



PUBLIC MEETING AGENDA

May 20-21, 2004
9:00 a.m. / 8:30 a.m.

04-5-1 Report to the Board
on a Health Update

04-5-2 Public Meeting to
Consider a Research
Proposal

04-5-3 Report to the Board
on the Hydrogen Highway
Update

04-5-4 Public Hearing to
Consider the Adoption
of the Engine Manufacturer
Diagnostics (EMD)

04-1-4 Report to the Board
on the Amendments to the
California Motor Vehicle
Service Information Regulation

Includes
Acrobat™
Reader™

PC and Mac
Compatible



ELECTRONIC BOARD BOOK

LOCATION:

California Environmental Protection Agency
Air Resources Board
Central Valley Auditorium, Second Floor
1001 I Street
Sacramento, California 95814

California Environmental Protection Agency
 **Air Resources Board**

PUBLIC MEETING AGENDA

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

May 20 - 21, 2004
9:00 a.m./8:30 a.m.

04-5-1 Report to the Board on a Health Update

Staff will discuss the association between particulate **air pollution** and infant mortality. Previously the **elderly** have been considered most susceptible to premature mortality from exposure to particulate pollution, however, recent **studies** have examined the **potential** mortality risk to infants. Staff will present **the** results of studies assessing **the** relationship between **particulate air pollution** and infant mortality conducted in both the United States and South Korea.

04-5-2 Public Meeting to Consider a Research Proposal

"Analysis of Building Characteristics and Indoor Environmental Quality in California **Classrooms,**" Westat, \$116,780, Proposal No. **2550-239.**

04-5-3 Report to the Board on the Hydrogen Highway Update

Staff will update **the** Board on the implementation plan for the Governor's executive order which **was** signed April **20**, 2004, and requires California Environmental Protection Agency (**CalEPA**) to establish a Hydrogen Economy **Blueprint** Plan.

04-5-4 Public Hearing to Consider the Adoption of the Engine Manufacturer Diagnostics (EMD)

This proposal would require **all** 2007 and subsequent heavy-duty engines to be equipped with diagnostic systems to detect **malfunctions** of emission-related **components** including the fuel system, exhaust gas recirculation system, and particulate matter trap.

CONTACT CLERK OF THE BOARD, 1001 I Street, **23rd** Floor, Sacramento, CA 95814

(916) 3225594

FAX: (916) 322-3928

ARB Homepage: www.arb.ca.gov

To submit written comments on an agenda item in **advance** of the meeting.

To request special accommodation or language needs.

TTY/TDD/Speech-to-Speech users may dial 7-1-1 for the California Relay Service.,

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

04-1-4 Report to the Board on the Amendments to the California **Motor Vehicle** Service Information Regulation

Staff will present an update to the Board on implementation of particular amendments to the original service information regulation approved at the January 2004 hearing. These include heavy-duty service information provisions and liability issues, and continued immobilizer information access concerns related to on-board computer remanufacturers.

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

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

THOSE ITEMS ABOVE THAT ARE NOT COMPLETED ON MAY 20 WILL BE HEARD BEGINNING AT **8:30** A.M. ON MAY 21.

THE AGENDA ITEMS LISTED ABOVE MAY BE CONSIDERED IN A DIFFERENT ORDER AT THE BOARD MEETING.

LOCATION:

California Environmental Protection Agency
Air Resources Board
Central Valley Auditorium, Second Floor
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Sacramento, California 95814

California Environmental Protection Agency



PUBLIC MEETING AGENDA

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CONTACT CLERK OF THE BOARD, 1001 I Street, 23rd Floor, Sacramento, CA 95814

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State of California
AIR RESOURCES BOARD

Research Resolutions

Research Division

May 20, 2004

INTRODUCTION

Contained herein for Board review is one resolution and an accompanying summary from the Extramural Research Program recommended to the Board by the Research Screening Committee.

Item 1 is a research proposal, Resolution 04-15, from Westat, entitled, "Analysis of Building Characteristics and Indoor Environmental Quality in California Classrooms". The principal investigator will be Robert Paul Clickner, PhD.

PROPOSER

State of California
AIR RESOURCES BOARD

RESEARCH PROPOSAL

Resolution 04-15

May 20-21, 2004

Agenda Item No.: 04-5-2

WHEREAS, the Air Resources Board has been directed to carry out an effective research program in conjunction with its efforts to combat air pollution, pursuant to Health and Safety Code sections 39700 through 39705;

WHEREAS, a research proposal, number 2550-239, entitled "Analysis of Building Characteristics and Indoor Environmental Quality in California Classrooms," has been submitted by **Westat**, in response to RFP No. 03-328;

WHEREAS, the Research Division staff has reviewed and recommended this proposal for approval;

WHEREAS, the California Energy Commission has agreed to cosponsor this proposal for \$100,000 making the Air Resources Board's contribution \$16,780; and

WHEREAS, the Research Screening Committee has reviewed and recommends for funding:

Proposal Number 2550-239 entitled "Analysis of Building Characteristics and indoor Environmental Quality in California Classrooms", submitted by **Westat**, for a total amount not to exceed \$116,780.

