State of California
AIR RESOURCES BOARD

STAFF REPORT:
INITIAL STATEMENT OF REASONS FOR PROPOSED RULEMAKING

Engine Manufacturer Diagnostic System Requirements for 2007 and Subsequent Model Year Heavy-Duty Engines (EMD)

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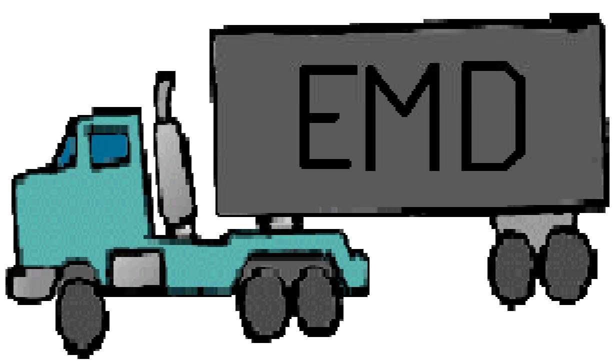

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I. EXECUTIVE SUMMARY

On-board diagnostics (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 would 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.

California OBD regulations require 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). However, there are currently no equivalent requirements for heavy-duty vehicles (i.e., vehicles with a gross vehicle weight rating greater than 14,000 pounds). Staff has begun development of OBD requirements that would be equally effective as the OBD II requirements, and plans to present them for Board consideration in 2005. In the meantime, staff has worked with industry to come up with an interim /first step. These proposed requirements, referred to as the engine manufacturer diagnostic system (EMD) regulation, build on the basic engine diagnostic system heavy-duty engine manufacturers are currently using to provide diagnostic capability for the most important emission control systems. Sufficient lead time exists to implement the EMD system by the 2007 model year when emission standards become more stringent and universal use of particulate filters is expected. Because the proposed interim diagnostics does not approach the capabilities and sophistication of the OBD systems used on current light-duty vehicles, it is referred to as EMD requirements, and the term OBD will be reserved for use in the comprehensive OBD proposal next year.

The Air Resources Board staff is proposing the adoption of section 1971, title 13, California Code of Regulations that would require all 2007 and subsequent model year heavy-duty Otto-cycle (gasoline) and diesel engines to be equipped with diagnostic systems. The proposed EMD regulation, which is included herewith as Attachment A, would require manufacturers to monitor the fuel system, exhaust gas recirculation system, particulate matter trap, and emission-related electronic components. The EMD system would help ensure that the engines are able to meet these standards and maintain low emissions for the life of the engine. It would accomplish this by monitoring the durability and performance of the emission control components and systems, and by providing technicians with information that would help in diagnosing and fixing malfunctions.

II. INTRODUCTION AND BACKGROUND INFORMATION

Introduction

On-board diagnostics (OBD) systems are comprised mainly of software designed into the vehicle's on-board computer to detect emission-control system malfunctions as they occur. This is done by monitoring virtually every component and system that can cause increases in emissions. With a couple of exceptions, no additional hardware is required to perform the monitoring; rather, the powertrain control computer is designed to better evaluate the electronic component signals that are already available, thereby minimizing any added hardware complexity. When an emission-related malfunction is detected, the OBD system alerts the vehicle operator by illuminating the malfunction indicator light (MIL) on the instrument panel. By alerting the operator of malfunctions as they occur, repairs can be sought promptly, which results in fewer emissions over the life of the vehicle. Additionally, the OBD system stores important information, including identifying the faulty component or system and the nature of the fault, which would allow for quick diagnosis and proper repair of the problem by technicians. This helps vehicle owners achieve less expensive repairs and promotes repairs being done correctly the first time.

Currently, California regulations require all 1996 and newer passenger cars, light-duty trucks, and medium-duty vehicles and engines to be equipped with OBD systems (referred to as OBD II systems). The Air Resources Board (ARB) first adopted the OBD II regulation (title 13, California Code of Regulations (CCR) section 1968.1) in 1989 and subsequently modified the regulation in regular updates in later years to address manufacturers' implementation concerns and strengthen specific monitoring requirements, among other reasons. In 2002, ARB amended the OBD II regulation by adopting title 13, CCR sections 1968.2 and 1968.5, which established OBD II requirements and an OBD II-specific in-use enforcement protocol, respectively, for 2004 and subsequent model year passenger cars, light-duty trucks, and medium-duty vehicles and engines.

