California Environmental Protection Agency

Air Resources Board

PUBLIC MEETING AGENDA

REVISED

LOCATION:
South Coast Air Quality Management District
Auditorium
21865 East Copley Drive
Diamond Bar, CA 91765-4182

This facility is accessible by public transit. For transit information, call: (800) 743-3463, http://www.foothilltransit.org/ (This facility is accessible to persons with disabilities.)

September 15, 2005
9:00 A.M.

05-8-1: Public Hearing to Consider a Health Update: Results of a Study Linking Particle Pollution to Atherosclerosis in Los Angeles

Staff will present the results of a study using the data of 798 participants from two clinical trials to investigate the association between atherosclerosis and long-term exposure to ambient PM2.5 in the Los Angeles Basin. The study found an increase in corotid intima-media thickness (CIMT), a quantitative measure of atherosclerosis. For each 10 ug/m^3 increase in $PM_{2.5}$ exposure a 5.9 percent increase in CIMT was observed. These results represent the first epidemiologic evidence of an association between atherosclerosis (which is an underlying factor in cardiovascular disease) and ambient air pollution.

05-8-2: Public Hearing to Consider five (5) Research Proposals

1. *"Follow-on Development of CARBITS," University of California, Davis, $100,000, Proposal No. 2587-249.*
2. *"Assessment of Health Impacts of Particulate, Matter from Indoor Sources," University of California, Davis, $399,998, Proposal No. 2588-249.*
3. *"Responses to Short-Term Fluctuation in Particulate Air Pollution in Asthmatic Children: Implications for Asthma Natural History," University of California, Berkeley, $350,000, Proposal No. 2591-249.*
4. *"Environmental Justice Saturation Monitoring of Selected Pollutants in Wilmington," Desert Research Institute, $399,994, Proposal No. 2589-249.*
5. *"Survey of the Use of Ozone-Generating Air Cleaners by the California Public," University of California, Berkeley, $99,997, Proposal No. 2590-249.*

05-6-3: (THIS ITEM WILL BE RECALENDARED FOR OCTOBER 20, 2005) Public Hearing to Consider the Adoption of Emission Standards and Test Procedures for New 2007 and Later Off-Road Large Spark-Ignition (LSI) Engines and Fleets Requirements for Users of Off-Road LSI Engines

This regulation for Board consideration would align California LSI engine standards with certification standards adopted by the U.S. EPA beginning in 2007, adopt more stringent emission standards for 2010 and later, and allow engine manufacturers the option to certify to lower emission standards. The regulation would also establish fleet average requirements for specific LSI equipment including forklifts, sweeper/scrubbers and airport ground support equipment. A new procedure for verifying the performance of retrofit emission control equipment is also proposed. This is a continuation of a hearing conducted June 23, 2005.

05-8-3: Overview and Background for Agenda Items Relating to Fleet Rules in South Coast Air Quality Management District: Agenda Items 05-8-4, 05-8-5, and 05-8-6

05-8-4: Public Hearing to Consider the Adoption of a Clean On-Road School Bus Regulation for School Buses Operating in the South Coast Air Quality Management District

This regulation for Board consideration would require school districts, private schools, and private transportation companies that contract with school districts to purchase/lease school buses powered by the cleanest engines available, and to retrofit eligible in-use diesel buses with ARB-verified emission control equipment. Integral to the implementation of this regulatory proposal is that it cannot place an unfunded mandate on schools. Compliance with the regulatory proposal would be contingent upon the availability of grant funding or external funding sources.

05-8-5: Public Hearing to Consider the Proposed Modification of the Diesel Particulate Control Measure for On-Road Heavy-Duty Residential and Commercial Solid Waste Collection Vehicles: Fleet Rule for the South Coast Air Quality Management District

The proposal requires all owners of solid waste collection vehicles operating in the South Coast Air Quality Management District, whether owned or operated by public agencies or private companies, to purchase the lowest emitting trucks available. Staff projects that the lowest emitting trucks will be alternative-fueled, most likely natural gas, through the 2009 model year.

05-8-6: Public Hearing to Consider Amendments to the Exhaust Emission Standards and Test Procedures – 1985 and subsequent Model Heavy-Duty Urban Bus Engines and Vehicles and the Fleet Rule for Transit Agencies Specific to Agencies Operating in the South Coast Air Basin (Noticed as "Public Hearing to Consider Proposed Amendments to the Exhaust Emission Standards for 2007-2009 Model-Year Heavy-Duty Urban Bus Engines and the Fleet Rule for Transit Agencies")

Staff has developed two specific amendments. First, staff has developed a new proposed requirement that all transit agencies operating in the District be required to follow the alternative-fuel compliance path, as defined in ARB's regulations. Under ARB's current regulations, transit agencies made a non-revocable election to follow either the diesel fuel path or the alternative-fuel path, as of January 1, 2001. Of the 17 transit agencies in the District, 11 chose the alternative-fuel path, and six chose the diesel path. Under the proposal, the six transit agencies in the District currently on the diesel fuel compliance path would be required to change to the alternative-fuel path effective January 1, 2006. This change would lock these transit agencies into purchasing alternative-fuel engines through 2015, consistent with South Coast Air Quality Management District's Rule 1192.

A second set of proposed amendments originally scheduled for this hearing is being recalendared for October 20, 2005. In these amendments, staff is proposing deletion of the current 2007 and beyond exhaust emission standard for urban bus engines and alignment of the urban bus standards with the California heavy-duty truck engine exhaust emission standards for 2007 and beyond. When those amendments are considered, the Board will also consider a possible statewide requirement that all transit agencies currently on the diesel fuel compliance path – including those outside the South Coast Air District – would be required to change to the alternative fuel path effective January 1, 2006.

05-8-7: Public Hearing to Consider the Proposed Amendments to the Portable Fuel Container (PFC) Regulations

The Board will consider amendments to the existing portable fuel container (PFC) regulations. The PFC regulations currently control Reactive Organic Gases from three main processes: evaporation, permeation, and spillage. The proposed amendments to the existing regulations are intended to improve consumer acceptance with the existing PFCs, reduce emissions from spillage, and include kerosene containers into the definition of a PFC.

TO SUBMIT WRITTEN COMMENTS ON AN AGENDA ITEM IN ADVANCE IF THE MEETING:

CONTACT CLERK OF THE BOARD, 1001 I Street, 23rd Floor, Sacramento, CA 95814 **(916) 322-5594**
FAX: (916) 322-3928
ARB Homepage: www.arb.ca.gov

To request special accommodation or language needs, please contact the following:

- TTY/TDD/Speech-to-Speech users may dial 7-1-1 for the California Relay Service.
- Assistance for Disability-related accommodations, please go to http://www.arb.ca.gov/html/ada/ada.htm or contact the Air Resources Board ADA Coordinator, at (916) 323-4916.
- Assistance in a language other than English, please go to http://www.arb.ca.gov/as/eeo/languageaccess.htm or contact the Air Resources Board Bilingual Coordinator, at (916) 324-5049.

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

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.