NOW, THEREFORE, BE IT RESOLVED, that the Air Resources *Board*, pursuant to the authority granted by Health and Safety Code section 39703, hereby accepts the recommendation of the Research Screening Committee and approves the following:

Proposal Number 2550-239 entitled "Analysis of Building Characteristics and Indoor Environmental Quality in California Classrooms", submitted by **Westat**, for a total amount not to exceed \$116,780.

BE IT FURTHER RESOLVED, that the Executive **Officer** is hereby authorized to initiate administrative procedures and execute all necessary documents and contracts for the research effort proposed herein, and as described in Attachment A, in *an* amount not to exceed \$116,780.

ATTACHMENT A

"Analysis of Building Characteristics and Indoor Environmental Quality in
California Classrooms"

Background

The Air Resources Board (ARB) and the Department of Health Services (DHS) recently conducted a study to assess environmental health conditions in California's portable classrooms, as required by California Health and Safety Code Section 39619.6. A great deal of new data were collected for the Portable Classrooms Study (PCS). However, detailed analyses of some of these data were not funded in the initial study. The ARB needs further analyses of the PCS data to help refine specific recommendations to schools and guide further activities for preventing indoor environmental quality (IEQ) problems in schools. The California Energy Commission (Commission) is also interested in further analysis of the PCS data in order to obtain information needed for revising their building energy efficiency standards for schools. The Commission is providing the major portion of the funding for this effort.

Objective

The objectives of this project are to further analyze variables on ventilation, other energy-related factors, and socioeconomic indicators, and to examine their relationship to indoor air quality and other environmental characteristics, in both portable and traditional classrooms.

Methods

The contractor will conduct basic statistical and multivariate analyses of the relationship between ventilation, other energy-related factors, and socioeconomic indicators to indoor air quality and other environmental characteristics, using statistical methods and software programs appropriate for population-weighted data.

Expected Results

The contractor will provide weighted descriptive statistics for variables on detailed building characteristics related to ventilation, temperature, relative humidity, noise, and lighting, that were not previously analyzed.

The contractor will analyze the relationships between key building performance variables and indoor environmental quality variables, using appropriate techniques for descriptive and multivariate methods available. The data analyses will explore four main types of associations: 1) between ventilation rates and/or ventilation indicators and the levels of indoor air pollutants, noise, teacher satisfaction, and other factors measured in the PCS; 2) between natural ventilation (use of open doors and windows) and levels of indoor air pollutants, moisture, noise, teacher satisfaction, and other factors measured in the PCS; 3) between lighting levels/type and teacher satisfaction and other factors; 4) between pollutant levels (indoor and outdoor) and a school's

socioeconomic indicators, such as student body **ethnicity** and proximity to **nearby pollutant sources**.

The contractor, in consultation with ARB and Commission staff, will also conduct further analyses based on findings of the analyses described above.

Significance to the Board

The results of this study will help the ARB to better understand the impacts of ventilation types, other energy-related factors, and socioeconomic indicators on indoor pollution levels, including levels of Toxic Air Contaminants (TACs). ARB staff will also use results to help refine specific recommendations to schools and guide further activities for preventing IEQ problems in schools. The Commission will use the results to improve energy efficiency and IEQ in California schools through revised building standards.

Contractor:

Westat

Contract Period:

18 months

Principal Investigator (PI):

Robert Paul Clickner, Ph.D.

Contract Amount:

\$116,780

Cofunding:

The California Energy Commission is contributing \$100,000 to the cost of this study.

Basis for indirect Cost Rate:

The indirect cost is part of their fully loaded rates.

Past Experience with this Principal Investigator:

Dr. Robert Clickner is an Associate Director at Westat and a senior statistician with 31 years of experience in the development, implementation, and management of statistical and environmental research projects. He has directed a number of major environmental studies of exposure to heavy metals, pesticides, lead-based paint in homes, indoor environmental quality, asbestos in schools, and industrial solid waste. Dr. Clickner has designed and analyzed national statistical surveys using a variety of optimization and modeling techniques, and has analyzed numerous environmental exposure survey databases, both weighted and unweighted. Dr. Clickner has presented numerous invited papers before universities, professional and technical organizations, and international institutes, and has served on the Board of Councilors of the International Society of Exposure Analysis. Although Dr. Clickner has not previously done work for the ARB, staff are familiar with his work on several, large federally funded exposure projects, which is impressive, and believe he is well-suited for this project.

