANCE

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

addition to the general denominator, manufacturers are required to track specific denominators for several major monitors. These denominators are tailored to the specific components being monitored and provide a more accurate and appropriate indication of the monitoring opportunities for each of those components relative to how often those components are used.

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

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

Additionally, staff is proposing amendments to the denominator incrementing criteria for the PM filter filtering performance and missing substrate monitors in both the HD OBD and OBD II regulations. The HD OBD regulation currently requires these PM filter monitors to increment the denominator when, in addition to the general denominator criteria, the cumulative engine run time exceeds 800 minutes, while the OBD II regulation currently requires the denominator to increment when, in addition to the general denominator criteria, the cumulative miles of vehicle operation exceeds 500 miles. Further, the HD OBD regulation requires these monitors to meet a minimum acceptable in-use performance ratio of 0.100, while the OBD II regulation requires these

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

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

Staff is also proposing changes to the ignition cycle counter requirements for heavy-duty hybrid vehicles. Currently, manufacturers are required to track and report an ignition cycle counter, which is required to be incremented every time the vehicle is

started (i.e., “engine start” is met). This is basically a counter of the number of driving cycles experienced by the vehicle. Staff is proposing to modify the incrementing criteria for hybrid vehicles under the HD OBD regulation to clarify that manufacturers increment the ignition cycle counter when the “propulsion system active” definition is met (e.g., each time the vehicle is operated, without respect to whether the engine is started or used).

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

F. DIESEL MISFIRE MONITORING

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

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

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

Staff agrees that there are significant difficulties in creating a repeatable misfire on diesel engines that is representative of the worst case emissions and thus is proposing the manufacturers' suggested solution of using a fixed percentage of 5 percent as the malfunction criterion for both heavy-duty engines and medium-duty vehicles. Concerning the continuous monitoring requirement, while staff agrees that some relaxation is necessary, there are still concerns and questions about the likelihood and possible effects of misfire during higher speed and load regions. Thus, for the interim model years of 2016 through 2018, staff modified the proposal to be consistent with the manufacturers' proposal to limit monitoring to positive torque conditions with engine speed up to 75 percent of the maximum-rated engine speed and engine load up to 75 percent maximum-rated load. Additionally, at the manufacturers' suggestion, a small region of high engine speed and very low load was defined and is proposed as an area where monitoring would not be required. However, because staff is concerned that higher speed and load regions may very well be susceptible to misfire, the proposal also requires manufacturers to phase in monitoring all the way up to the maximum engine speed and load for the 2019 through 2021 model years. Further, manufacturers would be required to collect and report data demonstrating the compliance of the misfire monitor as part of the certification application, similar to what is currently required for gasoline vehicles and engines. Specifically, the manufacturers would be required to

provide data demonstrating the probability of detection of misfire events of the misfire monitoring system over the required engine speed and load operating range and data identifying all disablement of misfire monitoring that occurs during a specified test cycle. These data would provide assurance that the misfire monitor is robust and enabled under the required conditions. In addition to the new proposed misfire monitor requirements, manufacturers would still be subject to the idle-only misfire monitor requirements. Staff expects that manufacturers will be able to meet both requirements with the revised monitor developed to cover the expanded speed and load ranges. However, in case unforeseen difficulties arise that prevent detection of the 5 percent misfire at idle, the manufacturers would have to retain the current idle monitor. This would help protect the credibility of the monitoring system capability in the eyes of repair technicians by avoiding the situation where a technician can identify that an engine has an obvious and severe misfire at idle but the OBD system is incapable of detecting it. Staff is proposing all these changes to both the HD OBD and medium-duty OBD II requirements.

G. DIESEL EXHAUST GAS RECIRCULATION (EGR) SYSTEM MONITORING

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

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

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

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

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

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

emissions, which would make it more difficult to meet the NOx-based monitoring requirements.