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

California Environmental Protection Agency

Air Resources Board

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PUBLIC MEETING AGENDA

INDEX

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		Pages
05-8-1:	Public Hearing to Consider a Health Update: Results of a Study Linking Particle Pollution to Atherosclerosis in Los Angeles	---
05-8-2:	Public Hearing to Consider five (5) Research Proposals	---
05-8-3:	Overview and Background for Agenda Items Relating to Fleet Rules in South Coast Air Quality Management District: Agenda Items 05-8-4, 05-8-5, and 05-8-6	---
05-8-4:	Public Hearing to Consider the Adoption of a Clean On-Road School Bus Regulation for School Buses Operating in the South Coast Air Quality Management District	1 - 134
05-8-5:	Public Hearing to Consider the Proposed Modification of the Diesel Particulate Control Measure for On-Road Heavy-Duty Residential and Commercial Solid Waste Collection Vehicles: Fleet Rule for the South Coast Air Quality Management District	135 - 306
05-8-6:	Public Hearing to Consider Amendments to the Exhaust Emission Standards and Test Procedures – 1985 and subsequent Model Heavy-Duty Urban Bus Engines and Vehicles and the Fleet Rule for Transit Agencies Specific to Agencies Operating in the South Coast Air Basin (Noticed as "Public Hearing to Consider Proposed Amendments to the Exhaust Emission Standards for 2007-2009 Model-Year Heavy-Duty Urban Bus Engines and the Fleet Rule for Transit Agencies")	307 - 436
05-8-7:	Public Hearing to Consider the Proposed Amendments to the Portable Fuel Container (PFC) Regulations	437 - 572

TITLE 13. CALIFORNIA AIR RESOURCES BOARD

NOTICE OF PUBLIC HEARING TO CONSIDER THE ADOPTION OF A CLEAN ON-ROAD SCHOOL BUS REGULATION FOR SCHOOL BUSES OPERATING IN THE SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

The Air Resources Board (ARB or Board) will conduct a public hearing at the time and place noted below to consider adoption of a regulation for school buses operating in the South Coast Air Quality Management District (SCAQMD or District). Both owners of public and private school bus fleets and private companies under contract to a school district are affected by this proposal. This notice summarizes the proposed control measure. The staff report presents the control measure in greater detail.

DATE: September 15-16, 2005

TIME: 9:00 a.m.

PLACE: South Coast Air Quality Management District
Auditorium
21865 East Copley Drive
Diamond Bar, California 91765

This item will be considered at a two-day meeting of the Board, which will commence at 9:00 a.m., September 15, 2005, and may continue at 8:30 a.m., September 16, 2005. This item may not be considered until September 16, 2005. Please consult the agenda for the meeting, which will be available at least 10 days before September 15, 2005, to determine the day on which this item will be considered.

If you have a disability-related accommodation need, please go to http://www.arb.ca.gov/html/ada/ada.htm for assistance or contact the ADA Coordinator at (916) 323-4916. If you are a person who needs assistance in a language other than English, please contact the Bilingual Coordinator at (916) 324-5049. 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 new sections 2024 and 2024.1 of article 4 within chapter 1, division 3, title 13, California Code of Regulations (CCR).

Background: The Air Resources Board (ARB or the Board) is the state agency responsible for protecting public health and the environment from the harmful effects of air pollution. The ARB has the sole responsibility for controlling emissions from vehicular sources, except as otherwise provided by law.

The SCAQMD is the sole and exclusive local agency within the South Coast Air Basin and the desert portion of Riverside County in the Salton Sea Air Basin with responsibility for comprehensive air pollution control. The South Coast Air Basin has been designated as a serious nonattainment area for particulate matter (PM) and an extreme nonattainment area for ozone. In 1987, the Legislature enacted Health and Safety Code section 40447.5, which authorizes SCAQMD to adopt regulations that require operators of 15 or more public and commercial fleet vehicles, when adding or replacing vehicles, to purchase vehicles that are capable of operating on methanol or other equivalently clean-burning alternative fuel.

Under its Clean Fleets program, SCAQMD adopted seven fleet rules during the years 2000 and 2001. These rules were developed to gradually shift public agencies and certain private entities to lower emissions by requiring them to acquire alternative fuel vehicles whenever an operator with 15 or more vehicles purchased or leased vehicles for replacement or addition to its fleet. One of the seven rules is Rule 1195 for Clean On-Road School Buses.

Shortly after the District adopted its fleet rules, the Engine Manufacturers (EMA) and the Western States Petroleum Association (WSPA) sued the District in federal court challenging its authority to adopt the rules. In April 2004, the United States Supreme Court ruled that it appears likely that at least certain aspects of the fleet rules were preempted by section 209(b) of the federal Clean Air Act. The Supreme Court remanded the case back to the federal District Court to determine whether some parts of the fleet rules could be characterized as state purchasing decisions and, if so, whether preemption applied. In response to this decision, SCAQMD requested that ARB submit the District's rules to the United States Environmental Protection Agency (U.S. EPA) for a waiver of preemption pursuant to section 209(b) of the Clean Air Act. The ARB requested public comment and consulted with U.S. EPA regarding the legal requirements for obtaining a waiver for a rule adopted by a local government. The ARB staff concluded that the fleet rules, as written and adopted by SCAQMD, would not receive a section 209(b) waiver because these rules have not been adopted by ARB as state regulations (applicable within the boundaries of SCAQMD).

When the State Legislature adopted Health and Safety Code section 40447.5, it intended that SCAQMD have the authority to adopt and implement clean fuel fleet rules. Accordingly, ARB staff has reviewed the information and prepared the present proposal, which through the state rulemaking process, is meant to support the intent of the State Legislature.

Meanwhile, on May 5, 2005, the federal District Court ruled that, under the "market participant" doctrine, the SCAQMD fleet rules are not preempted to the extent they apply to purchasing decisions made by state and local governmental entities. However, the District Court has not yet addressed questions of whether the fleet rules are preempted as they apply to private entities under contract with state or local governments or to used or leased vehicles. It is also possible that EMA or WSPA could appeal the "market participant" decision.

Proposed Actions: The ARB and the local air districts recognize that emissions from diesel-fueled engines and vehicles are a serious public health concern, particularly for school age children who are more susceptible to their harmful health effects. The proposed regulation would require school districts, private schools, and private companies that contract with school districts to provide school bus services, to purchase/lease school buses powered by the cleanest engines available when adding or replacing school buses in the fleet. Proposed sections 2024 and 2024.1, title 13, CCR, would comprise the clean on-road school bus regulation for school buses operating in SCAQMD.

1. Scope and Applicability

The proposed regulation establishes requirements that apply beginning in the 2005 model year when school buses are purchased or leased by public and private school bus fleets that operate 15 or more buses within SCAQMD. Sufficient funding through grants or other sources external to the school bus fleet's budget must be available to fully cover the cost difference between a school bus purchase that would be made in the absence of the regulation and the school bus purchase or lease that meets the proposal's emission criteria. If this funding is not available, the school bus fleet operator may apply for an exemption from these requirements.

The proposed regulation also requires that operators of public and private school bus fleets of 15 or more buses install verified diesel emission control methods on at least 25 percent of their in-use diesel buses for which a method is available each year, beginning January 1, 2006. Sufficient grants or other sources external to the school bus fleet's budget must be available to cover the cost and installation of the verified diesel emission control method.

A school bus is defined as any vehicle that is used for the specific purpose of carrying students between home and school and to school activities. This applies to students through the twelfth grade. A medium-duty school bus is any school bus having a gross vehicle weight rating of 6,000 to 14,000 pounds. A heavy-duty school bus is any school bus with a gross vehicle weight rating of over 14,000 pounds.

2. Purchase and Lease Requirements for Newly Manufactured Vehicles

The regulatory proposal places purchase and lease requirements on operators of school bus fleets of 15 or more medium- and/or heavy-duty school buses. This proposal requires that when adding to or replacing medium- and heavy-duty school buses with new buses in an existing fleet, fleet operators must purchase or lease new school buses equipped with engines meeting a set of standards which have been given the designation of best engine selection/technology (BEST). The BEST criteria for newly manufactured medium- and heavy-duty vehicles are described in the following two paragraphs.

BEST for Medium-duty School Buses: The BEST criterion for the purchase or lease of a newly manufactured medium-duty school bus is that the bus be equipped with a non-diesel engine certified as Ultra Low Emission Vehicle (ULEV) or cleaner.

