(Mike's copy)

Air Resources Board

1001 I Street • P.O. Box 2815
Sacramento, California 95812 • www.arb.ca.gov

Alan C. Lloyd, Ph.D.
Agency Secretary

Arnold Schwarzenegger
Governor

March 7, 2005

Mr. Jeffrey R. Holmstead
Assistant Administrator
Office of Air and Radiation
6101A
U.S. EPA Headquarters
Ariel Rios Building
1200 Pennsylvania Avenue, NW
Washington, D.C. 20460

RE: Adoption of Engine Manufacturer Diagnostics for 2007 and Subsequent Model Heavy-Duty Engines and Vehicles; Request for Waiver of Preemption Under Clean Air Act Section 209(b)

Dear Administrator Holmstead:

On May 20, 2004, the California Air Resources Board (ARB) approved for adoption a regulation establishing Engine Manufacturer Diagnostics (EMD) for 2007 and subsequent model year heavy-duty vehicles and engines certified for sale in California. I am writing to request that the Administrator of the U.S. Environmental Protection Agency (U.S. EPA) grant California a waiver of federal preemption for the regulation pursuant to Clean Air Act (CAA) section 209(b).

An analysis setting forth California's basis for making the waiver request is attached for your review. The analysis sets forth a summary of the EMD regulation, a review of the criteria governing U.S. EPA's evaluation of a California waiver request, and the legal arguments for why California's request must be granted. The analysis, in turn, includes attachments which are also enclosed.

If you need additional technical information on this item or have legal questions, please contact Michael L.Terris of ARB's Office of Legal Affairs, at (916) 445-9815.

Sincerely,

Catherine Witherspoon
Executive Officer

Enclosure
Attachments

cc: Mr. David J. Dickinson, Attorney/Advisor (w/encl., w/attchs.)
United States Environmental Protection Agency
Ariel Rios Building
1200 Pennsylvania Avenue, NW
Mail Code 6405J
Washington, D.C. 20460

Mr. Steve Albu, Chief (w/encl., w/o attchs.)
Chief Engineering Studies Branch
Mobile Source Control Division

Mr. Michael McCarthy (w/encl., w/o attchs.)
Manager Advanced Engineering Section
Mobile Source Control Division

Mr. Michael L. Terris, (w/encl., w/attchs.)
Office of Legal Affairs

ATTACHMENT

BEFORE THE
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

CALIFORNIA AIR RESOURCES BOARD'S REQUEST FOR GRANTING WAIVER PURSUANT TO CLEAN AIR ACT SECTION 209(b) FOR RECENTLY ADOPTED ENGINE MANUFACTURER DIAGNOSTIC REQUIREMENTS FOR NEW 2007 AND SUBSEQUENT MODEL-YEAR HEAVY DUTY VEHICLES

INTRODUCTION AND BACKGROUND

Pursuant to section 209(b) of the Clean Air Act ("CAA"), the California Air Resources Board ("ARB" or "Board") hereby requests that the Administrator of the U.S. Environmental Protection Agency ("U.S. EPA") grant California's request for a waiver from the preemption provisions of CAA section 209(a). The request covers California's recent adoption of Engine Manufacturer Diagnostic ("EMD") requirements for 2007 and subsequent model-year on-road heavy-duty vehicle engines.[1] The regulation, as well as other California regulations, defines an on-road, heavy-duty vehicle engine as an engine used in a motor vehicle having a gross vehicle weight rating greater than 14,000 pounds that is certified to the requirements of title 13, CCR sections 1956.1 or 1956.8.[2]

At a public hearing on May 20, 2004, the ARB, by Resolution 04-16 (appended hereto), approved the adoption of EMD requirements for 2007 and subsequent model-year on-road heavy-duty vehicle engines. The Board formally adopted the EMD requirements on November 8, 2004, and the California Office of Administrative Law ("OAL") approved the regulations on December 27, 2004. The regulations became operative upon certification by the Secretary State 30 days after approval by OAL.

The EMD regulation requires on-road, heavy-duty motor vehicle engine manufacturers to incorporate first generation on-board diagnostic ("OBD") systems on all new 2007 and subsequent year engines. The regulation applies to both Otto-cycle and diesel engines. The requirements build on the basic engine diagnostic system heavy-duty engine manufacturers are currently using to provide diagnostic capability for their most important emission control systems. The EMD system can alert the operator of specified malfunctions as they occur so that repairs can be sought promptly.