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

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

Further, manufacturers have indicated that ability of the catalyst to generate a desired feedgas (e.g., high levels of NO_2) is a secondary function that often has very minor

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

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

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

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

Staff has met with virtually every manufacturer and several suppliers to assess current capability and what improvements are available in the near term. While several medium-duty manufacturers are on track to meet the existing 2013 standards, most heavy-duty manufacturers are not. Given the importance of achieving and preserving the NOx benefits of the 0.2 g/bhp-hr tailpipe standard, staff is committed to continuing to drive to the limits of technical feasibility to achieve the lowest threshold possible. Further, given industry trends towards increasing engine-out NOx emissions even higher for engine efficiency improvements or greenhouse gas reductions, staff is concerned that some may try to push too far in that direction such that tailpipe or OBD

capability is sacrificed. Thus, staff is cautious about providing even interim relaxation that could be misinterpreted as showing that some ARB requirements are more important than others instead of keeping manufacturers on track to find a reasonable middle ground that meets all of our requirements, including OBD, tailpipe standards, and greenhouse gas standards (where applicable). In discussions with the manufacturers, it seems there are many elements of base SCR control and dynamics that are not well refined or understood. The problem appears to be exacerbated on larger catalysts that are more common on the biggest engine displacements, and many point to unknowns related to ammonia storage and release that produce both inconsistent in-use conversion efficiency and, consequently, quite varied catalyst monitoring results. Last-minute changes to the underlying base emission control strategy has also placed the OBD engineers within manufacturers at a disadvantage by forcing them to either develop and calibrate on less-than-finalized software or wait until very late in the process to begin the calibration process. Those manufacturers with more stable emission control solutions that were finalized early in the process tend to be further ahead in OBD capability as well.

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

Taking that all into consideration, staff is proposing a couple changes to the current HD OBD and OBD II requirement of a '+ 0.2' threshold across the board in the 2013 model

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

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

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

extrapolation techniques and calibrations carefully to ensure that manufacturers are calibrating to an equivalent stringency for any ratings they are including in the phase-in percentages.

J. DIESEL PARTICULATE MATTER (PM) FILTER MONITORING

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

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

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

suppliers, staff has confirmed that wide-scale implementation of PM sensors in heavy-duty engines is not feasible for the 2013 model year.

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

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

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

implement earlier (2014 model year) on a smaller portion of their fleet or implement later (2015 model year) but on a larger fraction of their fleet.

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

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

Staff believes that such secondary functions are not trivial and warrant monitoring to ensure overall effectiveness of the emission control system. Staff recognizes that the success of the monitoring approaches may be highly dependent on the actual catalyst configuration, significance of the catalyst loading on the PM filter, and regeneration strategy (especially reliance on high levels of passive regeneration) and thus require manufacturers to take OBD monitoring capability into consideration when designing and

implementing the aftertreatment system and control strategy. It further recognizes that manufacturer OBD engineers have often been left out of the design process due to the rapid deployment of new technologies and increasingly stringent standards. Thus, consistent with the Board's approval of amendments to the OBD II regulation in January 2012, staff is proposing to delay the monitoring requirements of the catalyst function of catalyzed PM filters until the 2015 model year for heavy-duty engines to give manufacturers more time to refine their systems, optimize regeneration strategies, and better investigate the impacts of the catalyzed PM filter.

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

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

K. DIESEL NOx SENSOR MONITORING

The HD OBD and medium-duty OBD II regulations currently require manufacturers to detect faults of the NOx sensor before emissions exceed the following thresholds: for

the 2010 through 2012 model years, the applicable NOx standard plus 0.4 g/bhp-hr, and for the 2013 and subsequent model years, the applicable NOx standard plus 0.2 g/bhp-hr. Manufacturers have argued that they are unable to meet the 2013 model year thresholds given the current NOx sensor technology – specifically, considering the tolerances of the latest NOx sensors, they claimed there is too little separation between good sensors and bad sensors to ensure robust detection. Thus, they proposed that staff delay the 2013 model year thresholds until a later model year.

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

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

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

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

L. GASOLINE MISFIRE MONITORING

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

M. GASOLINE SECONDARY AIR SYSTEM MONITORING

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

exceed the threshold, the manufacturer would be required to detect a fault when the system has reached its control limits such that it cannot reduce air flow during normal operation of the secondary air system.

N. ENGINE COOLING SYSTEM MONITORING

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

O. COMPREHENSIVE COMPONENT MONITORING

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

system faults of the fuel quantity in relation to achieving the target idle speed for "known", not "given," operating conditions.