BEST for Heavy-duty School Buses: The BEST criteria for the purchase or lease of a newly manufactured heavy-duty school bus include emission standards for both NOx and PM that require increasingly cleaner vehicles as the program progresses. The standards for 2005-2006 model-year engines would require certification to a NOx plus non-methane hydrocarbon (NMHC) standard of 1.8 grams per brake horsepower-hour (g/bhp-hr) and to a PM standard of 0.03 g/bhp-hr. For purchases or leases of new school buses with 2007-2009 model-year engines, certification to 0.2 g/bhp-hr maximum NOx family emission limit (FEL) and to a 0.01 g/bhp-hr maximum PM standard is required. At this time, only alternative-fueled engines are expected to be able to meet 0.2 g/bhp-hr NOx FEL. For 2010 and later model-year school bus purchases and leases, the engine must be certified to the NOx standard of 0.2 g/bhp-hr and the PM standard of 0.01 g/bhp-hr that will apply to all alternative fuel and diesel fuel heavy-duty engines.

3. Purchase and Lease Requirements for Pre-Owned School Buses

When school bus fleet operators purchase or lease a pre-owned heavy-duty school bus, the regulatory proposal will require that they purchase or lease a school bus that has been repowered with a new engine that meets the BEST criteria. When school bus fleet operators purchase or lease a pre-owned medium-duty school bus, the regulatory proposal will require that they purchase or lease a school bus with an engine certified to the Low Emission Vehicle (LEV) emission levels or cleaner.

4. Exemptions

The regulatory proposal provides exemptions from the purchase or lease requirements for several reasons. The lack of availability of external funding to pay for the incremental costs of a cleaner vehicle is the first and primary reason for granting an exemption.

Exemptions are also available based on hardship due to difficulty in the practical application of the regulatory proposal's purchase or lease requirements. Exemptions may be granted based on the lack of availability of alternative-fuel refueling facilities or lack of funding for installation of refueling facilities. Exemptions may also be granted based on the non-availability of the required bus size for a fixed route, the allowance for buses required for field trips, and the occasion when an urgent need arises for the rapid acquisition of additional buses due to unforeseen circumstances. Additionally, there is a provision for the merger of two private bus fleets or the case where one fleet purchases another. In such cases, the transfer of ownership of school buses due to the merger or fleet purchase will not be subject to the purchase requirements if both fleets were already operating within SCAQMD at the time of the purchase or merger.

An exemption for a pre-owned bus could be granted if the oldest school bus in the operator's existing fleet is scrapped or permanently removed from operation in the fleet. The pre-owned school bus that is added to the fleet would have to be equipped with a verified diesel emission control method if (i) the bus is eligible for such a control method, and (ii) grants or external funding are available for the incremental cost of the verified diesel emission control method.

5. Diesel Emission Control Methods for School Buses in the South Coast Air District

The regulatory proposal includes a provision to reduce emissions from in-use diesel school buses operating in fleets. Pursuant to current regulations, ARB verifies emission control methods designed to be used in retrofitting certified heavy-duty engines. The proposal would require that operators of public and private school bus fleets of 15 or more buses install verified diesel emission control methods on at least 25 percent of their buses for which a method is available each year, beginning January 1, 2006. The control method installed must be the highest level of emission control that has been verified for the specific engine on which it will be used. If the emission control method is a fuel-based verified method, then the school bus operator must continue to use the fuel-based method as long as the bus is being operated in the fleet. If the operator wishes to discontinue using the fuel-based method, the operator must apply to SCAQMD to change to another verified method for the remaining operating life of the bus.

6. Record-Keeping Requirement for Fleet Operators

The proposed regulatory action includes provisions requiring record-keeping for purposes of compliance, auditing, and enforcement. Specifically, fleet information including manufacturer, model, model year, and fuel type must be made available to the District upon request to demonstrate compliance. Other records to be retained by the fleet operator include proof supporting exemptions and purchase records for fuel and fuel additives that are elements of an emission control strategy.

7. Administration and Non-Compliance

Under the proposal, SCAQMD's Executive Officer would be responsible for administering the regulation, including consideration of requests for exemptions. The Executive Officer or his/her designee may bring an action for civil penalties as specified in state law and regulations, including, but not limited to, Health and Safety Code section 39674, for any violation of this regulation.

8. Emission Benefits of the Proposal

The purpose of the proposed regulation is to reduce emissions from school buses, and to support the State Legislature's grant of authority to SCAQMD to adopt clean fuel fleet

rules. The proposed regulation seeks to close the possible emission gap created by the United States Supreme Court's decision. Staff's proposal would reduce approximately 0.04 tons of NOx per day and 0.001 ton per day of PM in SCAQMD by 2010.

COMPARABLE FEDERAL REGULATIONS

Although U.S. EPA sets emission standards for diesel and gasoline engines, U.S. EPA does not separately regulate school buses or school bus fleet operators. Federal emission standards for engines are codified in title 40, Code of Federal Regulations, part 86.

AVAILABILITY OF DOCUMENTS AND AGENCY CONTACT PERSONS

The Board staff has prepared a Staff Report, which includes the Initial Statement of Reasons (ISOR) for the proposed action and a summary of the economic and environmental impacts of the proposal. The staff has also prepared a Technical Support Document (TSD) that summarizes technology available and feasible for compliance with the proposal.

Copies of the staff ISOR, TSD, and the full text of the proposed regulatory language may be accessed on the Board's website listed below, or may be obtained from the Board's Public Information Office, Air Resources Board, Visitors and Environmental Services Center, 1001 I Street, 1st Floor, Sacramento, California 95814, (916) 322-2990 at least 45 days prior to the scheduled hearing on September 15, 2005.

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

Inquiries concerning the substance of the proposed regulation may be directed to Ms. Krista Fregoso, Air Pollution Specialist, by email at kfregoso@arb.ca.gov or by phone at (916) 445-5035, or to Ms. Renee Kemena, Manager, by email at rkemena@arb.ca.gov or by phone at (916) 327-7214.

Further, the agency representative and designated back-up contact person to whom nonsubstantive inquiries concerning the proposed administrative action may be directed are Ms. Artavia Edwards, Manager, Board Administration & Regulatory Coordination Unit, (916) 322-6070, and Ms. Alexa Malik, Regulations Coordinator, (916) 322-4011. 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 contact persons.

This notice, ISOR, and all subsequent regulatory documents, including FSOR when completed, will be available on ARB's Internet site for this rulemaking at http://www.arb.ca.gov/regact/scschl05/scschl05.htm

COSTS TO PUBLIC AGENCIES AND TO BUSINESSES AND PERSONS AFFECTED

The determinations of the Board's Executive Officer concerning the costs or savings necessarily incurred 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 create costs or savings to a state agency or 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 local agencies.

1. Fiscal Effect On State Government

No increased cost is expected to the State upon the adoption of this proposed regulation. Funds provided by the State to reimburse school districts for their costs have already been allocated for these types of expenditures.

2. Fiscal Effect on Local Government

In developing this regulatory proposal, ARB staff evaluated the potential economic impacts on school districts. There are 129 public school districts in SCAQMD and of these, 65 have bus fleets containing 15 or more buses. The purchase requirements mandated in this proposal are entirely contingent on the availability of external funding. Therefore, the only cost to the affected school districts is for the minimal record-keeping requirements that aid in determining compliance with the proposed regulations.

Under Education Code section 17920 et seq., state mandated programs placed on public schools must be funded. Consequently, the incremental implementation cost for this regulatory proposal will be funded by public grants and funds external to the school bus fleet's fiscal budget. It is estimated that the cost of this regulation would be approximately $5.3 to $6 million in the current fiscal year (July 2005 to June 2006), and approximately the same in the following fiscal years through 2009.

3. Need for Reporting Requirements

In accordance with Government Code sections 11346.3(c) and 11346.5(a)(11), ARB's Executive Officer has found that the reporting requirements of the regulation which apply to school districts and private companies under contract to a school district are necessary for the health, safety, and welfare of the people of the State of California.