The EMD regulation specifically requires engine manufacturers to monitor the fuel system, exhaust gas recirculation system, particulate matter trap, and emission-related electronic components. The EMD system will help ensure that new engines meet the more stringent engine emission certification standards, which are also required to be implemented in the 2007 model year. It would accomplish this by monitoring the performance of the emission control components and systems and by providing technicians with information that would help in diagnosing and fixing malfunctions.

Recognizing the strict compliance schedule facing engine manufacturers to meet the 2007 model year emission standards and the continued developments in new and emerging emission control technologies, the EMD regulation does not

---

[1] The regulations are codified at title 13, California Code of Regulations (CCR), section 1971. Unless otherwise noted, all section references are to title 13, CCR.
[2] See section 1971(c) (6) and (9).

require the monitoring of every emission-related component in the vehicle as does the OBD system in lighter weight classifications. The first-generation EMD system requirements are less comprehensive and require only functional monitoring of major emission control components/systems. The EMD regulation also does not set standardization requirements for the emission-related information that is to be provided by the EMD system, nor does it tie Malfunction Indicator Light (MIL) warnings to specific emission levels.

SUMMARY OF SUBSTANTIVE REQUIREMENTS[3]

As stated above, the proposed heavy-duty EMD regulation would require all 2007 and subsequent 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 pressure control system, exhaust gas recirculation (EGR) system, and particular matter (PM) trap. Additionally, manufacturers would also be required to monitor any emission-related electronic component for proper operation. 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 consistent with existing methods used by engine manufacturers to alert the operator of other engine operations (e.g., illuminate a warning light). Engine manufacturers will be responsible for defining the monitoring conditions for detecting malfunctions and for submitting a certification application for review and approval to the ARB.

The regulation also provides manufacturers the opportunity to certify engines that do not meet all of the monitoring requirements.[4] The provision parallels the OBD II regulation, and addresses situations where a manufacturer has encountered unforeseen and generally last-minute problems with a

---

[3] A detailed discussion of the adopted EMD requirements is set forth in the Staff Report: Initial Statement of Reasons for Proposed Rulemaking, Engine Manufacturer Diagnostic System Requirements for 2007 and Subsequent Model Year Heavy-Duty Engines (EMD) ("Staff Report," a copy of which is appended hereto.) A more detailed exposition of some of the monitoring requirements may be found in the consistency discussion of the waiver analysis, *infra*.

[4] Section 1971(g).

monitoring strategy despite a good faith effort to comply with the requirements in full. Anticipating that heavy-duty engine manufacturers may experience similar problems during EMD implementation, the regulation provides relief that permits 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 regulation imposes no limit on the number of deficiencies that may be requested by a manufacturer or granted by the Executive Officer. Additionally, the manufacturer would not be subject to monetary penalties for granted deficiencies.

WAIVER ANALYSIS

A. Introduction

Section 209(b) of the CAA sets forth the protocol for granting California waivers to the general preemption of section 209(a) that prohibits the states from adopting and enforcing standards and other requirements relating to the control of emissions from motor vehicles. Under section 209(b), the Administrator shall grant a waiver to California if the state has determined that its standards will be, in the aggregate, at least as protective of public health and welfare as applicable federal standards, unless the Administrator finds that (1) the state's protectiveness determination is arbitrary and capricious, (2) California does not need separate state standards to meet compelling and extraordinary conditions, or (3) the state standards and accompanying enforcement procedures are not consistent with section 202(a) of the CAA. The Administrator shall grant a waiver unless he can find sufficient evidence in the record to support any of the above listed criteria that would dictate not granting the waiver.[5]

In considering a waiver request, California's regulations and protectiveness determination are presumed to satisfy the criteria for granting a waiver, and the burden to show otherwise is on those persons challenging the waiver request.[6] As held by the court in *MEMA* and long followed by U.S. EPA:

> The language of the statute and its legislative history indicate that California's regulations, and California's determination that they

[5] *California State Motor Vehicle Pollution Control Standards; Waiver of Federal Preemption--Notice of Decision* 61 Fed.Reg. 53371 (October 11, 1996).
[6] *Manufacturers Association* v. *EPA (MEMA)* (D.C. Cir. 1979) 627 F.2d 1095, 1121.