The OBD II requirements serve an important role in achieving and maintaining low vehicle emissions. Manufacturers are required to improve their emission control system performance and durability in order to meet the very low and near-zero emission standards of the Low Emission Vehicle II program. Since the OBD II program is designed to ensure maximum emission control system performance for the entire life of the vehicles (regardless of mileage), it is able to monitor the low-emission performance of vehicles and ensure that they are performing as required throughout their useful lives and beyond. This is important, since most emission problems occur as vehicles age and accumulate high mileage. Input from manufacturers, service technicians, Inspection and Maintenance (I/M) programs, and in-use evaluation programs indicate that the OBD II program is very effective in finding emission problems and facilitating repairs. The United States Environmental Protection Agency (U.S. EPA), in fact, issued a final rule that indicates its confidence in the performance of OBD II systems by requiring states to perform OBD II checks for these newer vehicles and allowing them to be used in lieu of current tailpipe tests in I/M programs. Overall, ARB staff is pleased with the significant and effective efforts of the automotive industry in implementing the program requirements.

Why Require OBD Systems on Heavy-Duty Vehicles and Engines?

Heavy-duty vehicles are an important part of the country's transportation network. Due to their fuel efficiency, maintenance costs, and durability, diesel engines are employed on the vast majority of the heavy-duty trucks in lieu of gasoline engines. Unfortunately, the emissions emitted from these heavy-duty trucks, especially diesel trucks, are of great concern. Currently, diesel truck emissions account for about 28 percent and 16 percent of the total statewide mobile source oxides of nitrogen (NOx) and particulate matter (PM) emissions, respectively. NOx is a precursor to ozone and atmospheric PM as well as a lung irritant, while diesel PM is carcinogenic and has been identified as a toxic air contaminant by ARB. While emissions from heavy-duty diesels are of particular concern, emissions from heavy-duty gasoline vehicles are also of concern, given the state's ongoing challenge in meeting state and federal ambient air quality standards.

As stated previously, OBD systems are required on all 1996 and newer passenger cars, light-duty trucks, and medium-duty vehicles and engines. Presently, however, there are no regulations in California requiring OBD systems on heavy-duty vehicles (i.e., vehicles with a gross vehicle weight rating greater than 14,000 pounds). Staff has begun development of OBD requirements that would be equally effective as the OBD II requirements and plans to present them for Board consideration in 2005. In the meantime, staff has worked with industry to come up with an interim /first step. ARB staff is proposing the adoption of title 13, CCR section 1971 that would require manufacturers to implement diagnostic systems on all 2007 and subsequent model year heavy-duty Otto-cycle (gasoline) and diesel engines. These proposed requirements, referred to as the engine manufacturer diagnostic system (EMD) regulation (proposed title 13, CCR section 1971), build on the basic diagnostic system heavy-duty engine manufacturers are currently using to provide diagnostic capability for the most important emission control systems. Sufficient leadtime exists to implement the EMD program by the 2007 model year when emission standards become more stringent and universal use of particulate filters is expected. It does not, however, reflect the level of diagnostics that staff will be pursuing at a later date for future OBD requirements and, as such, is referred to as EMD while the term OBD will be reserved for use in the comprehensive OBD proposal next year.