4. Fiscal Impact on Businesses

In developing this regulatory proposal, ARB staff evaluated the potential economic impacts on businesses. The businesses directly affected by this regulatory proposal are

private fleets of school buses that operate within SCAQMD and have 15 or more buses. These fleets include one private school fleet and 12 private contractor school bus fleets that provide services to public schools. Because the proposed regulation is structured to exempt school bus fleets from requirements if external funding is not available, the staff believes there will be no significant impact on small businesses. In addition, the proposed regulation exempts fleets with fewer than 15 buses, making it even less likely that small businesses will be impacted.

Businesses indirectly affected by the regulatory proposal are school bus manufacturers, diesel and alternative-fueled engine manufacturers, diesel retrofit-equipment manufacturers, alternative fuel providers, and alternative-fuel-refueling equipment manufacturers and installers.

The adoption of the proposed regulatory action will not have a significant statewide adverse economic impact directly affecting businesses, including the ability of California businesses to compete with businesses in other states, or on representative private persons. Businesses that provide technology or services mandated under this proposal, such as engines, emission control systems, alternative-fuel refueling equipment, or installation services, may experience significant economic benefit from this rule. Some, but not all, of those businesses are located in California.

In accordance with Government Code section 11346.3, the Executive Officer has determined that the proposed regulatory action may affect the creation or 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. An assessment of the economic impacts of the proposed regulatory action can be found in the Staff Report.

In developing this regulatory proposal, ARB staff evaluated the potential economic impacts on representative private persons or businesses. The ARB has determined that there will be no, or an insignificant, potential cost impact, as defined in Government Code section 11346.5(a)(9) on representative private persons or businesses in reasonable compliance with the proposed action.

5. Costs to the Public

School buses in SCAQMD are owned and operated by school districts and private companies under contract to a school district. Grant money for the incremental cost of purchasing school buses and installing infrastructure, such as fueling stations, must be available to purchase buses required by this proposed regulation. Without available external funding, the school bus fleet operator is exempted from the requirements of this proposed regulation. The total lifetime cost of this regulation has been estimated at $28.4 to $30.1 million based on the five-year period (through the 2009 model-year) that the school-bus-fleet operator requirements will differ from ARB's current standards for medium- and heavy-duty vehicles.

6. Consideration of Alternatives

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.

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 **no later than 12:00 noon, September 14, 2005**, 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: **scschl05@listserv.arb.ca.gov** and received at ARB **no later than 12:00 noon, September 14, 2005.**

Facsimile transmissions are to be transmitted to the Clerk of the Board at (916) 322-3928 and received at ARB **no later than 12:00 noon, September 14, 2005.**

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 address each comment. The Board encourages members of the public to bring to the attention of 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 sections 39600, 39601, 39658, 43013 and 43018 of the Health and Safety Code. This action is proposed to implement, interpret and make specific sections 39002, 39003, 39658, 39667, 43000, 43010, 43013, 43018, 43101, 43102, 43104, 43105 and 43700 of the Health and Safety Code.

HEARING PROCEDURES

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 ARB's 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: July 19, 2005

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.

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

AIR RESOURCES BOARD

INITIAL STATEMENT OF REASONS

PROPOSED CLEAN ON-ROAD SCHOOL BUS REGULATION FOR SCHOOL BUSES OPERATING IN THE SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

Date of Release: July 29, 2005
Scheduled for Consideration: September 15 - 16, 2005

This report has been reviewed by the staff of the California Air Resources Board and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Air Resources Board, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

State of California
California Environmental Protection Agency
AIR RESOURCES BOARD

PROPOSED CLEAN ON-ROAD SCHOOL BUS REGULATION FOR SCHOOL BUSES OPERATING IN THE SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

Staff Report

July 29, 2005

Table of Contents

EXECUTIVE SUMMARY i

I. INTRODUCTION 1

A. Overview and Purpose 2
B. Regulatory Authority 3
C. Current Regulations and Voluntary Programs 3
1. Federal Standards for New Engines 3
2. California Standards Affecting Heavy-Duty Engines 5
3. Local Regulations Related to School Buses (need to check that this heading still makes sense after editing) 7
4. Incentive Programs 8
D. Role of Alternative Fuels 11

II. PUBLIC OUTREACH 13

A. Environmental Justice 13
B. Outreach Efforts 14
1. South Coast Fleet Rules 14
2. School Bus Regulatory Proposal for South Coast Region 15

III. NEED FOR EMISSION REDUCTIONS 15

A. Air Quality in the South Coast Air Quality Management District 15
B. Children's Exposure to Pollutants During School Bus Commutes 16

IV. SOUTH COAST SCHOOL BUS FLEET CHARACTERIZATION 16

A. Bus Population and Emission Inventory 16
1. Bus Population 16
2. Emission Inventory 18
B. CNG Refueling Infrastructure and Maintenance 19
1. School Bus Fueling Requirements 19
2. Existing Fueling Stations 20
3. Fueling Infrastructure Costs 21
4. Repair Facility Modification 22
5. Operating Costs 22
6. User Experience 23

V. SOUTH COAST FLEET RULE 1195 23

A. Requirements 23
B. Exemptions 25
1. Lack of Funding For Alternative-Fuel Fueling Stations and Alternative-Fuel Maintenance Facility Upgrade 25
2. Other Available Exemptions 25
C. Implementation History 25
1. Compliant Vehicle Purchases 25
2. Medium-Duty School Bus Purchases 26

VI. SUMMARY OF PROPOSED REGULATION 27
A. Requirements 27
1. Purpose 28
2. Definitions 28
3. Purchase and Lease Requirements 28
4. Exemptions from Purchase Requirements 30
5. Diesel Emission Control Methods for In-Use School Buses 33
6. Compliance, Auditing and Enforcement 33
B. Differences Between South Coast Rule 1195 and Staff Proposal 34
VII. AVAILABILITY & TECHNOLOGICAL FEASIBILITY 35
A. Technology Assessment: School Bus Engines 35
1. Heavy-Duty School Bus Engines 35
2. Medium-Duty School Bus Engines 35
B. Verified Aftertreatment Devices 36
C. Future Aftertreatment and Retrofit Devices 36
VIII. REGULATORY ALTERNATIVES 37
A. Do Not Adopt this Rule 37
B. Allow School Bus Fleet Operators to Purchase/Lease Heavy-Duty School Buses Equipped with Engines with a Declared NOx FEL of 0.9 g/bhp-hr for Model Year 2007 through 2009 38
IX. ECONOMIC IMPACT 39
A. Legal Requirement 39
B. Affected Businesses 39
C. Potential Impact on Businesses 39
D. Potential Impact on Businesses Competitiveness 40
E. Potential Impact on Employment 40
F. Potential Impact on Creation, Elimination, or Expansion 40
G. Potential Cost to Local and State Agencies 41
1. Federal Regulations 41
2. Implementation Cost 41
X. ENVIRONMENTAL IMPACTS AND COST EFFECTIVENESS 45
A. Benefits within the South Coast Air Basin 45
1. Emission Reductions From New Heavy-Duty School Bus Purchases 45
2. Emission Reductions From New Medium-Duty Bus Purchases 46
3. Emission Reductions From In-Use Diesel Bus Retrofits 47
4. Benefits of the Proposal 47
B. Cost-Effectiveness of Proposed Regulation 47
C. Potential Negative Impacts 48
1. Creation of Nitrogen Dioxide by Passive Catalyzed Diesel Particulate Filters 48
2. Toxics from Diesel-Fueled and Alternative-Fueled Engines 49
3. Ammonia Slip from Selective Catalytic Reduction 50
4. Ash Management 51

XI. ISSUES 51

A. School Transportation Funding and School Bus Ridership 51
B. Funding Split between Alternative-Fuel and Lower-Emitting Diesel Purchases 54
C. Federal Clean Air Act Waiver of Preemption Challenges 55
D. Waiver Process Will Delay Regulation Implementation 57