> comply with the statute, when presented to the Administrator are presumed to satisfy the waiver requirements and that the burden of proving otherwise is on whoever attacks them. [It is they who] bear the burden of persuading the Administrator that the waiver request should be denied.[7]

U.S. EPA has long recognized that substantial deference should be provided to the policy judgments of California in adopting its own motor vehicle adopting regulations. In granting the initial waiver for the OBD II regulation, then Administrator Browner summarized:

> Because it determined that California was entitled to exercise broad discretion in its choice of mobile source air pollution control methods, Congress acted to ensure that EPA's review of California's decision making be narrow. From the outset, EPA has consistently complied with congressional intent.

Citing earlier U.S. EPA waiver decisions, Administrator Browner continued:

> The law makes it clear that the waiver requests cannot be denied unless the specific findings in the statute can properly be made. The issue of whether a proposed California requirement is likely to result in only marginal improvements in air quality not commensurate with its cost or is otherwise an arguably unwise exercise of regulatory power is not legally pertinent to my decision under section 209, so long as the California requirement is consistent with section 202(a) and is more stringent than applicable Federal requirements in the sense that it may result in some further reduction in air pollution in California.[8]
>
> The structure and history of the California waiver provision clearly indicate a Congressional intent and an EPA practice of leaving the decision on ambiguous and controversial public policy to California's judgment . . . Sponsors of the (waiver) language eventually adopted[,]referred repeatedly to their intent to make sure that no "Federal bureaucrat" would be able to tell the people of California what auto emission standards were good for them, as long as they were stricter than the Federal standards.[9]

---

[7] *Id.*; See also Decision Document accompanying OBD II Waiver Determination, 61 Fed.Reg. 53371, at p.15-16.
[8] 61 Fed.Reg. 53371 (October 11, 1996), Decision Document, p. 37, citing 36 Fed.Reg. 178458 (August 31, 1971).
[9] *Id.*, citing 40 Fed.Reg. 23101 (May 28, 1975). (Emphasis in original.)

B. The EMD Regulation Meets the Criteria for Granting a Waiver

(1) Protectiveness

In adopting Resolution 04-16, the Board expressly found that the EMD requirements set forth at section 1971, in the aggregate, to be at least as protective of the public health and welfare as applicable federal standards. In reviewing California's protectiveness finding accompanying a newly adopted regulation, those challenging the waiver must present clear and convincing evidence to show that a protectiveness finding by California is arbitrary and capricious.[10] This standard is in accord with "Congressional intent to provide California with the broadest possible discretion in setting regulations it finds protective of the public health and welfare".[11] In this case, the determination made by the Board is clearly not arbitrary and capricious. As evidenced by the simple fact that U.S. EPA has, to date, not promulgated any type of OBD system requirements for heavy-duty vehicles and engines with a gross vehicle weight rating over 14,000 pounds, no challenger can meet the high standard of review to overcome the Board's finding.

(2) The Adopted Regulations are Necessary to Meet Compelling and Extraordinary Circumstances

California needs its own on-road engine and vehicle program to meet serious air pollution problems unique to the State. The Administrator has previously and consistently recognized California's unique needs when granting waivers for motor vehicles under section 209(b) and authorization for California's nonroad regulations under section 209(e) of the CAA. The relevant inquiry under section 209(b)(1)(B) is whether California needs its own emission control program to meet compelling and extraordinary conditions, not whether any given standard is necessary to meet such conditions.[12] In approving waivers under section 209(b), the Administrator has determined that:

> [C]ompelling and extraordinary conditions' does not refer to levels of pollution directly, but primarily to the factors that tend to produce them: geographical and climatic conditions that, when combined

---

[10] *MEMA*, 627 F.2d at 1122; Decision Document accompanying OBD II Waiver Determination, at p. 14.

[11] *Id.*

[12] The Administrator has recognized that even if such a standard by standard test were applied to California, it "would not be applicable to its fullest stringency due to the degree of discretion given to California in dealing with its mobile source pollution problems," (41 Fed.Reg. 44209, 44213, (October 7, 1976); 49 Fed.Reg. 18887, 18892 (May 3, 1984).) See also *Final 209(e) Rule*, 59 Fed.Reg. at 36982.