The reasons for requiring OBD systems on heavy-duty vehicles and engines are analogous to those for requiring OBD II systems on light- and medium-duty vehicles. Like the light- and medium-duty vehicles, the emission standards for heavy-duty vehicles have become increasingly stringent over the years. By 2004, the heavy-duty diesel emission standards for NOx and PM have been reduced by 60 to 80 percent compared to the standards in 1990. In 2007, both emission standards would be reduced further by 90 percent compared to the 2004 standards. Emission standards for heavy-duty gasoline vehicles and engines are also similarly reduced beginning in 2008. While the adoption of increasingly stringent standards are a step towards meeting California's air quality goals, there must be some assurance that these standards continue to be met in-use, since emission-related malfunctions can cause vehicle emissions to increase well beyond the standards that they are intended to meet. To meet these stringent standards, manufacturers must improve existing emission control technologies as well as utilize new technologies. The technologies include combinations of electronic powertrain and emission controls as well as exhaust aftertreatment components. Accordingly, in order to maintain low emissions throughout the vehicle's life, the durability and performance of these components and systems must be monitored. Additionally, with these changes comes the development of more complex electronic emission control systems, which increasingly rely on computer-based control. Therefore, the diagnosing of malfunctions related to emission-related components and systems becomes more complicated as well. OBD systems would ensure that emission-related malfunctions are quickly detected as well as properly identified and repaired by providing repair technicians with information concerning the malfunctioning component and the type of failure present.

Recognizing the strict compliance schedule facing engine manufacturers to meet the stringent 2007 model year emission standards and the continued developments in new and emerging emission control technologies, the ARB staff is not proposing the immediate development of comprehensive OBD systems that require the monitoring of every emission-related component in the vehicle. Thus, the proposed EMD regulation for the 2007 model year includes requirements that are less comprehensive than an OBD regulation. Specifically, it would require functional monitoring of major emission control components/systems but would not set standardization requirements for the emission-related information that is to be provided by the EMD system, nor would it tie OBD warnings to specific emission levels. The proposed EMD regulation is intended to be the first step towards adopting comprehensive heavy-duty OBD requirements analogous to the OBD II regulation adopted for light-duty and medium-duty vehicles. The heavy-duty OBD regulation, scheduled for a Board hearing next year, would provide for comprehensive monitoring tied to emission levels, standardized monitoring requirements to assist in repairs, and a mechanism to assure the OBD system functions frequently in the field.

What Would the Heavy-Duty EMD Regulation Require?

As stated above, the proposed heavy-duty EMD regulation would require all 2007 model year heavy-duty gasoline and diesel engines to be equipped with EMD systems. Manufacturers would be required to perform functional monitoring of the fuel system, exhaust gas recirculation (EGR) system, and PM trap. Additionally, manufacturers would also be required to monitor any emission-related electronic component for proper function. For example, for components that provide input to the on-board computer, the EMD system would generally be required to monitor for out-of-range values (generally open or short circuit malfunctions) and input values that are not reasonable based on other information available to the computer (e.g., sensor readings that are stuck at a particular value or biased significantly from the correct value). For output components that receive commands from the on-board computer, the EMD system would generally be required to monitor for proper function in response to these commands (e.g., the system verifies that a valve actually opens and closes when commanded to do so). Monitoring of these components is important, since the EMD system relies on many of these components to perform monitoring of the more critical emission control devices. When a malfunction of any of the systems/components mentioned above is detected, the proposed regulation would require the diagnostic system to alert the operator to the problem by illuminating a warning light.

The proposed regulation would not require the monitoring of aftertreatment technologies (e.g., catalysts, NOx adsorbers/traps) other than PM traps. At this time, however, the absence of monitoring is not a great concern. Based on discussions with industry, engine manufacturers are not expected to utilize NOx aftertreatment in order to meet the 2007 standards. Thus, widespread usage of NOx aftertreatment on heavy-duty engines is not anticipated until later than the 2007 model year (possibly to meet the 2010 standards). Additionally, manufacturers planning to implement selective catalytic reduction systems in the 2007 timeframe are required under federal regulations to establish safeguards (under 40 Code of Federal Regulations Part 86) to help ensure proper operation of the systems. Under these requirements, manufacturers would need to demonstrate that, among other things, an adequate urea infrastructure is in place (e.g., ensuring the availability of urea) and measures against tampering are in place. While these safeguards help mitigate the absence of specific monitoring requirements currently, they do not offer “complete” protection from malfunctions of the systems, which ARB intends to address with its future comprehensive OBD requirements. For noncompliances, manufacturers will be subject to enforcement under the applicable provisions of the Health and Safety Code.