XII. SUMMARY AND STAFF RECOMMENDATION 57

XIII. REFERENCES 59

XIV. AVAILABILITY OF TECHNICAL SUPPORT DOCUMENT 61

Appendices

Appendix A: Proposed Regulation Order
Appendix B: Impacts of Diesel Particulate Matter
Appendix C: Cost Effectiveness Analysis Methodology
Appendix D: SCAQMD Rule 1195

List of Figures

Figure 1 California On-Road Fuel Supply and Demand Forecast 12
Figure 2 CNG Fueling Stations in the South Coast Air Basin 20

List of Tables

Table 1. Federal NOx and PM Emission Standards for Truck and Bus Engines (g/bhp-hr) 4
Table 2. California Optional, Reduced-NOx Emission Standards *(g/bhp-hr) 5
Table 3. Chassis–Based Medium-Duty Vehicle Standards - 8,500 – 10,000 GVWR (g/mi) 6
Table 4. Chassis-Based Medium-Duty Vehicle Standards –10,000 – 14,000 GVWR (g/mi) 6
Table 5. Engine Emission Standards for 2004-2006 MY Medium-Duty ULEVs and SULEVs (g/bhp-hr) 7
Table 6. Engine Emission Standards for 2007 and Subsequent MY Medium-Duty ULEVs and SULEVs (g/bhp-hr) 7
Table 7. SCAQMD 2000 Survey Estimated Number of Affected School Buses by Fuel Type - SCAQMD 2000 Survey (Fleets of 15 or More) 17
Table 8. Distribution of Affected Diesel and Gasoline Population into Heavy- and Medium-Duty Types - SCAQMD 2000 Survey 17
Table 9. EMFAC2002 School Bus Population in Year 2005 for SCAQMD 18
Table 10. EMFAC2002 Baseline Emissions in the SCAQMD from Gasoline and Diesel School Buses (TPD) 19
Table 11. School Districts with No CNG Refueling within 5 Miles 21
Table 12. Rule 1195 Compliant School Bus Purchases, 2001 - 2005 26
Table 13. Rule 1195 Exemptions Granted 26
Table 14. Number of Non Compliant Field Trip Buses Allowed 32
Table 15. Incremental Costs per Bus Over 25 Year Lifetime 43
Table 16. Emission Benefits in 2010 from Regulatory Proposal: Heavy-Duty School Bus Purchases 46
Table 17. Emission Comparison: Diesel Truck Engine vs. Natural Gas Truck Engine 50
Table 18. School Bus Ridership By State 53

EXECUTIVE SUMMARY

The Air Resources Board (ARB or "the Board") is the state agency responsible for protecting public health and the environment from the harmful effects of air pollution. ARB oversees all air pollution control efforts in California, including the activities of 35 independent local air districts, and works in cooperation with the districts and the U.S. Environmental Protection Agency (U.S. EPA) on strategies to attain state and federal ambient air quality standards and to reduce air toxic emissions.

The South Coast Air Quality Management District (SCAQMD) is the local government agency primarily responsible for air quality assessment and improvement in the South Coast Air Basin and the desert portion of Riverside County in the Salton Sea Air Basin. The South Coast Air Basin is federally designated as a serious nonattainment area for particulate matter (PM_{10}) and a severe nonattainment area for the eight-hour ozone standard.

Under its Clean Fleets program, the SCAQMD adopted seven fleet rules during 2000 and 2001. The SCAQMD adopted the fleet rules based on its authority granted by the State Legislature through Health and Safety Code Section 40447.5. These rules were developed to gradually shift public agencies and certain private entities to lower emissions by requiring them to acquire alternative-fueled vehicles whenever an operator with 15 or more vehicles purchased or leased vehicles for replacement or addition to its fleet. One of these seven rules is Rule 1195 concerning school buses.

The District's fleet rules, including Rule 1195, were challenged in federal court based on authority issues. In April 2004, the United States Supreme Court (U.S. Supreme Court) ruled that certain aspects of the fleet rules were preempted by federal law. The U.S. Supreme Court then remanded the case back to a lower court to determine whether the fleet rules could be characterized as state purchase decisions and, if so, whether a different standard of preemption applies.

In response to the U.S. Supreme Court's decision, the SCAQMD requested that ARB submit the SCAQMD's rules to the U.S. EPA for a waiver of preemption pursuant to Section 209(b) of the Clean Air Act. The ARB staff concluded, in consultation with the U.S. EPA, that the local fleet rules would not receive a Section 209 waiver because they have not been adopted by the ARB as state regulations. As a result, ARB staff initiated this public rulemaking process to develop an enforceable state school bus regulation applicable to the South Coast region for which a federal waiver could be obtained.

The federal District Court recently affirmed the SCAQMD's authority to regulate public fleets (approximately 43 percent of the affected school buses within the SCAQMD). The federal District Court did not explicitly rule on the District's authority to regulate private fleets operating under contract to public agencies,

leaving some ambiguity about the scope of the District's power. About 56 percent of affected school buses within the SCAQMD are under such contracts. The SCAQMD has no authority to regulate private schools that own or operate their own school bus fleets. There is only one private school with a fleet that exceeds 15 buses (the District's threshold for inclusion).

Adoption of this regulation would enable the SCAQMD to regulate the 21 school buses owned by the one private school with more than 15 buses. Adoption of this regulation would also help protect the SCAQMD in the event of further legal challenge to its authority to regulate private contractors to public agencies. Therefore, the ARB staff is presenting this proposal for Board consideration.

This proposal requires public and private school bus fleet operators with 15 or more school buses to purchase, lease, or contract for new school buses equipped with the cleanest engines available (referred to as Best Engine Selection Technology or BEST), and to annually retrofit 25 percent of eligible in-use diesel school buses with ARB-verified diesel emission control systems.

For new heavy-duty school buses, the proposal specifically requires fleet operators to:

- Acquire only buses equipped with engines that meet a 1.8 gram per brake horsepower-hour (g/bhp-hr) oxides of nitrogen (NOx) plus non-methane hydrocarbon standard and a 0.03 g/bhp-hr PM standard during the 2005-2006 model years;
- Acquire only buses equipped with engines that meet a 0.2 g/bhp-hr NOx family emission limit (FEL) and a 0.01 g/bhp-hr PM standard during the 2007-2009 model years. At this time, the staff expects that only alternative-fueled engines will meet this NOx family emission limit.

For new medium-duty school buses, the proposal specifically requires fleet operators to:

- Acquire non-diesel buses that are certified to the ultra low emission vehicle (ULEV) emission standard category or are equipped with non-diesel engines certified as ULEV.

No state agency can place an unfunded mandate on schools. Accordingly, compliance with the regulatory proposal is wholly contingent upon the availability of grant funding or external funding sources. Funding must be available for the incremental purchase cost of a reduced-emission school bus meeting the proposal's requirements or for the installation of exhaust emission control equipment to reduce pollutants from in-use diesel school buses. Funding must also be available to cover the other costs of regulatory compliance associated with compressed natural gas school buses, such as infrastructure costs, maintenance facility upgrade costs, and reasonable incremental operating and maintenance

costs. If external funding is not available for the incremental purchase cost of a reduced-emission school bus plus the associated additional costs, fleet operators may take advantage of the proposal's exemption process to purchase a standard school bus.

Because this proposal does not mandate additional costs on schools, the estimated benefits of this proposal are entirely contingent on the availability of external funding sources to assist public school districts and private transportation companies that contract with public schools. In this report, the staff has identified known sources of available external funding and has based its emission benefit estimates on expected external funding levels of approximately $11 million per year.

Based on the identified funding being available for new bus purchases, the ARB staff estimates that this proposal will result in a 0.04 ton per day NOx reduction and a 0.001 ton per day PM reduction in the SCAQMD in 2010. The proposal would result in an additional PM reduction of 0.01 ton per day in 2010 if external funding of approximately $4 million per year becomes available for implementation of the in-use diesel school bus retrofit requirements.