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

Additionally, as discussed early in sections II.H. and II.J., manufacturers have requested that this monitor be subject to test-out criteria allowing manufacturers to be exempted from monitoring if the impact is less than 15 percent of the standard. While many manufacturers seem to be making great strides in adaptive strategies that nearly fully compensate for mismatches, achieving complete compensation may prove to be very difficult. Accordingly, staff is proposing to also apply test-out criteria to features that fall under this provision. Specifically, mismatches or faults that cause less than a 15 percent of the standard increase in emissions and are below the emission standard would be exempt from monitoring. However, because this function is often on multiple components (e.g., all injectors) and the severity of the fault can vary by how far off the mismatch is, staff is proposing that manufacturers be required to submit a test plan for Executive Officer approval of the test procedures and combination of failed parts and the degree to which they are a mismatch that will be used for the test-out. While staff would normally take the position of the worst-case scenario (e.g.., all injectors with a mismatch and with the largest mismatch possible), such a scenario is statistically

virtually impossible and not very representative of the type of mismatches that happen in the real world. Accordingly, staff is proposing to give some additional latitude to manufacturers to propose a more realistic scenario based on the distribution of parts and likely in-use scenarios. Staff's intent is for the manufacturers to identify a reasonable bound within which most replacement parts would fall (e.g., perhaps within one sigma from the median part) and propose a test condition that would represent a reasonable worst case emissions scenario within those bounds. These proposed changes would apply to both the HD OBD and OBD II regulations.

P. STANDARDIZATION REQUIREMENTS

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

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

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

Readiness Status:

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

Staff is also proposing additional amendments to correct confusion related to implementing the readiness requirements, including specific language on how to deal with monitors that detect faults of more than one major emission-related component (e.g., an oxygen sensor monitor that is used to detect both oxygen sensor faults that are tied to the oxygen sensor readiness bit and air-fuel ratio cylinder imbalance faults that are tied to the fuel system readiness bit). Lastly, staff is proposing to delete the current requirement that allows manufacturers to request Executive Officer approval to set the readiness status to "complete" without monitoring actually having been completed if monitoring is disabled on multiple driving cycles due to extreme operating conditions

(e.g., cold ambient temperatures, high altitudes). This requirement was originally carried over from the OBD II requirements, where staff allowed a showing of complete status to avoid light- and medium-duty vehicles from failing inspection and maintenance tests due to unset readiness bits solely because the vehicle was being operated in extreme conditions (e.g., high altitude, very cold temperatures, etc.) in which monitoring was routinely disabled. However, given that heavy-duty vehicles do not undergo periodic inspections, staff believes this condition is not needed.

Data Stream Parameters:

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

Lastly, staff is proposing to identify the specific SPNs that manufacturers must use for the required data stream parameters "normalized trigger for PM filter regeneration" and "PM filter regeneration status". In these specific cases, SAE J1939 contains more than one SPN that is related or very similar to these parameters, which may result in an engine utilizing a different SPN than another engine for the same parameter or

confusion among manufacturers as to which variant of the parameter they should be supporting. So while manufacturers are required to report both these data parameters starting with the 2013 model year and different manufacturers will likely meet this requirement by supporting different SPNs, staff is proposing to clarify which exact SPN manufacturers should be using to meet these requirements starting in the 2016 model year to ensure consistent implementation across all manufacturers.

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

Calibration Verification Number (CVN):
Staff is proposing amendments to the CVN requirements. The HD OBD regulation currently requires the CVN to be stored at all times, calculated, and re-stored at least once per ignition cycle, and to be made immediately available at all times through the data link connector to a generic scan tool in accordance with the requirements in SAE J1979 or J1939. The only exceptions allowed in the regulation are for extreme circumstances where the stored value has been erased and not had an opportunity to

be calculated and re-stored yet. Specifically, relief is granted from having the CVN immediately available to a scan tool if it is requested within 60 seconds of the ECU being reprogrammed or having non-volatile memory cleared, or within 30 seconds of a volatile memory clear or battery disconnect. A few manufacturers have indicated that the timeframes of 60 and 30 seconds might be insufficient to recalculate a new CVN and have it available. To address this, staff is proposing to modify the HD OBD regulation to clarify these timeframes and the associated events that are allowed and to clarify that, at all other times, immediately available means the value is returned to the requesting scan tool within the normal message response timing and does not allow for any extended message response timings or negative response codes. Additionally, given the very limited and rare scenarios in which the 60 and 30 second timeframes apply, staff is proposing to extend the timeframe to 120 seconds for both situations.