What Do the Federal Regulations Require?

Currently, the U.S. EPA only has OBD requirements for light-duty vehicles and trucks and for federally defined "heavy-duty" vehicles and engines with a gross vehicle weight rating (GVWR) between 8,500 to 14,000 pounds. These are the same categories of vehicles covered by ARB's OBD II regulations which apply to light- and medium-duty vehicles (where medium-duty is defined in California as the 8,500 to 14,000 pound GVWR range). Presently, like ARB, the U.S. EPA does not have OBD requirements for vehicles and engines above 14,000 pounds, which is the weight range for California’s “heavy-duty” class. ARB staff and the U.S. EPA staff have been discussing the heavy-duty requirements and the U.S. EPA staff has indicated its intent to propose and adopt a regulation for heavy-duty vehicles and engines over 14,000 pounds. U.S. EPA staff have indicated a strong interest in working with ARB, the heavy-duty industry, and other stakeholders to develop harmonized ARB and federal programs.

III. GENERAL MONITORING REQUIREMENTS

A. Monitoring Conditions

As stated previously, the intent of the EMD system is to detect malfunctions of the emission control system. Accordingly, manufacturers are required to define all monitoring conditions necessary to allow for proper detection of malfunctioning components.

B. MIL Requirements

The EMD system would also be required to illuminate a warning light(s) upon detection of an emission-related malfunction. Manufacturers would have the flexibility to utilize a dedicated light or an existing warning light(s) as long as it would be likely to cause the vehicle operator to seek corrective action (e.g., repair). Lastly, to verify the integrity of the warning light itself, the EMD system would be required to perform a bulb check by illuminating the warning light in the key on, engine off position prior to engine cranking. This would allow a technician or vehicle operator to ensure the MIL is capable of illuminating by simply cycling the key on.

IV. PROPOSED MONITORING SYSTEM REQUIREMENTS

A. FUEL SYSTEM MONITORING

<u>Background</u>

An important component in emission control is the fuel system. Proper delivery of fuel can play a crucial role in maintaining low engine-out emissions. The performance of the fuel system is also critical for exacting optimum performance from other emission controls. As such, monitoring of the fuel system is an essential element of the EMD system.

A substantial change has occurred in recent years as most manufacturers have transitioned to (or are currently working on) new high-pressure fuel systems. One of the most widely used is a “common-rail” fuel injection system, which, unlike an older style fuel system, is capable of controlling to any desired fuel pressure independent of engine speed. Increased fuel pressure control allows greater precision relative to fuel quantity and fuel injection timing, and provides engine manufacturers with tremendous flexibility in optimizing the performance and emission characteristics of the engine. While most diesel engine manufacturers use common-rail systems, some use improved unit injector systems. In these systems, fuel pressure is generated within the injector itself rather than via an electric fuel pump in a common-rail system. Earlier versions of unit injector systems were limited in the pressure that could be achieved (since the fuel pressure was a function of engine speed and could not be modified apart from a change in engine speed), but newer design iterations have created an injector with extra valves that allow the system to deliver higher or lower pressures at a given engine speed, thus enabling the fuel system to achieve much of the same fuel pressure range a common-rail system is capable of achieving.

Proposed Monitoring Requirements

Given the complexity and importance of proper fuel pressure control, the proposed requirements target malfunctions that would prevent proper control of the fuel system pressure. Accordingly, if the engine is equipped with feedback control of the fuel pressure, the proposed regulation would require the EMD system to indicate a malfunction when the fuel system has reached its control limits (i.e., has used up all the adjustments allowed) such that it cannot achieve the target fuel pressure.