If costs are split between NOx and PM reductions, the cost effectiveness of the new bus purchase requirements is approximately $60,000 per ton of NOx and $405,000 per ton of PM reduced. The cost effectiveness of this rule is less favorable compared to cost effectiveness values for other NOx and PM control measures that have been recently approved by the Board, most of which ranged from $400 to $16,000 per ton of ozone precursor reduced. For PM control, two recently adopted measures have cost effectiveness values ranging from $50,000 to $64,000 per ton of PM reduced, if costs are split between NOx and PM reductions.

The regulation is contained in new sections 2024 and 2024.1, title 13, California Code of Regulations and set forth in the proposed Regulation Order in Appendix A. Information on how to access the Technical Support Document for this rulemaking can be found at the end of this report.

I. INTRODUCTION

The Air Resources Board (ARB or "the Board") seeks to provide clean, healthful air to the residents of California. ARB is the state agency responsible for protecting public health and the environment from the harmful effects of air pollution. ARB oversees all air pollution control efforts in California, including the activities of 35 independent local air districts. ARB works in cooperation with the districts and the U.S. Environmental Protection Agency (U.S. EPA) on strategies to attain state and federal ambient air quality standards and to reduce air toxic emissions.

The South Coast Air Quality Management District (SCAQMD or District) is the local governmental agency primarily responsible for air quality assessment and improvement in the South Coast Air Basin and the desert portion of Riverside County in the Salton Sea Air Basin. The South Coast Air Basin, which includes Orange County and the non-desert portions of Los Angeles, Riverside and San Bernardino Counties, is federally designated as a serious nonattainment area for particulate matter (PM10 - particulate matter under 10 microns) and a severe nonattainment area for the eight-hour ozone standard. The Coachella Valley, located in the desert portion of Riverside County, is classified as a serious nonattainment area for PM10 and a severe nonattainment area for ozone.

Significant amounts of both particulate matter (PM) and oxides of nitrogen (NOx) are emitted from mobile sources. Diesel PM is a toxic air contaminant (TAC), a cancer-causing pollutant that also has significant short- and long-term negative cardiovascular impacts. NOx is a reactive, oxidizing gas that contributes to the atmospheric formation of ozone and fine particles, and causes respiratory illness and impaired lung functioning.

The SCAQMD performed a Multiple Air Toxics Exposure Study II (MATES II) that identified mobile sources, particularly diesel exhaust, as the overwhelming contributor to local air toxic risk levels. Based on the results of the MATES II study, in March 2000 the SCAQMD Governing Board adopted the Air Toxic Control Plan, which included an early action control measure known as the Clean Fleets program.

Under the Clean Fleets program, the SCAQMD adopted seven fleet rules from 2000 to 2001. The rules were developed to gradually shift public agencies and certain private entities to lower emission and alternative-fueled vehicles whenever a fleet operator, with 15 or more vehicles, purchases or leases a vehicle for replacement or addition to a fleet.

The SCAQMD developed fleet rules for transit buses, school buses, refuse collection vehicles, airport shuttles and taxis, street sweepers, light-duty and medium-duty publicly-owned vehicles, and heavy-duty publicly-owned vehicles.

A. Overview and Purpose

In 2000, the SCAQMD adopted several fleet rules as part of their Clean Fleets Program, including Rule 1195 for Clean On-Road School Buses. The SCAQMD adopted the fleet rules based on its authority granted by the State Legislature through Health and Safety Code Section 40447.5. Rule 1195 requires that school districts, private schools, and private companies that contract with school districts in the SCAQMD acquire only alternative-fuel vehicles when purchasing or leasing new school buses. Since their adoption by the District, the fleet rules, including Rule 1195, have been challenged in federal court based on authority issues. In April 2004, the U. S. Supreme Court ruled that certain aspects of the fleet rules were preempted by federal law. The U.S. Supreme Court then remanded the case back to a lower court to determine whether the fleet rules could be characterized as state purchase decisions and, if so, whether a different standard of preemption applies.

In response to the U.S. Supreme Court's decision, the SCAQMD requested that the ARB submit the SCAQMD's rules to the U.S. EPA for a waiver of preemption pursuant to Section 209(b) of the federal Clean Air Act (CAA). The ARB requested public comment and consulted with the U.S. EPA regarding the legal requirements for obtaining a waiver for a rule adopted by a local government. The ARB staff concluded, in consultation with the U.S. EPA, that the fleet rules would not receive a Section 209(b) waiver because they have not been adopted by the ARB as state regulations. As a result, the ARB staff initiated the public rulemaking process in February 2005 to develop a state regulation applicable to school buses operating in the South Coast region.

With concurrence from the SCAQMD, ARB limited the new rulemaking process to three fleet rules that were likely to be most effective in controlling diesel engine emissions. Those rules, with their current SCAQMD identifiers were:

Rule 1192	Clean On-Road Transit Buses
Rule 1193	Clean On-Road Residential and Commercial Refuse Collection Vehicles
Rule 1195	Clean On-Road School Buses

Meanwhile, the federal District Court continued its proceedings on the District rules. On May 5, 2005, the federal District Court ruled that the District's authority is not preempted under the market participant doctrine for the aspects of the District fleet rules that relate to purchasing decisions made by state and local governments. The federal District Court did not explicitly rule on the District's authority to regulate private fleets operating under contract to public agencies, however, which left some ambiguity as to the scope of the District's authority. The SCAQMD has no authority to regulate private schools that own or operate their own school bus fleets.

Adoption of this regulation would enable the SCAQMD to regulate the 21 school buses owned by the one private school with more than 15 buses. Adoption of this regulation would also help protect the SCAQMD in the event of further legal challenge to their authority to regulate private contractors to public agencies.

B. Regulatory Authority

The federal CAA grants California, alone among the states, the authority to adopt more stringent controls of emissions from new mobile sources. Under the federal CAA, California must apply for a Section 209(b) waiver for its requirements, demonstrating that the requirements are at least as protective of public health as applicable federal requirements.

In 1988, the California Legislature enacted the California Clean Air Act (Health and Safety Code sections 39002, 43013, and 43018), which declared that attainment of state ambient air quality standards is necessary to promote and protect public health, particularly the health of children, older people, and those with respiratory diseases. The Legislature directed that these standards be attained by the earliest practicable date.

C. Current Regulations and Voluntary Programs

Both the federal government and the State of California have adopted rules that reduce PM and NOx from on-and off-road vehicles. The following sections briefly describe the existing federal, state, local and voluntary programs that currently apply to diesel-fueled engines and vehicles operating in California.

1. Federal Standards for New Engines

Standards for smoke emissions from on-road heavy-duty diesel vehicles were set by the U.S. EPA beginning in 1970. New engines were subject to PM and NOx exhaust emission standards with the model year (MY) 1988. Over the years, more stringent emission standards have paralleled improvements in control technology. Recent amendments to the on-road standards regulate the heavy-duty vehicle and its fuel as a single system, including diesel-fuel sulfur-content requirements. Below is a brief discussion of federal emission standards for heavy-duty diesel-fueled engines and vehicles ; a summary of the current federal standards is provided in Table 1.

a. Current Standards

The current PM engine emission standard for on-road heavy-duty diesel trucks is 0.10 grams per brake-horsepower hour (g/bhp-hr) and the current federal and California PM emission standard for new urban transit bus engines is 0.05 g/bhp-hr. The current NOx emission standard for on-road heavy-duty diesel trucks and new urban transit bus engines is the same. This emission standard is 2.4 g/bhp-hr for NOx plus non-methane hydrocarbons (NMHC) or 2.5 g/bhp-hr NOx plus NMHC with 0.5 g/bhp-hr NMHC cap.

b. 2007-2010 MY Standards

The PM standard that takes effect for model year 2007 new heavy-duty diesel engines used in trucks and school buses is 0.01 g/bhp-hr, which is a 90 percent reduction from the existing standard. That standard is based on the use of high-efficiency exhaust emission control devices or comparably effective advanced technologies. Because these devices are less efficient when used with the current formulation of diesel fuel, reducing the level of sulfur in highway diesel fuel by 97 percent to 15 parts per million by weight (ppmw) by mid-2006 is also required.