Q. CERTIFICATION DEMONSTRATION TESTING REQUIREMENTS

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

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

Staff is also proposing amendments to the HD OBD testing requirements for gasoline oxygen sensor emission threshold-based monitors to limit the number of tests required to be performed. Specifically, for conventional oxygen sensors, the manufacturer would be required to perform a test for two malfunction cases: (1) the single worst case

response rate malfunction among all symmetric and asymmetric patterns, and (2) the worst case asymmetric response rate malfunction that results in delays during transitions from rich-to-lean or lean-to-rich sensor output. For wide range or universal sensors, the manufacturer also would be required to perform a test for two malfunction cases: (1) the single worst case response rate malfunction among all symmetric and asymmetric patterns, and (2) the symmetric response rate malfunction that results in delays during transitions from rich-to-lean and lean-to-rich sensor output. For the worst case malfunctions, staff would require manufacturers to submit data and/or analysis demonstrating that the malfunction will result in the worst case emissions compared to all the other response rate malfunctions.

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

R. DEFICIENCIES

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

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

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

deficiencies, to six months after commencement of the start of engine production or vehicle production, whichever is later.

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

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

or to come into compliance as expeditiously as possible---both would still be required to qualify both initially and in each subsequent year for a deficiency to be granted.

S. OTHER PROPOSED AMENDMENTS

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

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

Concerning the OBD II regulation, staff is proposing amendments for medium-duty diesel vehicles certified to a chassis dynamometer tailpipe emission standard. The OBD II regulation currently requires manufacturers of these vehicles to request approval of the emission-based malfunction criteria in lieu of the engine dynamometer-based malfunction criteria (e.g., 2.0 times the applicable standards) required for each applicable diesel monitor in section 1968.2(f). At the time of the last amendments in 2006, the vast majority of medium-duty diesels were certified using the engine dynamometer standards and chassis dynamometer-based certifications were extremely

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

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

T. HD OBD AND OBD II ENFORCMENT REGULATIONS

The HD OBD and OBD II enforcement provisions (sections 1971.5 and 1968.5, respectively) help ensure the effectiveness of the HD OBD and OBD II regulations and to address OBD noncompliances in the field. The enforcement regulations detail procedures for evaluating and remediating (where necessary) OBD-specific in-use issues. Specifically, the regulations contain detailed protocols that provide clear direction as to the procurement, testing, sampling, and evaluation criteria that ARB staff uses to determine compliance with the OBD requirements. They include performance testing of emission threshold-related monitors, downloading of data of in-use monitoring

performance ratios, and evaluation of other OBD requirements (e.g., diagnostic connector location, communication protocol standards, MIL illumination protocol, etc.). The results of the tests would be compared to the minimum performance levels prescribed in the enforcement regulations, which would determine if the engines/vehicles in question may be subject to remedial action or fines including mandatory recall for the most egregious nonconforming OBD systems.

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

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

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

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

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

Staff is also proposing additional changes to the mandatory recall criteria for PM filter filtering performance monitoring in the OBD II enforcement regulation. The OBD II enforcement regulation currently mandates a mandatory recall if a malfunction is not detected before emissions exceed two times the malfunction criteria. The OBD II regulation currently requires manufacturers to detect a PM filter fault before emissions exceed 0.03 g/bhp-hr for all 2013 and subsequent model year vehicles. Some

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

III. ENVIRONMENTAL IMPACT ANALYSIS

A. INTRODUCTION

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

B. ENVIRONMENTAL REVIEW PROCESS

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

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

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

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

C. ENVIRONMENTAL IMPACTS

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

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

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

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

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

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

IV. ENVIRONMENTAL JUSTICE

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

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

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

V. ECONOMIC IMPACT

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

The proposed amendments to the HD OBD and OBD II regulations are not anticipated to have a significant impact on businesses or individuals related to the diesel and gasoline engine manufacturing industry. The proposed amendments primarily affect computer software, and additional lead time would be provided to manufacturers to allow them to implement such changes at the time they normally schedule system updates. The new reporting requirements will result in some additional costs to manufacturers, and the proposed amendments to require manufacturers to implement full OBD on alternate-fueled engines two years earlier than previously required will impose staffing and equipment costs two years earlier than previously anticipated, but will concomitantly provide emission benefits earlier than anticipated. These additional

and earlier imposed costs will be passed on nationwide to consumers of heavy-duty vehicles since manufacturers normally certify one version of an engine for the entire nation. Additionally, staff believes that the proposed requirements would cause no noticeable adverse impact in California employment, business status, and competitiveness since all companies that manufacturer medium- and heavy-duty engines are required to meet the same requirements whether they are located in California or elsewhere.