Technical Feasibility of Proposed Monitoring Requirements

For diesel engines, under the light- and medium-duty OBD II requirements, a few passenger cars and several medium-duty applications utilizing diesel engines have been monitoring the fuel system components since the 1997 model year. Recently, this has included vehicles using common-rail fuel injection and improved unit injector systems, the same new technology expected to be used throughout the heavy-duty industry. Manufacturers (including half of the heavy-duty engine manufacturers) have been able to meet the more stringent OBD II monitoring requirements on medium-duty applications. Thus, the technical feasibility for the less stringent EMD requirements has been demonstrated.

B. EGR SYSTEM MONITORING

Background

EGR is one of the most effective emission control technologies for reducing NOx emissions in vehicles today. Generally, NOx emissions are formed under high combustion chamber temperature and pressure conditions. EGR systems redirect spent combustion gases from the exhaust stream to the intake system to dilute the oxygen concentration and increase the heat capacity of the air/fuel charge. This effectively reduces the combustion temperature, which results in lower levels of NOx emissions. For diesel engines especially, EGR systems have become more commonplace and will likely be a key emission control component in helping heavy-duty diesel engines meet the future stringent emission standards.

Proposed Monitoring Requirements

The proposed regulation would require the EMD system to indicate an EGR system malfunction when the system has reached its control limits (i.e., cannot increase or decrease EGR flow) such that it cannot achieve the commanded EGR flow (i.e., the flow is either too low or too high).

Technical Feasibility of Proposed Monitoring Requirements

The light- and medium-duty OBD II regulations have required EGR system monitoring to more stringent levels since the 1996 model year. The technical feasibility of EGR monitoring has already been demonstrated for these applications which include diesel engines built by half of the heavy-duty engine manufacturers for use in medium-duty applications.

C. PM TRAP MONITORING

Background

As indicated earlier, the PM emission standards for the 2007 model year will be reduced by 90 percent from the 2004 model year standards. In order to meet the increasingly stringent standards, manufacturers will likely use aftertreatment devices such as PM traps to achieve the necessary emission levels. PM traps are considered the most effective control technology for the reduction of particulate emissions and can typically achieve PM reductions in excess of 90 percent. In general, a PM trap consists of a filter material that permits exhaust gases to pass through but traps the particulate matter. In order to maintain the performance of the PM trap and the vehicle, the trapped PM must be periodically removed before too much particulate is accumulated and exhaust backpressure reaches unacceptable levels. The process of periodically removing accumulated PM from the trap is known as regeneration and is very important for maintaining low PM emission levels. PM trap regeneration can be passive (i.e., occur continuously during regular operation of the filter), active (i.e., occur periodically after a predetermined quantity of particulates have been accumulated), or a combination of the two. With passive regeneration, oxidation catalyst material is typically placed on the PM trap system to lower the temperature for oxidizing PM. This allows the trap to continuously oxidize trapped PM material during normal driving. In contrast, active systems utilize an external heat source such as an electric heater or fuel burner to facilitate PM trap regeneration. It is projected that virtually all PM trap systems will have some sort of active regeneration mechanism.

One of the key factors that needs to be taken into account for a trap regeneration control system is the amount of soot quantity that is stored in the PM trap (often called soot loading).[1] If too much soot is stored in the PM trap when regeneration is activated, the soot can burn uncontrollably and damage the filter. However, activating regeneration when there is too little trapped soot is also undesirable since there is a minimum amount of soot quantity needed to ensure good combustion propagation. Another important factor to be considered in the control system design is the fuel economy penalty involved with trap regeneration. Prolonged operation with high backpressures in the exhaust and too frequent regenerations are both detrimental to fuel economy and durability. Therefore, trap designers will need to carefully balance the regeneration frequency with various conflicting factors. In order to optimize the trap

[1] Salvat, O., Marez, P., and Belot, G., "Passenger Car Serial Application of a Particulate Filter System on a Common Rail Direct Injection Diesel Engine," SAE Paper 2000-01-0473.

regeneration for these design factors, the control system for the regeneration system is projected to utilize both pressure sensors and temperature sensors to model soot loading among other properties.[1] Through the information provided by these sensors, designers can optimize the PM trap for high effectiveness and maximum durability while minimizing fuel economy and performance penalties.