The NOx standard in 2010 for new heavy-duty diesel engines used in trucks and buses is 0.2 g/bhp-hr. However, between 2007 and 2009, U.S. EPA requires only 50 percent of the heavy-duty diesel engine families (groupings) to meet this standard. Since averaging is allowed, a manufacturer may certify all of its engines to 1.2 g/bhp-hr as an alternative. Most engine manufacturers have indicated they plan to use this latter approach.

Table 1. Federal NOx and PM Emission Standards for Truck and Bus Engines (g/bhp-hr)

Model Year	Truck*		Urban Bus	
	NOx	PM	NOx	PM
2004	2.2 [(a)]		2.2 [(a)]	0.05 [(c)]
2007	1.2 [(b)]	0.01	1.2 [(b)]	0.01
2010	0.2 [(b)]		0.2 [(b)]	

* Truck standards apply to school buses.

(a) Nominal NOx value of 2.2 g/bhp-hr is based on emission standards of 2.4 g/bhp-hr for NOx plus NMHC or 2.5 g/bhp-hr NOx plus NMHC with 0.5 g/bhp-hr NMHC cap, which took effect in October 2002 for those engines subject to the U.S. EPA Consent Decrees and the California Settlement Agreements. The Consent Decree-complying engines had to comply with 2004 standards by October 1, 2002.

(b) Between 2007 and 2009, U.S. EPA requires 50 percent of heavy-duty diesel engine family certifications to meet the 0.2 g/bhp-hr NOx standard. Averaging is allowed, and it is expected that most engines will conform to the fleet NOx average of approximately 1.2 g/bhp-hr.

(c) In-use standard or 0.07 g/bhp-hr.

2. California Standards Affecting Heavy-Duty Engines

a. New Heavy-Duty Engines

California is the only state granted authority by the Federal Clean Air Act to set standards for new mobile engines. California has harmonized with federal standards for new heavy-duty diesel engines since 1988. However, California's urban bus standards are more stringent.

Heavy-duty school buses are generally powered by diesel engines and are subject to emission standards for heavy-duty truck engines (as opposed to emission standards for new urban bus engines). PM and NOx are the pollutants of most concern with heavy-duty diesel engines.

b. Optional Standards for New Engines

In addition to mandatory standards, California also has optional reduced-emission standards for new heavy-duty engines, as shown in Table 2. In general, only alternative-fueled vehicles have certified to a reduced-emission standard and thus have been eligible for incentive funding. Beginning in October 2002, optional PM standards ranging from 0.03 to 0.01 g/bhp-hr with an 0.01 increment were available.

Table 2. California Optional, Reduced-NOx Emission Standards *(g/bhp-hr)

Model Year	Optional Standards	Increment
2000	2.5-0.5	0.5
October 2002	1.8-0.3[c]	0.3
2004-2006 [a, b]	1.8-0.3[c]	0.3

* Truck standards apply to school buses.

(a) For urban buses, emission standards apply only to alternative fueled engines.

(b) For urban buses, engine manufacturers may sell diesel hybrid-electric buses certified at 1.8 g/bhp-hr standard to transit agencies with approved NOx offset plans.

(c) Optional emission standards of 1.8 – 0.3 g/bhp-hr are for NOx + NMHC. Engines certified to the optional NOx standard are excluded from participating in the Averaging, Banking, and Trading (ABT) program.

c. Medium-duty School Bus Standards

SCAQMD Rule 1195 and the staff's proposed regulation affect medium-duty school buses as well as heavy-duty school buses. Medium-duty school buses have a gross vehicle weight rating (GVWR) of 8,500 pounds to 14,000 pounds, whereas heavy-duty school buses have a GVWR of greater than 14,000 pounds. Medium-duty vehicle (MDV) emission standards (which affect medium-duty school buses) fall into two categories – chassis emission standards, wherein the engine

and vehicle are certified as a whole, and engine emission standards, wherein the engine is certified by itself.

Table 3 and Table 4 present ARB chassis emission standards for new 2004 and subsequent model year MDVs. Three vehicle emission categories are defined for these standards, low emission vehicle (LEV), ultra low emission vehicle (ULEV), and super ultra low emission vehicle (SULEV). The chassis emission standards are based on grams per mile (g/mi). Manufacturers must meet a fleet average requirement based on sales of vehicles in each of the emission categories.

Table 3. Chassis–Based Medium-Duty Vehicle Standards - 8,500 – 10,000 GVWR (g/mi)

(Vehicles in this category are tested at their adjusted loaded vehicle weight)

Vehicle Emission Category	Non Methane Organic Gas (NMOG)	Carbon Monoxide (CO)	Oxides of Nitrogen (NOx)	Formaldehyde (HCHO)	Particulates (PM)
LEV	0.195	6.4	0.2	32	0.12
ULEV	0.143	6.4	0.2	16	0.06
SULEV	0.100	3.2	0.1	8	0.06

Table 4. Chassis-Based Medium-Duty Vehicle Standards –10,000 – 14,000 GVWR (g/mi)

(Vehicles in this category are tested at their adjusted loaded vehicle weight)

Vehicle Emission Category	Non Methane Organic Gas (NMOG)	Carbon Monoxide (CO)	Oxides of Nitrogen NOx)	Formaldehyde (HCHO)	Particulates (PM)
LEV	0.230	7.3	0.4	40	0.12
ULEV	0.167	7.3	0.4	21	0.06
SULEV	0.117	3.7	0.2	10	0.06

Manufacturers can also certify medium-duty engines to engine standards, as illustrated in Table 5 and Table 6 below. Note that engine emission standards are given in grams per brake horsepower-hour. Diesel engines typically certify to engine-based standards, while gasoline engines typically certify to chassis-based standards.

Table 5. Engine Emission Standards for 2004-2006 MY Medium-Duty ULEVs and SULEVs (g/bhp-hr)

Vehicle Emission Category	NOx + NMHC	CO	PM	HCHO
ULEV[(a)] OptionA	2.5 (with a 0.5 cap on NMHC	14.4	0.10	0.05
ULEV[(a)] Option B	2.4	14.4	0.10	0.05

(a) Emissions averaging may be used to meet these standards

Table 6 presents emission standards for 2007 and subsequent model year medium-duty engines. As with the heavy-duty engines previously discussed, manufacturers have the ability to phase-in the 0.2 g/bhp-hr NOx emission standard. Manufacturers have indicated this will be accomplished with 1.2 g/bhp-hr NOx engines, beginning in 2007.

Table 6. Engine Emission Standards for 2007 and Subsequent MY Medium-Duty ULEVs and SULEVs (g/bhp-hr)

Vehicle Emission Category	NOx	NMHC or NMHCE	CO	PM	HCHO
ULEV (2007-2009)[(a)]	1.2	0.14	15.5	0.01	0.01
ULEV (2010 +)[(a)]	0.2	0.14	15.5	0.01	0.01
SULEV[(b)]	0.1	0.07	7.7	0.005	0.005

(a) Emissions averaging may be used to meet these standards
(b) Optional emission standards

3. Local Regulations Related to School Buses (need to check that this heading still makes sense after editing)

Local air districts participate with local transportation agencies to develop and implement transportation control measures aimed at reducing vehicle activity and emissions. Some districts have developed model ordinances to reduce idling of trucks and buses, to encourage the purchase of low-emission vehicles for public fleets, and to require public agency contracting that is '"green."

a. Current South Coast Air Quality Management District Fleet Rules

As previously discussed, the SCAQMD adopted seven fleet rules from 2000 to 2001. The rules were developed to gradually shift public agencies and certain private entities to lower emission and alternative-fueled vehicles whenever a fleet operator with 15 or more vehicles purchased or leased a vehicle for replacement or addition to a fleet. The SCAQMD defines alternative fuels as compressed natural gas, propane, or liquefied natural gas.