Prior Research Division Funding **to Westat:**

Year	2003	2002	2001
Funding	\$0	\$0	\$0

BUDGET SUMMARY

Westat

Analysis of Building Characteristics and Indoor Environmental
Quality in California Classrooms

DIRECT COSTS AND BENEFITS

1.	Labor and Employee Fringe Benefits	\$93,977	
2.	Subcontractors	\$16,866	
3.	Equipment	\$ 0	
4.	Travel and Subsistence	\$ 2,796	
5.	Electronic Data Processing	\$ 672	
6.	Reproduction/Publication	\$ 823	
7.	Mail and Phone	\$ 823	
8.	Supplies	\$ 823	
9.	Analyses	\$ 0	
10.	Miscellaneous	<u>\$ 0</u>	
	Total Direct Costs		\$116,780

INDIRECT COSTS'

1.	Overhead	\$ 0	
2.	General and Administrative Expenses	\$ 0	
3.	Other indirect Costs	\$ 0	
4.		<u>\$ 0</u>	

Total Indirect Costs \$ 0

TOTAL PROJECT COSTS \$116,780

1. Indirect Costs are included in the fully loaded rates used in Labor and Employee Benefits

Attachment 1

SUBCONTRACTORS' BUDGET SUMMARY

Subcontractor: Building Ecology Research Group

Description of subcontractors responsibility: Hal Levin of Building Ecology Research Group would provide California-based indoor air quality and ventilation expertise in the analyses of data and interpretation of results.

DIRECT COSTS AND BENEFITS

1.	Labor and Employee Fringe Benefits	\$14,850	
2.	Subcontractors	\$ 0	
3.	Equipment	0	
4.	Travel and Subsistence	\$ 540	
5.	Electronic Data Processing	\$ 0	
6.	Reproduction/Publication	\$ 0	
7.	Mail and Phone	\$ 0	
8.	Supplies	\$ 0	
9.	Analyses	\$ 0	
10.	Miscellaneous	\$ 0	
	Total Direct Costs		\$15,390

INDIRECT COSTS

1.	Overhead	\$ 0	
2.	General and Administrative Expenses	\$ 0	
3.	Other Indirect Costs	\$ 1,476 ¹	
4.	Fee or Profit	\$ 0	
	Total Indirect Costs		<u>\$16,866</u>

TOTAL PROJECT COSTS **\$16,866**

(notes)

1. Indirect Costs are for Westat's administrative charges.

TITLE 13. CALIFORNIA AIR RESOURCES BOARD

NOTICE OF PUBLIC HEARING TO CONSIDER ENGINE MANUFACTURER DIAGNOSTIC SYSTEM REQUIREMENTS FOR 2007 AND SUBSEQUENT MODEL YEAR HEAVY-DUTY ENGINES (EMD)

The Air Resources Board (the 'Board" or "ARB") will conduct a public hearing at the time and place noted below to consider adoption of proposed California EMD requirements for 2007 and subsequent model year heavy-duty engines.

DATE: May 20.2004

TIME: 9:00 a.m.

PLACE: California Environmental Protection Agency
Air Resources Board
1001 I Street
Central Valley Auditorium, Second Floor
Sacramento, California 95814

This item will be considered at a two-day meeting of the Board, which will commence at 9:00 a.m., May 20, 2004, and may continue at 8:30 a.m., May 21, 2004. This item might not be considered until May 21, 2004. Please consult the agenda for the meeting, which will be available at least ten days before May 20, 2004, to determine the day on which this item will be considered.

This facility is accessible to persons with disabilities. If you have special accommodation or language needs, please contact the ARB's Clerk of the Board at (916) 322-5594 or landreon@arb.ca.gov as soon as possible. TTY/TDD/Speech-to-Speech users may dial 7-1-1 for the California Relay Service.

INFORMATIVE DIGEST OF PROPOSED ACTION AND POLICY STATEMENT OVERVIEW

Sections Affected: Proposed adoption of title 13, California Code of Regulations (CCR) section 1971 for 2007 and subsequent model year heavy-duty engines.

Background: The Board originally adopted title 13, CCR section 1968.1 in 1989, which required manufacturers to implement second generation on-board diagnostic (OBD II) systems on new motor vehicles sold in California. OBD II systems serve an important role in helping to ensure that vehicles maintain low emissions and meet the emission standards. The regulation was first implemented beginning with the 1994 model year, and requires that essentially all new 1996 and later model year passenger cars, light-duty trucks, and medium-duty vehicles and engines be equipped with OBD II systems. The regulation specifically requires monitoring of engine misfire, catalysts, oxygen sensors, evaporative systems, fuel systems, and electronic power-train components, among other components and systems that can affect emissions when malfunctioning.

The regulations also require OBD II systems to provide specific diagnostic information in a standardized format through a standardized serial data link on-board the vehicles. Subsequently, the Board adopted section 1968.2 in 2002, which established OBD II requirements, for 2004 and subsequent model year passenger cars, light-duty trucks, and medium-duty vehicles and engines.

Currently, 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). Unfortunately, the emissions emitted from 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 (NO_x) and particulate matter (PM) emissions, respectively. NO_x is a precursor to ozone 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* problem in *meeting* state and federal ambient air quality standards. Additionally, the emission standards for heavy-duty vehicles have become increasingly stringent over the years. By 2004, the heavy-duty diesel emission standards for NO_x and PM have been reduced by over 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 in 2008. 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.