Proposed Monitoring Requirements

The proposed regulation would require the EMD system to indicate a PM trap malfunction when the PM trap fails such that it causes the backpressure in the exhaust system to exceed the manufacturer's specified limits for normal operation. Additionally, manufacturers would be required to indicate a malfunction when the PM trap substrate is completely destroyed, removed, or missing, or if the PM trap assembly is replaced with a straight pipe.

Technological Feasibility of Proposed Monitoring Requirements

It is anticipated that manufacturers will not need additional hardware to meet the PM trap monitoring requirements. The same pressure and temperature sensors that are used to control trap regeneration can be used for monitoring. In general, a pressure sensor placed upstream of the trap (or a differential pressure sensor across the trap) and at least one temperature sensor located near the PM trap are used for the control system. As mentioned earlier, pressure sensors are expected to be used on PM trap systems to prevent damage due to delayed or incomplete regeneration that could lead to excess temperatures. When a pressure sensor placed upstream of the trap senses high backpressures, active regeneration can be activated. The same pressure sensor could also be used to identify the presence of excessive backpressure and indicate a malfunction. To detect a missing or destroyed PM trap, the same backpressure sensor could be used to detect too little backpressure. With a properly functioning PM trap, a minimum level of backpressure will always be present but if the trap is missing or destroyed, the backpressure will fall below the minimum level. Also, backpressure on a normal PM trap should progressively increase as the mass of soot and trapped particles increase. In general, the mass of soot and trapped particles should increase as the mileage traveled or time of operation increase. However, a destroyed or missing filter will not cause an increase in backpressure as expected. Therefore, a destroyed or missing filter can alternatively be detected if the backpressure fails to increase at the rate projected by the soot-loading model. One European vehicle manufacturer has already incorporated PM trap monitoring on their PM trap-equipped vehicles since 2000.

D. EMISSION-RELATED ELECTRONIC COMPONENT MONITORING

Background

Similar to the OBD II requirements for light- and medium-duty vehicles, the staff is proposing that manufacturers monitor for malfunctions of emission-related electronic components on heavy-duty vehicles, which covers all other electronic powertrain components or systems not mentioned above that either are determined by the manufacturer to be emission-related or are used as part of the EMD diagnostic strategy for another monitored component or system. These components are generally identified as input components, which provide input directly or indirectly to the on-board computer, or as output components/systems, which receive commands from the on-board computer. Typical examples of input components include temperature sensors and pressure sensors, while examples of output components/systems include the idle speed control system, glow plugs, wait-to-start lamps, and automatic transmission solenoid or controls.

While the emission impact of malfunctioning emission-related electronic components may not be as high as the fuel system, EGR system, or PM trap, they still could result in a measurable increase in emissions. With the heavy-duty emission standards becoming increasingly stringent in the near future, manufacturers need to ensure that their emission-control systems are working properly in order to meet these standards. Furthermore, the proper performance of these components can be critical to the monitoring strategies of other components or systems. Malfunctions of emission-related electronic components that go undetected by the EMD system may disable or adversely affect the robustness of other EMD monitors without any indication. This could potentially result in the failure to detect other faulty emission-related components or systems. Due to the vital role these components play, it is important that these components are properly monitored.

Proposed Monitoring Requirements

The EMD system would be required to detect malfunctions of all electronic components that are emission-related or are used for other EMD monitors. Where feasible, input components would be required to be monitored for out-of-range and circuit continuity faults (shorts, opens, etc.) as well as rationality faults (e.g., where a sensor reads inappropriately high or low but, unlike out-of-range faults, still within the valid operating range of the sensor). Rationality monitoring would be required to use all available information and would generally be accomplished by comparing the output characteristics of multiple sensors that read the same metric during certain engine operating conditions.

The staff is proposing that, where feasible, output components be monitored for proper functional response (i.e., that the component has properly carried out a command from the on-board computer) and for proper circuit operation (i.e., circuit continuity and shorts).