> with large numbers and high concentrations of automobiles, create serious air pollution problems.[13]

In the California Clean Air Act of 1988, the California Legislature found that:

> [D]espite the significant reductions in vehicle emissions which have been achieved in recent years, continued growth in population and vehicle miles traveled throughout California have the potential not only to prevent attainment of the state standards, but in some cases, to result in worsening of air quality.[14]

In response to the undisputed severe air quality problems in California, the California Legislature provided ARB with broad authority to regulate on and off-road engines and other sources to meet federal and state air quality standards.[15]

California – the South Coast and San Joaquin Valley Air basins in particular – continues to experience some of the worst air quality in the nation.[16] California's ongoing need for dramatic emission reductions generally and from heavy-duty diesel engines specifically is abundantly clear from its recent adoption of state implementation plans for the South Coast and other California air basins.[17] The ongoing need for additional emission reductions from on-road heavy duty diesel engines is repeatedly referenced in the subject rulemaking.[18] The unique geographical and climatic conditions, and the tremendous growth in vehicle population and use that moved Congress to authorize California to establish separate vehicle standards in 1967, still exist today. Note that U.S. EPA recently confirmed ARB's judgment, on behalf of the State of California, on this matter.[19]

Nothing in these conditions has changed to warrant a devergence from this determination. Accordingly, for all the aforementioned reasons, there can be no doubt of the continuing existence of compelling and extraordinary conditions justifying California's need for its own heavy-duty diesel engine program.

---

[13] See, e.g., 46 Fed.Reg. 2371, 26373 (May 12, 1981); 43 Fed.Reg. 32182 (July 25, 1978).
[14] California Health and Safety Code section 43000.5.
[15] California Health and Safety Code sections 43013 and 43018.
[16] See, e.g., Approval and Promulgation of State Implementation Plans; California--South Coast, 64 Fed.Reg. 1770, 1771 (January 12, 1999). See also 69 Fed.Reg. 23858, 23881-90 (April 30, 2004) (designating 15 areas in California as non-attainment for the 8-hour ozone national ambient air quality standard).
[17] See, e.g., "2003 State and Federal Strategy for the California SIP," Executive Summary, available at http://www.arb.ca.gov/planning/sip/stfed03/stfed03.htm.
[18] Resolution 01-38 (Attachment 1), at pp. 3, 6. See also Staff Report: Initial Statement of Reasons (Attachment 5), at pp. 14-16 and 44-49.
[19] *California State Motor Vehicle Pollution Control Standards; Waiver of Federal Preemption--Notice of Decision,* 68 Fed.Reg. 19811, 19812 (April 22, 2003).

(3) Consistency

(a) General

The EMD regulation is consistent with section 202(a) of the CAA. The U.S. EPA has historically interpreted consistency with section 202(a) under a two-prong test: (1) that there is sufficient lead time to permit the development of technology necessary to meet the standards and other requirements, giving appropriate consideration to the cost of compliance in the time frame provided, and (2) that the California and federal test procedures are sufficiently compatible to permit manufacturers to meet both the state and federal test requirements with one test vehicle or engine.[20]

(b) Technological Feasibility of EMD Requirements

In the OBD II waiver, the Administrator agreed with the ARB that in considering OBD II requirements, the U.S. EPA should evaluate technological feasibility "based on a continuum or sliding scale," explaining:

> [A] showing of more certain technological solutions is necessary for monitoring requirements which are near implementation and a showing of theoretical solutions and responses to technological concerns would be necessary for monitoring requirements which are either first implemented several model years from [ARB] adoption of the requirement or for a monitoring requirements with phase-ins where more theoretical solutions for later years of the phase-in would be allowed.[21]

Additionally, as previously stated, U.S. EPA has long recognized that California should be given broad deference in its approach to addressing the significant air pollution confronting the state. As the Administrator stated in 1975 and reaffirmed in 1995:

> [E]ven on this issue of technological feasibility, I would feel constrained to approve a California approach to the problem which I might also feel unable to adopt at the Federal level in my own capacity as a regulator. The whole approach of the Clean Air Act is to force the development of new types of emission control technology where that is needed by compelling the industry to "catch up" to some degree with newly promulgated standards.

---

[20] See 61 Fed.Reg. 53371, 53372 (October 11, 1996); Decision Document at p.2 (*OBD II Waiver Decision*).