California's problems with ozone pollution continue to be the worst in the nation. In an effort to meet federal and state ambient air quality standards and comply with the federally mandated State Implementation Plan (SIP) to meet those standards, California has continued to be in the forefront in adopting the most stringent motor vehicle emissions control program in the nation. To complement the new emission standards for heavy-duty diesel engines, measure 17 (M17) was included as part of the SIP. Adopting diagnostic requirements for heavy-duty vehicles is an essential first step towards M17 to reduce emissions from on-road heavy-duty diesels.

Staff Proposal: As stated above, considering the amount of pollution emitted from heavy-duty vehicles (particularly NO_x and PM emissions from diesel vehicles) and the increasingly stringent emission standards that will be phased in starting in the 2007-2008 timeframe, there must be some assurance that low emissions are maintained and the stringent standards are met in-use.

Staff is proposing the adoption of title 13, CCR section 1971 that would require first-generation diagnostic systems be equipped on all 2007 and subsequent model year on-road heavy-duty engines and vehicles produced for sale in California with a GVWR greater than 14,000 pounds. These proposed requirements, which are referred to as engine manufacturer diagnostic system (EMD) requirements, 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 system by the 2007 model year when emission standards become more stringent and universal use of particulate filters is expected. The EMD system would help ensure that the engines are able to meet the new emission 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. Having first adopted OBD II requirements for light-duty and medium-duty vehicles in 1989, ARB staff has had extensive experience with OBD systems and in developing diagnostic requirements.

The proposal, however, does not reflect the level of diagnostics that staff plans on presenting to the Board for consideration in 2005 that will more closely reflect light- and medium-duty OBD II requirements. 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.

The proposed EMD regulation would require manufacturers to monitor the fuel system, exhaust gas recirculation (EGR) system, the PM trap, and emission-related electronic components. Unlike the requirements for light-duty vehicles, the proposed EMD monitoring requirements would not require manufacturers to tie the monitors to the emission standards (i.e., to indicate a malfunction before a specific emission threshold is reached). When a malfunction is detected, the proposed regulation would require the EMD system to illuminate a warning light, which could be an existing light or a new light based on the manufacturers preference. Additionally, though the EMD system would be required to output diagnostic information for use by repair technicians, the proposed regulation would not establish standardized requirements defining the content or **format** of **specific** information required to be output.

As stated, this regulation is intended to be the first step towards adopting comprehensive heavy-duty OBD requirements analogous to the OBD II regulation. In the near future, staff will be proposing this more complete OBD regulation for the Board's consideration. The future heavy-duty OBD regulation would address the new and improved emission control technologies used to help meet the 2010 standards as well as include requirements that would assist repair technicians and facilitate implementation of heavy-duty OBD checks in inspection and maintenance or other roadside inspection programs.

COMPARABLE FEDERAL REGULATIONS

Currently, the United States Environmental Protection Agency (U.S. EPA) has OBD requirements only for light-duty vehicles and trucks and federally defined "heavy-duty" vehicles and engines with a 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). However, like ARB, the U.S. EPA currently does not have OBD requirements for vehicles and engines above 14,000 pounds, which is the weight

range for California's "heavy-duty" class. The U.S. EPA staff has indicated its intent to propose and adopt an OBD regulation for heavy-duty vehicles and engines over 14,000 pounds in the near future, and has indicated a strong interest in developing harmonized ARB and federal OBD programs.

AVAILABILITY OF DOCUMENTS AND AGENCY CONTACT PERSONS

The ARB staff has prepared a Staff Report: Initial Statement of Reasons (ISOR) for the proposed regulatory action that includes a summary of the environmental and economic impacts of the proposal. The report is entitled: Engine Manufacturer Diagnostic Requirements for 2007 and Subsequent Model Year Heavy-Duty Engines (EMD).

Copies of the ISOR and the full text of the proposed regulatory language may be accessed on the ARB's web site listed below, or may be obtained from the Public Information Office, Air Resources Board, 1001 "I" Street, Visitors and Environmental Services Center, 1st Floor, Sacramento, California 95814, (916) 322-2990 at least 45 days prior to the scheduled hearing (May 20, 2004).

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

Inquiries concerning the substance of the proposed regulation may be directed to the designated agency contact persons for this rulemaking: Jason Wong, Air Resources Engineer, at (626) 575-6838 or e-mail jjwong@arb.ca.gov, or Mike McCarthy, Manager, Advanced Engineering Section, Mobile Source Control Division, at (626) 575-6615 or e-mail mmccarth@arb.ca.gov.

Further, the agency representative and designated back-up contact persons to whom nonsubstantive inquiries concerning the proposed administrative action may be directed are Artavia Edwards, Manager, Board Administration & Regulatory Coordination Unit, (916) 322-6070, or Alexa Malik, Regulations Coordinator, (916) 3224011. The Board has compiled a record for this rulemaking *action*, which includes all the information upon which the proposal is based. This material is available for inspection upon request to the agency contact persons.

If you are a person with a disability and desire to obtain this document in an alternative format, please contact the ARB's Clerk of the Board at (916) 322-5594 or landreon@arb.ca.gov as soon as possible. TTY/TDD/Speech-to-Speech users may dial 7-1-1 for the California Relay Service.