Technical Feasibility of Proposed Monitoring Requirements

The light- and medium-duty OBD II regulations have required emission-related electronic component monitoring since the 1996 model year. The technical feasibility has clearly been demonstrated for these packages.

V. CERTIFICATION REQUIREMENTS

The certification requirements would require manufacturers of EMD systems to submit an application for each EMD system. The documentation would consist of: (1) a description of the functional operation of the EMD system, and (2) a listing of all electronic powertrain input and output signals (including those not monitored by the EMD system) and identification of those signals that are monitored by the EMD system.

VI. DEFICIENCIES

During the early stages of OBD implementation for light- and medium-duty vehicles, some manufacturers encountered unforeseen and generally last-minute problems with some monitoring strategies despite a good faith effort to comply with the requirements in full. The staff anticipates the same problems may occur during heavy-duty EMD implementation. Thus, the staff is proposing a provision that would permit certification of heavy-duty EMD systems with "deficiencies" in cases where a good faith effort to fully comply has been demonstrated. Specifically, in granting deficiencies, the Executive Officer would consider the following factors: the extent to which the proposed requirements of the EMD regulation are satisfied overall based on the application review, the relative performance of the resultant EMD system compared to systems fully compliant with the proposed requirements of the EMD regulation, and a demonstrated good-faith effort on the part of the manufacturer to: (1) meet the proposed requirements in full by evaluating and considering the best available monitoring technology; and (2) come into compliance as expeditiously as possible. The proposed regulation would have neither a limit on the number of deficiencies granted nor any fines imposed on the manufacturer based on the number of deficiencies granted.

VII. ANALYSIS OF ENVIRONMENTAL IMPACTS AND ENVIRONMENTAL JUSTICE ISSUES

The proposed regulation is an initial step towards ensuring that forecasted emission reduction benefits from adopted heavy-duty engine emission standards programs are achieved. The proposed regulation helps achieve these emission benefits in two distinct ways. First, it is anticipated that the manufacturers will produce increasingly durable, more robust emission-related components to minimize the detection of malfunctioning components. Second, by alerting vehicle operators of emission-related malfunctions, repairs can be made more promptly to restore the system to proper operation.

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 heavy-duty emission standards programs be achieved. The proposed EMD regulation is a necessary first step towards accomplishing this goal.

Having identified that the proposed regulation will not result in any adverse environmental impacts but rather will help ensure that measurable emission benefits are achieved statewide, the regulation should not adversely impact any community in the State, especially low-income and minority communities.

VIII. COST IMPACT OF THE PROPOSED REQUIREMENTS

A. Cost of the Proposed Requirements

Manufacturers are currently developing substantially redesigned emission control systems to meet the 2007 emission standards. Along with that redesign, manufacturers are adding hardware for proper control of the new emission components. Accordingly, the costs for the additional hardware and new emission controls have already been accounted for in the costs to comply with the 2007 emission standards. Further, this very same hardware will be used to meet the proposed EMD system requirements. As such, the proposed heavy-duty EMD regulation is not expected to result in additional hardware costs for manufacturers.

In regards to software, manufacturers are also currently increasing computer memory space to accommodate the needed software algorithms for proper emission control. Given the limited scope of the proposed EMD requirements for fuel system, EGR, and PM traps and because the proposed monitoring requirements are structured around detecting a fault when the system is operating outside of the manufacturer's control limits, the cost for additional software (if any) for these diagnostics is negligible. For the other emission-related electronic components, the proposed EMD monitoring requirements are very similar to the level of diagnostics manufacturers already currently implement to aid service technicians and to ensure the engine and control system is robust to failures that may occur in-use. As such, it is anticipated that there will be no additional cost for software to meet the proposed EMD requirements.