A. LEGAL REQUIREMENTS

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

B. COST AND COST EFFECTIVENESS

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

First, staff estimated the costs to manufacturers of heavy-duty diesel engines. These engines make up over 90 percent of all new heavy-duty engines and are manufactured only by large manufacturers. The amendments mainly provide short-term interim relaxed compliance for these manufacturers, with no associated compliance costs. However, there are additional costs associated with the reporting requirements that ensure compliance with the amendments for more comprehensive diesel misfire monitoring that begins with the 2016 model year. This will result in costs of up to $30,000 per manufacturer (for a large manufacturer) annually when the reporting requirements are fully phased in. These costs are expected to be passed on to consumers (new heavy-duty engine/vehicle purchasers) at an incremental retail cost of less than $0.56 per vehicle. For reference, this represents a less than 0.01 percent

increase in the retail price of a typical heavy-duty engine. To perform the analysis, staff took the national sales numbers for the top nine engine manufacturers and determined a composite average value of 72,440 engines. This number was rounded to 72,000 in the analysis. Staff then estimated the incremental costs for an engine manufacturer with sales of 72,000 engines. Staff further assumed the engine manufacturer would have three engine families that would require separate misfire monitoring data to be generated and calculated the total costs for such a manufacturer.

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

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

that have recently ranged from about $7,500 up to $32,000. Future incentives are currently being proposed and may be different from these amounts.

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

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

C. AFFECTED BUSINESSES AND POTENTIAL IMPACTS

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

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

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

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

D. POTENTIAL IMPACTS ON VEHICLE OPERATORS

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

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

E. POTENTIAL IMPACTS ON BUSINESS COMPETITIVENESS

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

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

F. POTENTIAL IMPACTS ON EMPLOYMENT

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

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

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

VI. ANALYSIS OF ALTERNATIVES

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

VII. SUMMARY AND RATIONALE FOR PROPOSED AMENDMENTS

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

<u>Proposed amendments to Cal. Code Regs., title 13, section 1971.1:</u>

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Subsection (c) “Permanent fault code” The proposed deletion of the phrase “currently commanding the MIL on” is needed to avoid confusion, since a permanent

fault code may not be commanding the MIL on in cases where the fault information in the on-board computer has been cleared by a scan tool or a battery disconnect.

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

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

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

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

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

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

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

Subsection (d)(2.3.1)(A) The purpose of this subsection is to indicate the protocol for extinguishing the MIL for engines using ISO 15765-4. The proposed

changes are needed to include reference to diesel monitors that have their own protocol for extinguishing the MIL in lieu of the requirements in this subsection, since the current language only referenced gasoline monitors. The proposed changes are also needed to clarify that the MIL is not allowed to be extinguished after less than three sequential driving cycles, since the original language may be misinterpreted.

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

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

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

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

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

Subsection (d)(4.3.2)(C) The purpose of this subsection is to describe the specifications for incrementing the denominator for evaporative system monitors. The proposed change is needed to allow other monitors (i.e., engine cooling system input

component monitors, comprehensive component input component temperature sensor rationality monitors) that also require a cold start to enable monitoring to use the same denominator. Further, the proposed change to add “engine” to “start” in subsection (d)(4.3.2)(C)(i) is necessary to be consistent with the terminology used in the definitions in section (c), which states “engine start”.

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

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

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

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

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

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

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

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

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

Subsection (d)(7.5) The purpose of this subsection is to indicate the HD OBD implementation schedule for alternate-fueled engines. The proposed change of the

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

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

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

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

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

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

needed to provide relaxation to manufacturers should their system be abnormally robust to an emission increase due to misfire.