This notice, the ISOR, and subsequent regulatory documents, including the FSOR, when completed, are available on the ARB internet site for this rulemaking at: www.arb.ca.gov/regact/emd2004/emd2004.htm.

COSTS TO PUBLIC AGENCIES AND TO BUSINESSES AND PERSONS AFFECTED,

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

Pursuant to Government Code sections **11346.5(a)(5)** and **11346.5(a)(6)**, the Executive Officer has determined that the proposed **regulatory** action will result in some additional costs to ARB but will **not create** cost or savings to any other state agencies. In addition, the Executive Officer has determined that the proposed regulatory action will not create costs or savings in federal funding to the state, costs or mandate to any local agency or school district whether or not reimbursable by the state pursuant to Part 7 (commencing with section **17500**), Division 4, Title 2 of **the Government Code**, or other nondiscretionary savings to state or local agencies.

In developing this regulatory proposal, ARB staff evaluated the potential economic impacts on representative private persons and businesses. The ARB is not aware of any significant cost impacts that a representative private person or business would necessarily incur in reasonable compliance with the proposed action.

The Executive **Officer** has made an initial determination that the adoption of this regulation will not have a significant statewide adverse economic impact directly affecting businesses, including the ability of California businesses to compete with business in other states. Support for this determination is set forth in the **ISOR**.

The Executive **Officer** has further found pursuant to Government Code sections **11 346.5(a)(10)** and 11346.3(b) that the proposed regulation would have minor or no impact on the creation and elimination of jobs within the State of California, the creation of **new** businesses or elimination of existing businesses within California, or the expansion of businesses currently doing business within California.

The businesses to which the proposed requirements are primarily addressed and for which compliance would be required are manufacturers of **California-certified heavy-duty** engines and other powertrain components (e.g., transmissions) used in heavy-duty vehicles. None of these businesses are located in California. The proposed requirements are also addressed to manufacturers of heavy-duty vehicles (assemblers, coach builders, etc.) installed with California-certified heavy-duty engines.

For all of the manufacturers identified above, the costs are expected to be negligible to comply **with** the proposed regulatory action. Manufacturers would be able to meet the proposed monitoring requirements without the addition of extra hardware on the vehicle or engine.

In developing this regulatory proposal, ARB staff has found that the proposed regulation will pose no adverse economic impact on private persons and businesses as consumers. The Executive **Officer** has determined that there will be no, or negligible, potential cost impact on representative private persons or businesses as a result of the

proposed regulatory action. The proposed requirements are not expected to increase the rate or the cost of vehicle repairs, so no cost impact on consumers is expected.

The Executive Officer has also determined, pursuant to title 1, CCR, section 4, that the proposed regulatory action will affect a minimal number of small businesses.

The Executive Officer has determined, pursuant to Government Code section 11346.3(c) and 11346.5(a)(11), that the reporting requirements that apply to manufacturers are necessary for the health, safety, and welfare of the people of the State of California.

The proposed regulatory action would require manufacturers to file written reports. The requirements would be minimal and should have a negligible impact on vehicle costs.

Before taking final action on the proposed regulatory action, the Board must determine that no reasonable alternative considered by the agency or that has otherwise been identified and brought to the attention of the agency would be more effective in carrying out the purpose for which the action is proposed or would be as effective and less burdensome to affected private persons than the proposed action.

FINDING OF NECESSITY FOR REPORTS

Pursuant to Government Code section 11346.3(c), the Board finds that it is necessary for the health, safety, and welfare of the people of this state that this regulation which requires a report apply to businesses.

SUBMITTAL OF COMMENTS

The public may present comments relating to this matter orally or in writing at the hearing, and in writing or by e-mail before the hearing. To be considered by the Board, written submissions not physically submitted at the hearing must be received by no later than 12:00 noon, May 19, 2004 and addressed to the following:

Postal Mail is to be sent to:

Clerk of the Board
Air Resources Board
1001 I Street, 23rd Floor
Sacramento, California 95814

Electronic mail is to be sent to: emd2004@listserv.arb.ca.gov and received at the ARB no later than 12:00 noon, May 19, 2004.

Facsimile submissions are to be transmitted to the Clerk of the Board at (916) 322-3928 and received at the ARB no later than 12:00 noon, May 19, 2004.

The Board requests, but does not require, that 30 copies of any written statement be submitted and that all written statements be filed at least 10 days prior to the hearing so

that ARB staff and Board Members have time to fully consider each comment. The ARB encourages members of the public to bring to the attention of the staff in advance of the hearing any suggestions for modification of the proposed regulatory action.

STATUTORY AUTHORITY AND REFERENCES

This regulatory action is proposed under that *authority granted in Health and Safety Code*, sections 39600, 39601, 43000.5, 43013, 43018, 43100, 43101, and 43104. This action is proposed to implement, interpret and make specific sections 39002, 39003, 39010-39060, 39515, 39600-39601, 43000, 43000.5, 43004, 43006, 43013, 43016, 43018, 43100, 43101, 43102, 43104, 43105, 43105.5, 43106, 43150-43156, 43204, 43211, and 43212 of the Health and Safety Code.