B. Cost Effectiveness of the Proposed Requirements

As stated above, the proposed EMD regulation is the initial step towards ensuring the emission reductions projected for the 2007 heavy-duty emission standards are achieved. The two programs complement each other to achieve the same emission reductions. Accordingly, the costs and estimated emission reductions for the EMD proposal are combined with the 2007 emission standards to determine the cost effectiveness. Given that the proposed EMD requirements are not expected to result in increased hardware or software costs and are helping to protect the emission benefits already projected, the cost effectiveness calculation does not change from the previously calculated value for the 2007 emission standards. For reference, the 2007 emission standards were calculated to have a cost-effectiveness of $0.42 per pound of NOx plus non-methane hydrocarbon and $3.42 per pound of PM for all heavy-duty vehicles.[2]

[2] ARB Staff Report: Initial Statement of Reasons, "Public Hearing to Consider Amendments Adopting More Stringent Emission Standards for 2007 and Subsequent Model Year New Heavy-Duty

IX. ECONOMIC IMPACT ANALYSIS

Overall, the proposed regulation is expected to have no impact on the profitability of heavy-duty powertrain suppliers (e.g., engine, transmission). It is also anticipated that the proposed regulation would result in no costs to vehicle manufacturers. Staff believes, therefore, that the proposed requirements would cause no noticeable adverse impact in California employment, business status, and competitiveness.

A. Legal requirements

Sections 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.

In addition, state agencies are required to estimate the cost or savings to any state or local agency, and school districts. The estimate is to include any non-discretionary cost or savings to local agencies and the cost or savings in federal funding to the state.

B. Affected businesses and potential impacts

Any business involved in manufacturing, purchasing, or servicing heavy-duty engines and vehicles could be affected by the proposed regulation. Of the powertrain businesses, there are 21 engine manufacturers and 3 transmission and other powertrain manufacturers, none of which are located in California. Of these businesses, two of the engine manufacturing companies are assumed to be “small businesses” (i.e., selling less than 150 engines per year based on California certification data).

There are approximately eight major vehicle manufacturers, but staff has been unable to estimate the total number of manufacturers that assemble and sell complete heavy-duty vehicles (e.g., coach builders) in California. Staff has thus been unable to determine how many of these companies are located in California and how many are considered “small businesses.” However, it is assumed that for these manufacturers, the regulation would impose little, if any, cost.

C. Potential impacts on vehicle operators

The proposed regulation would encourage manufacturers to build more durable

Diesel Engines”, September 7, 2001.

engines, which would result in the need for fewer repairs and savings for consumers. Additionally, the proposed EMD regulation is anticipated to have no impact on new vehicle prices.

D. Potential impacts on business competitiveness

The proposed regulation is 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 impact on retail prices of new engines and vehicles. Additionally, the U.S. EPA is expected to adopt federal heavy-duty requirements that are harmonized with those of ARB. Accordingly, even if there were a price increase for heavy-duty vehicles, it would not be expected to dampen the demand for heavy-duty trucks in California relative to other states, since any such price increase would be the same nationwide.

Further, all manufacturers that manufacture heavy-duty engines or powertrain components for sale in California are subject to the proposed heavy-duty EMD requirements regardless of where they are located and where the engines are planned for sale. As stated above, none of the heavy-duty engine or powertrain manufacturers are located in California.

E. Potential impact on employment

The proposed regulation is not expected to cause a noticeable change in California employment because California accounts for only a small share of engine and powertrain manufacturing employment, and the minimal additional work done by vehicle manufacturers can be done with existing staff.

F. Potential impact on business creation, elimination, or expansion

The proposed regulation is not expected to affect business creation, elimination, or expansion.

REFERENCES

Below is a list of documents and other information that the ARB staff relied upon in proposing the heavy-duty EMD regulation.

Salvat, O., Marez, P., and Belot, G., “Passenger Car Serial Application of a Particulate Filter System on a Common Rail Direct Injection Diesel Engine,” SAE Paper 2000-01-0473.[3]

ARB Staff Report: Initial Statement of Reasons, “Public Hearing to Consider Amendments Adopting More Stringent Emission Standards for 2007 and Subsequent Model Year New Heavy-Duty Diesel Engines”, September 7, 2001. http://www.arb.ca.gov/regact/HDDE2007/hdde2007.htm

[3] Copies of Society of Automotive Engineers (SAE) papers are available through the SAE at:
SAE Customer Service
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