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

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

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

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

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

Subsections (e)(5.2.2)(B), (e)(6.2.1)(A)(i), (e)(6.2.1)(D)(i), (e)(6.2.2)(A)(i) and (iv), (e)(7.2.1)(A) and(B), (e)(8.2.1)(A) and (B), (e)(8.2.1)(D), (e)(8.2.2)(B), (e)(9.2.1)(B)(i),

(e)(9.2.2)(A)(i) and (iv), (g)(3.4.3), and (j)(1.1) The proposed change of “emission standard” to “exhaust emission standard” is needed since “exhaust emission standard” is the more appropriate term to use.

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

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

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

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

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

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

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

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

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

Subsection (e)(9.3.1) The purpose of this subsection is to indicate the conditions under which NOx sensor monitoring shall occur. The proposed addition of section (e)(9.2.2)(D), for sensor monitoring capability monitors, to subsection (e)(9.3.1)(A) is needed since this monitor has been determined to be important based on reviews of

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

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

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

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

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

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

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

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

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

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

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

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

Subsection (f)(7.2.5) The purpose of this subsection is to require manufacturers to monitor multiple purge flow paths on a vehicle. The proposed change of “vehicles” to “engines” is needed since the reference to “engines” is more appropriate. The proposed change of “both purge flow paths” to “all purge flow paths” is needed to

correct an error, since vehicles can have more than two purge flow paths and should monitor all these purge flow paths.

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

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

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

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

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

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

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

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

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

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

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

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

Subsection (h)(2) The purpose of this subsection is to specify the requirements for the diagnostic connector. The proposed changes are needed to account for the new 500 kbps baud rate variant of SAE J1939 and its associated connector being allowed for communication protocol. The proposed language in subsections (h)(2.6.1) and

(h)(2.6.2) prohibiting additional identical connectors from being located in the same area as the standardized OBD connector is needed to avoid confusion among technicians and inspectors attempting to identify the correct connector to retrieve OBD information from.

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

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

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

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

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

Subsection (h)(4.7) The purpose of this subsection is to describe the standardized requirements for CVN. The proposed deletion of language from

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Subsection (j)(2.18) Staff is proposing to move the original language in subsection (j)(2.18) to subsection (j)(2.21). The new proposed requirement in

subsection (j)(2.18) to include information related to the in-use performance data is needed to assist staff in reviewing the application.

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

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

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

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

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

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

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

certified. Finally, the proposed changes to subsection (l)(1.5.1), which would require manufacturers to submit the test results (i.e., the test log file), is needed since this is important data for staff in determining if the system is working correctly.

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

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

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

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

<u>Proposed amendments to Cal. Code Regs., title 13, section 1968.2:</u>

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

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

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

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

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

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

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

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

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

Subsection (e)(6.1.1) The purpose of this subsection is to indicate the general requirement for diesel fuel system monitoring. The proposed change of “emission

standard" to "applicable standard" is needed since "applicable standard" is the more appropriate term to use.

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

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

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

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

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

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

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

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

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

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

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

manufacturers from using an alternate phase-in schedule instead of the required phase-in schedule proposed in subsection (f)(9.2.1)(A)(iii).

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

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

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

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

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

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

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

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

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

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

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

<u>Proposed amendments to Cal. Code Regs., title 13, section 1971.5:</u>

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

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

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

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

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

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

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

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

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

Subsection (d)(3)(A)(vi) The purpose of this new proposed subsection is to describe additional mandatory recall criteria for the PM filter monitor. This subsection is needed to ensure that monitors unable to detect PM filter missing substrate faults that

do not fall under the mandatory recall criteria in subsection (d)(3)(A)(ii) would still be subject to mandatory recalls.

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

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

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

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

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

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

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

Subsection (c)(3)(A)(ii) The purpose of this subsection is to describe the mandatory recall criteria for OBD II emission testing. The proposed change to allow the PM filter filtering performance monitor (section 1968.2(f)(9.2.1)) to be exempt from

mandatory recall for 2013 model year medium-duty vehicles is needed to provide some relaxation to manufacturers and to ensure manufacturers are able to certify their OBD II system for the 2013 model year.

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

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

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

DOCUMENTS INCORPORATED BY REFERENCE

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

REFERENCES

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

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