HEARING PROCEDURES AND AVAILABILITY OF MODIFIED TEXT

The public hearing will be conducted in accordance with the California Administrative Procedure Act, Title 2, Division 3, Part 1, Chapter 3.5 (commencing with section 11340) of the Government Code.

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

The public may request a copy of the modified regulatory text from the Boards Public Information Office, Air Resources Board, 1001 "I" Street, Visitors and Environmental Services Center, 1st Floor, Sacramento, California 95814, (916) 322-2990.

CALIFORNIA AIR RESOURCES BOARD


Catherine Witherspoon
Executive Officer

Date: 3/19/04

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

Request for Staff Report and Proposed Regulatory Language

The documents listed on the lower portion of this page are available on the Air Resources Boards Web Site, which can be accessed at:

<http://www.arb.ca.gov/msprog/obdprog/hdobdreq.htm>

If you would like to receive a hard copy of any of the documents, please mail or fax this form to:

Adriann Medina
California Air Resources Board
9528 Telstar Avenue
El Monte, California 91731

FAX: (626) 575-7012

Phone: (626) 4594405

Please check all that apply:

_____ Staff Report: initial Statement of Reasons. (15 pages)

_____ Proposed EMD Requirements for 2007 and Subsequent Model-Year Heavy-Duty Engines. (4 pages)

Name: _____

Company: _____

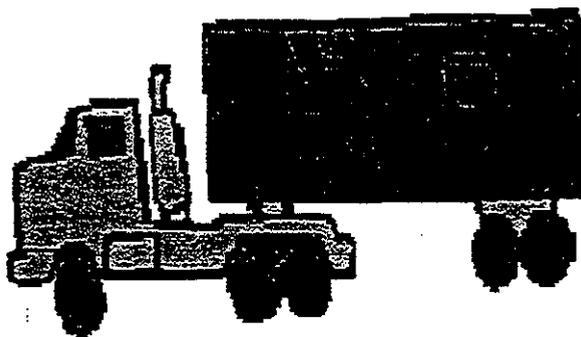
Address: _____

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)**

Date of Release: April 2, 2004
Scheduled for Consideration: May 20, 2004



Mobile Source Control Division
9528 Telstar Avenue
El Monte, California 91731
www.arb.ca.gov

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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 power-train 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 after-treatment technologies (e.g., catalysts, NO_x 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 NO_x after-treatment in order to meet the 2007 standards. Thus, widespread usage of NO_x 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.

EI. 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

Background

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.' 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 power-train

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 NO_x 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 power-train 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 power-train 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
400 Commonwealth Drive
Warrendale, PA 15096-0001, U.S.A.
Phone: 1-677-606-7323 (U.S. and Canada only)
724-776-4970 (outside U.S. and Canada)
Fax: 724-776-0790
E-mail: CustomerService@sae.org
Website: <http://www.sae.org>

Attachment A

Proposed Regulations

Title 13, California Code Regulations, Section 1971, Engine Manufacturer Diagnostic System Requirements for 2007 and Subsequent Model-Year Heavy-Duty Engines (EMD)

§1971 Engine Manufacturer Diagnostic System Requirements-2007 and Subsequent Model-Year Heavy-Duty Engines

(a) PURPOSE

The purpose of this regulation is to establish requirements for engine manufacturer diagnostic systems (EMD systems) that are installed on 2007 and subsequent model-year engines and other powertrain components certified for sale in heavy-duty vehicles in California. The EMD systems, through the use of a computer(s), shall monitor emission systems in-use for the actual life of the engine and shall be capable of detecting malfunctions of the monitored emission systems, illuminating a malfunction indicator light (MIL) to notify the vehicle operator of detected malfunctions, and storing diagnosis information regarding the detected malfunctions.

(b) APPLICABILITY

Except as specified elsewhere in this regulation (title 13, CCR section 1971), all 2007 and subsequent model-year on-road heavy-duty engines shall be equipped with an EMD system and shall meet all applicable requirements of this regulation (title 13, CCR section 1971).¹ For purposes of this regulation, "engine" shall refer to powertrain components (e.g., engine, transmission, hybrid) that are utilized in heavy-duty vehicles.

(c) DEFINITIONS

- (1) "Actual life" refers to the entire period that an engine is operated on public roads in California up to the time an engine is retired from use.
- (2) "Deactivate" means to turn-off, shutdown, desensitize, or otherwise make inoperable through software programming or other means during the actual life of the engine.
- (3) "Functional check" for an output component or system means verification of proper response of the component and system to a computer command.
- (4) "Heavy-duty vehicle" means any motor vehicle having a gross vehicle weight rating greater than 14,000 pounds.
- (5) "Key on, engine off position" refers to a vehicle with the ignition key in the engine run position (not engine crank or accessory position) but with the engine not running.
- (6) "Malfunction" means any deterioration or failure of a component that causes the performance to be outside of the applicable limits in section (e).
- (7) "Manufacturer" includes producers of engines, transmissions, other powertrain components, chassis, or coaches for use in heavy-duty vehicles and includes others involved *in* the assembly or modification of heavy-duty vehicles prior to being registered for on-road use.
- (S) "On-road heavy-duty engine" means an engine certified to the requirements of title 13, CCR sections 1956.1 or 1956.8 or a powertrain component designed for use with such an engine.
- (9) "Rationality fault diagnostic" for an input component means verification of the accuracy of the input signal while in the range of normal operation and when compared to all other available information.