[21] *Id.* at p. 73; see also *International Harvester Company* v. *Ruckelshaus* (D.C. Cir. 1973) 478 F.2d 615, 642 and *Natural Resources Defense Counsel* v. *U.S. EPA (D.C. Cir. 1981)* 655 F.2d 318, 331-332.

> Such an approach to automotive emission control might be attended with costs, in the shape of a reduced product offering, or price or fuel economy penalties, and by risks that a wider number of vehicle classes may not be able to complete their development work in time. Since a balancing of these risks and costs against the potential benefits from reduced emissions is a central policy decision for any regulatory agency, under the statutory scheme outlined above I believe I am required to give very substantial deference to California's judgment on that score.[22]

As stated in the Staff Report, except as specifically identified below, the EMD monitoring requirements build on the basic engine diagnostic systems heavy-duty vehicle engine manufacturers have been using to provide diagnostic capability for the most important emission control systems.[23] Consequently, the requirements, for the most part, involve implementing existing technology and are unquestionably feasible. A detailed summary of the technological approaches that the ARB envisions manufacturers will use to meet the EMD requirements for the 2007 model year are set forth below.

1. Fuel System Monitoring

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 that is capable of controlling fuel pressure independently 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 latter systems, fuel pressure is generated within the injector itself rather than via an electric fuel pump as 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 unit-

[22] *OBD II Waiver Decision* at p. 72, citing 1975 waiver decision at 40 Fed.Reg. 23102, 23103 (emphasis added by U.S. EPA in *OBD II Waiver Decision*).
[23] *Staff Report*, at p. 1.

injector system to achieve fuel pressure ranges comparable to those achieved by a common-rail system.

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

Manufacturers of heavy-duty diesel engines are expected to utilize the same technology for monitoring the fuel system as manufacturers of light- and medium-duty diesel vehicles. Under the OBD II requirements, a few diesel-powered passenger cars and several medium-duty vehicles have been monitoring their fuel-system-pressure-control components since the 1997 model year. In recent years, these monitored vehicles have been using both common-rail fuel injection and improved unit-injector systems, the same technology that will likely be used throughout the heavy-duty industry. Manufacturers of medium-duty vehicles and engines, which include in their numbers one-half of all heavy-duty vehicle engine manufacturers, have been able to meet the more stringent OBD II monitoring requirements on their medium-duty applications. In contrast to the OBD II emission-threshold monitoring, EMD monitoring of the fuel system only requires functional monitoring. Given the state of existing technology and the much lower technical requirements that heavy-duty engine manufacturers must meet, there is no question that the fuel-system EMD monitoring requirements are technologically feasible.

2. EGR System Monitoring

EGR is one of the most effective emission control technologies for reducing NOx emissions in heavy-duty 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 emission standards.

The new 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).

The light- and medium-duty OBD II regulations have, since the1996 model year, required EGR system monitoring to more stringent levels than required under the EMD regulation, which again only requires functional monitoring. As mentioned, half of the heavy-duty engine manufacturers build engines for use in medium-duty applications and have been successful in applying the technology to the lighter weight vehicles. Again, the same technology presently used to monitor light- and medium-duty diesel vehicles will be used for EMD's EGR monitoring; thus, the technology presently exists and should be fully applicable by the 2007 model year for heavy-duty vehicle engines.

3. PM-Trap Monitoring

Under the previously adopted regulations to strengthen the emission standards for 2007 and subsequent model year heavy-duty vehicles and engines, PM emission standards for the 2007 and subsequent model years will be reduced by 90 percent from the 2004 model year standards.[24] 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 intrusive fuel control strategies or an external heat source such as a 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 that is stored in the PM trap (often called "soot loading").[25] If too much soot is stored in the PM trap when regeneration is activated, the soot can burn uncontrollably and damage the filter.

---

[24] Section 1956.8.
[25] 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.

However, activating regeneration when there is too little trapped soot is also undesirable since a minimum amount of soot is needed to ensure good combustion. Another important factor to be considered in the control-system design is the fuel-economy penalty involved with trap regeneration. Prolonged operation with high back pressures 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 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. Through the information provided by these sensors, designers can optimize the PM trap for high effectiveness and maximum durability while minimizing penalties to fuel economy and performance.

The new regulation would require the EMD system to indicate a PM-trap malfunction when the PM trap 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.

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, the ARB expects pressure sensors to be used on PM-trap systems to prevent damage due to delayed or incomplete regeneration that could lead to excess temperatures. In such instances, when a pressure sensor placed upstream of the trap senses high backpressures, active regeneration will begin. The same pressure sensor that senses the presence of excessive backpressure could also be used to indicate a malfunction.

Moreover, the same back pressure sensor could be used to detect too little back pressure. In such cases, the sensor could also be used to detect a missing or destroyed PM trap. With a properly functioning PM trap, a minimum level of back pressure will always be present but if the trap is missing or destroyed, the back pressure will fall below the minimum level. Also, back pressure on a normal PM trap should progressively increase as the mass of soot and trapped particles increases with miles traveled or hours of operation. In contrast, a destroyed or missing filter will not cause an increase in anticipated back pressure. Thus, in such situations, the pressure sensor should be able to accurately detect a destroyed or missing filter if the back pressure fails to increase at the rate projected by the soot-loading model.

Given that the PM-trap monitoring requirements only require the EMD system to perform a functional check of the PM trap and do not require an emission-based malfunction threshold as required in the OBD II regulation, the requirements of the regulation are technologically feasible.

4. Emission-Related Electronic Component Monitoring

Similar to the OBD II requirements for light- and medium-duty vehicles, the EMD regulation requires heavy-duty-vehicle-engine manufacturers to monitor for malfunctions of emission-related electronic components. This requirement covers all other electronic powertrain components or systems not otherwise specifically mentioned in the regulation and that are either determined by the manufacturer to be emission-related or used by the manufacturer 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 and pressure sensors, while examples of output components/systems include the idle speed control system, glow plugs, and wait-to-start lamps.

While the emission impact of malfunctioning emission-related electronic components may not be as high as the impact from a malfunctioning fuel system, EGR system, or PM trap, malfunctioning electronic components could still cause a measurable increase in emissions. With the heavy-duty emission standards becoming increasingly stringent in the near future, manufacturers need to ensure that each and every emission-control component is 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.

The EMD system is required to detect malfunctions of all electronic components that are emission-related or are used for other EMD monitors. Where feasible, input components are 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 of input components is 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. Similarly, if feasible, the regulation requires that 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).

The monitoring of emission-related electronic components is conditioned on feasibility as determined by the manufacturer. A manufacturer who demonstrates that it is not feasible to monitor a particular component, will not be required to do so. The only question regarding feasibility is whether technology that is presently being used on light- and medium-duty vehicles under the OBD II regulations can be applied to heavy-duty-vehicle engines. Light- and medium-duty manufacturers have successfully been monitoring these components since the 1996 model year.

(c) Compatible Test Procedures

As stated, U.S. EPA has, to date, not adopted EMD monitoring requirements; accordingly no issue regarding compatibility exists. If EPA does not act to implement monitoring regulations for the 2007 and subsequent model years, this does not mean that manufacturers will be prohibited from selling vehicles ao equipped in the national market. Manufacturers will have the option to equip or not to equip their vehicles sold outside of California with monitoring systems.

CONCLUSION

Based on the foregoing, the ARB respectfully requests that the Administrator grant California a waiver of preemption for the adopted EMD regulation. The ARB encloses a CD-ROM that includes the following documents pertaining to the adopted regulation as part of this request.

1. Notice of Public Hearing to Consider Engine Manufacturer Diagnostic System Requirements for 2007 and Subsequent Model Year Heavy-Duty Engines (EMD), issued April 2, 2004.

2. Staff Report: Initial Statement of Reasons for Proposed Rulemaking,issued April 2, 2004, with Appendices.

3. Resolution 04-16, dated May 20, 2004.

4. Notice of Availability of Modified Text, issued July 26, 2004.

5. Executive Order G-04-069, dated November 8, 2004.

6. Final Statement of Reasons for Rulemaking Including Summary of Comments and Agency Response.

7. Final Regulation Order for title 13, California Code of Regulations, section 1971, approved by OAL on December 27, 2004.

8. Transcript of EMD Rulemaking Hearing on May 20, 2004.

bcc: Diane Moritz Johnston, EO/OLA (w/encl., w/o attchs.)
Stephan Lemieux, MSCD (w/encl., w/o attchs.)
Legal Chron (w/encl., w/o attchs.)
Waiver File (w/encl., w/o attchs.)