¹ Unless otherwise noted, all section references refer to section 1971 of title 13, CCR

(d) GENERAL REQUIREMENTS**(1) The EMD System.**

(A) If a malfunction is present as specified in section (e), the EMD system shall detect the malfunction.

(B) The EMD system shall provide diagnostic information to service and repair technicians to identify detected malfunctions.

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

(2) MIL Requirements.**(A) MIL Specifications.**

1. The MIL shall be of sufficient illumination and location to be readily visible under all lighting conditions. The MIL, when illuminated, shall display a phrase or icon determined by the manufacturer to be likely to cause the vehicle operator to seek corrective action. In lieu of a dedicated MIL, manufacturers may utilize an existing warning light(s) to also satisfy the requirements of the MIL.
2. The MIL shall illuminate in the key on, engine off position before engine cranking to indicate that the MIL is functional. This functional check of the MIL is not required during vehicle operation in the key on, engine off position subsequent to the initial engine cranking of an ignition cycle (e.g., due to an engine stall or other non-commanded engine shutoff).

(B) Illuminating the MIL.

Once a malfunction has been detected, the EMD system shall illuminate the MIL in accordance with the manufacturer's existing practices for notifying vehicle operators and service technicians.

(C) Extinguishing the MIL.

Once the MIL has been illuminated, it may be extinguished upon the EMD system determining that the malfunction is no longer present provided no other malfunction has been detected that would independently illuminate the MIL according to the requirements outlined above.

(3) Monitoring Conditions.

Manufacturers shall define monitoring conditions for detecting malfunctions identified in section (e) and for determining if malfunctions no longer exist.

(e) MONITORING REQUIREMENTS**(1) FUEL SYSTEM MONITORING**

(A) Requirement: The EMD system shall monitor the fuel delivery system.

(B) Malfunction Criteria: If the engine is equipped with feedback control of the fuel pressure, the EMD system shall detect a malfunction of the fuel system when the

feedback control system has used up all of the adjustment allowed by the manufacturer and cannot achieve the desired fuel pressure.

(2) EXHAUST GAS RECIRCULATION (EGR) SYSTEM MONITORING

(A) Requirement: The EMD system shall monitor the EGR system on engines so-equipped.

(B) Malfunction Criteria:

1. Low Flow: The EMD system shall detect a malfunction of the EGR system when the system has reached its control limits such that it cannot increase EGR flow to achieve the commanded flow rate.
2. High Flow: The EMD system shall detect a malfunction of the EGR system when the system has reached its control limits such that it cannot reduce EGR flow to achieve the commanded flow rate.

(3) PARTICULATE MATTER (PM) TRAP MONITORING

(A) Requirement The EMD system shall monitor the PM trap on engines so-equipped.

(B) Malfunction Criteria:

1. Excessive Backpressure: The EMD system shall detect a malfunction when the PM trap fails to regenerate, clogs, or otherwise malfunctions such that it causes the backpressure in the exhaust system to exceed the manufacturer's specified limits for operation.
2. Missing substrate: The EMD system shall detect a malfunction if either the PM trap substrate is completely destroyed, removed, or missing, or if the PM trap assembly is replaced with a straight pipe.

(4) EMISSION-RELATED ELECTRONIC COMPONENT MONITORING

(A) Requirement: The EMD system shall monitor for malfunction any electronic powertrain component/system that either provides input to (directly or indirectly) or receives commands from the on-board computer(s), and: (1) is defined by the manufacturer as emission-related, or (2) is used as part of the diagnostic strategy for any other emission-related monitored system or component

(B) Malfunction Criteria:

1. Input Components: Where determined by the manufacturer to be feasible given existing hardware and software, the EMD system shall detect malfunctions of input components caused by a lack of circuit continuity, out-of-range values, and rationality faults.
2. Output Components/Systems: Where determined by the manufacturer to be feasible given existing hardware and software, the EMD system shall detect a malfunction of an output component/system when proper functional response of the component and system to computer commands does not occur or when a lack of circuit continuity or circuit fault occurs (e.g., short to ground or high voltage).

(f) CERTIFICATION

The Executive Officer shall grant certification for the EMD system upon the manufacturer submitting the following certification information:

- (1) A description of the functional operation of the EMD system.
- (2) A listing of all electronic power-train input and output signals (including those not monitored by the EMD system) that identifies which signals are monitored by the EMD system.

(g) DEFICIENCIES

The Executive **Officer** may certify EMD systems installed on engines even though the systems do not comply with one or more of the requirements of title 13, CCR section 1971. In granting the **certification**, the Executive Officer shall consider the following factors: the extent to which the requirements of section 1971 are satisfied overall based on a review of the engine applications in question, the relative performance of the resultant EMD system compared to systems fully compliant with the requirements of section 1971, and a demonstrated good-faith effort on the part of the manufacturer to: (1) meet the requirements in full by evaluating and considering the best available monitoring technology; and (2) come into compliance as expeditiously as possible. Manufacturers shall not be subject to limitations on the number of granted deficiencies nor subject to fines for granted deficiencies.

NOTE: Authority cited: Sections 39600, 39601, 43000.5, 43013, 43018, 43100, 43101, and 43104, Health and Safety Code. Reference: Sections 39002, 39003, 39010-39060, 39515, 39600-39601, 43000, 43000.5, 43004, 43006, 43013, 43016, 43018, 43100, 43101, 43102, 43104, 43105, 43105.5, 43106, 43150-43156, 43204, 43211, and 43212, Health and Safety Code.

TITLE 13. CALIFORNIA AIR RESOURCES BOARD

NOTICE OF PUBLIC MEETING TO REVIEW AND DISCUSS APPROVED AMENDMENTS TO THE REGULATION FOR THE AVAILABILITY OF CALIFORNIA MOTOR VEHICLE SERVICE INFORMATION

The Air Resources Board (ARB or the Board) will conduct a public meeting to further review and discuss approved amendments to the regulation that requires the availability of emission-related service information for passenger cars, light-duty trucks, **medium-duty** vehicles, and heavy-duty vehicles. These amendments were approved by the Board at the January 22, 2004, hearing. This public meeting shall take place as follows:

DATE: May 20, 2004

TIME: 9:00 a.m.

PLACE: California Environmental Protection Agency
Air Resources Board
Central Valley Auditorium, Second Floor
1001 I Street
Sacramento, CA 95814

This item will be considered at a two-day meeting of the Board, which will commence at 9:00 a.m., May 20, 2004, and may continue at 8:30 a.m., May 21, 2004. This item might not be considered until May 21, 2004. Please consult the agenda for the meeting, which will be available at least 10 days before May 20, 2004, to determine the day on which this item will be considered.

The facility is accessible to persons with disabilities. If you have special accommodation or language needs, please contact the ARB's Clerk of the Board at (916) 322-5594 or landreon@arb.ca.gov as soon as possible. TTY/TDD/Speech-to-Speech users may dial 7-1-1 for the California Relay Service.

At the January 22, 2004, hearing, the Board unanimously approved amendments to the original service information regulation. Among other things, the amendments broaden the scope of the regulation to include 2007 model year and later heavy-duty vehicles equipped with on-board diagnostic (OBD) systems. The staff's update to the Board and the Board-approved amendments also addressed the issue of information access for immobilizer anti-theft system initialization. In conjunction with its approval of the amendments, the Board directed the staff to meet with affected stakeholders and report back on the following issues at the time that the Board considers adopting OBD requirements for heavy-duty vehicles:

1. Manufacturer liability issues related to the potential misuse of heavy-duty data stream information, bidirectional information, and diagnostic and reprogramming tools made available for purchase to aftermarket technicians.
2. Continued concerns of aftermarket stakeholders that the technical solution identified by ARB staff to facilitate bench testing of remanufactured light duty

42 vehicle on-board computers equipped with immobilizer anti-theft strategies is not feasible.

The Board also indicated at the January 22 hearing that it would accept additional comments on its adoption of service information requirements for heavy-duty vehicles in light of new staff proposals for OBD requirements.

Inquiries concerning these issues may be directed either Mr. Dean Hermano, Air Resources Engineer, at (626) 4594487, or Mr. Allen Lyons, Chief, Mobile Source Operations Division at (626) 450-6156. All regulatory documents related to the approved amendments are available on the following ARB Internet site:
<http://www.arb.ca.gov/reqact/cmvsip04/cmvsip04.htm>

The public may present comments relating to this matter orally or in writing at the hearing, and in writing or by e-mail before the hearing. To be considered by the Board, written submissions not physically submitted at the hearing must be received no later than 12:00 noon, May 19, 2004, and addressed to the following:

Postal Mail is to be sent to:

Clerk of the Board
Air Resources Board
1001 "I" Street, 23rd Floor
Sacramento, California 95814

Electron/c mail is to be sent to: cmvsip04@listserv.arb.gov and received at the ARB by no later than 12:00 noon, May 19, 2004.

Facsimile submissions are to be transmitted to the Clerk of the Board at (916) 322-3928 and received at the ARB no later than 12:00 noon, May 19, 2004.

The Board requests, but does not require, 30 copies of any written statement be submitted and that all written statements be filed at least 10 days prior to the hearing so that ARB staff and Board Members have time to fully consider each comment. The ARB encourages members of the public to bring any suggestions for modification of the regulatory language, relative to the above issues, to the attention of staff in advance of the hearing.

CALIFORNIA AIR RESOURCES BOARD


Catherine Witherspoon
Executive Officer

Date: April 27, 2004

**No written material was available at the time this
electronic board book was created.**