The SCAQMD has fleet rules for transit buses, school buses, refuse collection vehicles, airport shuttles and taxis, street sweepers, light and medium-duty publicly-owned vehicles, and heavy-duty publicly-owned vehicles.

For school buses, school bus operators are required to purchase or lease non-diesel buses, either alternative-fueled or gasoline, depending on the bus type, when acquiring or replacing school buses in their fleets. These requirements apply to fleets of 15 or more buses.

4. Incentive Programs

Efforts to reduce air pollution outside of a mandated requirement are considered voluntary. Voluntary efforts play a key role in helping to achieve air quality goals. Incentives can induce vehicle owners to reduce vehicle emissions prior to compliance deadlines or by reducing emissions beyond regulatory requirements.

For school buses specifically, many of these incentive programs have provided funding support for the purchase of new buses, exhaust emission control devices for in-use buses, natural gas fueling facilities, and some maintenance facility modifications.

a. Federal Incentives

Voluntary Diesel Retrofit Program

The U.S. EPA established a Voluntary Diesel Retrofit Program to address pollution from diesel construction equipment and heavy-duty on-highway vehicles. This program, established in 2000, allows fleet operators to choose U.S. EPA-verified and, as of 2004, ARB-verified technologies that will reduce the emissions of the vehicles and engines in their fleets and identify potential funding sources to assist air quality planners and fleet operators as they create and implement retrofit programs. Approximately $14 million has funded appropriate projects through 2004. Of this funding, $10 million was spent on the Clean School Bus Program nationwide. For 2005, $8.3 million is set aside to fund Voluntary Diesel Retrofit Program projects; $7.5 million of that money is for clean school bus projects. Penalty revenues have also funded retrofits and ultra low sulfur diesel fuel for school buses.

b. State Incentives

The Carl Moyer Program

The Carl Moyer Program provides grants to fund the extra capital cost of cleaner-than-required diesel-powered heavy-duty vehicles and equipment. Between 1998 and 2003, $154 million was appropriated to the Carl Moyer Program to clean up 7000 engines. In 2004, the program was expanded to $140 million a year of incentive funding statewide.

To date, the SCAQMD has distributed approximately $28 million of Carl Moyer funding to transit buses, refuse trucks, street sweepers, and, on a very limited basis, school buses. The Carl Moyer Program has not been a significant source of funding for school buses due to the very low mileage of these vehicles, which causes school bus projects to exceed the cost effectiveness limits of the Carl Moyer Program.

The Lower-Emission School Bus Program

In 2000, the Lower-Emission School Bus Program was enacted. The goal of this program is to reduce school children's exposure air pollution by directly: 1) replacing pre-1987 model year school buses with new, lower-emitting models; and 2) retrofiting in-use diesel school buses with exhaust control devices.

Over fiscal years 2000 - 2001 and 2001 - 2002, statewide program funding was $66 million. Of this total, $49.5 million went to the purchase of safe, lower-emitting new school buses (alternative fuel and ultra low sulfur diesel). The remaining $16.5 million was spent on installation of exhaust control devices to reduce PM emissions from in-use diesel school buses.

Proposition 40, the California Clean Water, Clean Air, Safe Neighborhood Parks, and Coastal Protection Act of 2000, granted additional school bus funding. The measure provided about $50 million over two years, 20 percent of which was to be spent for the acquisition of "clean, safe, school buses for use in California's public schools." The remainder was allocated to the Moyer Program. For the 2002 – 2003 fiscal year, $4.92 million was available for the purchase of new safe, lower-emitting school buses – about 40 buses statewide. For the 2003 – 2004 fiscal year, $4.6 million was available for the purchase of new school buses – about 36 buses statewide.

During the four years the school bus program has been funded, the SCAQMD has received nearly $35 million total in state funds to purchase new school buses to replace pre-1987 model year buses and to retrofit in-use diesel buses. Of that funding amount, approximately $25.8 million has been dedicated to new bus purchases, with the remaining $8.9 million dedicated to in-use retrofits. With these state allocations, plus additional local funding totaling more than $21 million over the past five years from other incentive programs, settlement fees, and district funds, the SCAQMD has replaced nearly 400 pre-1987 model year buses with new lower-emitting models and has equipped over 2,100 in–use diesel buses with exhaust control devices (primarily diesel particulate filters) to significantly reduce PM.

State law authorizes air districts to increase motor vehicle registration fees by $2 to reduce air pollution through Carl Moyer Program projects, light-duty accelerated vehicle scrap programs, selected agricultural projects, and new school bus purchases pursuant to the Lower-Emission School Bus Program Guidelines. The SCAQMD raised those fees and has committed $14 million over the next 18

months to new school bus purchases and expects to commit similar funding levels yearly—approximately $9.3 million on an annual basis—to new bus purchases. This commitment represents the bulk of the incentive funding that would be available for implementation of the ARB's regulatory proposal.

Approximately $25M in new funding was earmarked in the state fiscal year 2005 - 2006 budget to continue implementing the Lower-Emission School Bus Program. However, at the time the staff developed its emission benefits analysis for this rulemaking, the state budget had not been finalized and approved. As such, this potential additional funding has not been factored into the ARB's emission benefit estimates of this proposal.

c. SCAQMD Incentive Funding Sources

State law also authorizes districts to impose a registration surcharge of $4 per vehicle for use in reducing air pollution from motor vehicles. The Department of Motor Vehicles (DMV) collects the fees at the request of the district. The SCAQMD has imposed the $4 per vehicle fee and the additional $2 per vehicle fee as authorized by AB 923 (2004). In addition, the SCAQMD has the authority to impose an additional $1 per vehicle until January 1, 2010, and has done so. Below is a brief description of the District's incentive funding sources using motor vehicle registration fees, as well as other local incentive funding sources.

Mobile Source Air Pollution Reduction Review Committee

In the South Coast region, the $4 per vehicle fee is distributed as follows: 30 percent to the District's general fund, 40 percent to cities and counties, and 30 percent to the Mobile Source Air Pollution Reduction Review Committee (MSRC) to contribute a funding match towards qualifying projects. The MSRC has provided a total of $42 million for the purchase of lower-emitting school buses, transit buses, street sweepers, and refuse trucks since the 1995-1996 fiscal year. The cities and counties portion of the DMV fees has funded some infrastructure needs for alternative-fueled school buses.

AB 923 Fees

The SCAQMD anticipates $22 million annually from the $2 increase in DMV fees in the South Coast region, which may be spent in four project areas, including new school bus purchases. Of the anticipated $22 million annually, the District has designated $14 million for school bus purchases over the next 18 months, and expects to commit a similar funding level on an annual basis in subsequent years.

Clean Fuel Fund

The $1 fee per vehicle funds the Clean Fuel Fund. The Clean Fuel Fund has been used to award grants for alternative fueling infrastructure projects for school buses, transit buses, refuse trucks, street sweepers. Since approximately 1998, over $30 million has been spent on infrastructure projects from this funding source.

South Coast Rule 2202

The Air Quality Investment Program (AQIP), Rule 2202, allows employers with 250 or more employees to participate in an air quality investment program in order to meet their emission reduction target. An employer may elect to participate in the program by investing annually $60 per employee or triennially $125 per employee into an AQMD administered restricted fund. Since 2000, over $1.6 million from AQIP has funded alternative fueled street sweepers and refuse trucks.

South Coast Rule 1309.1

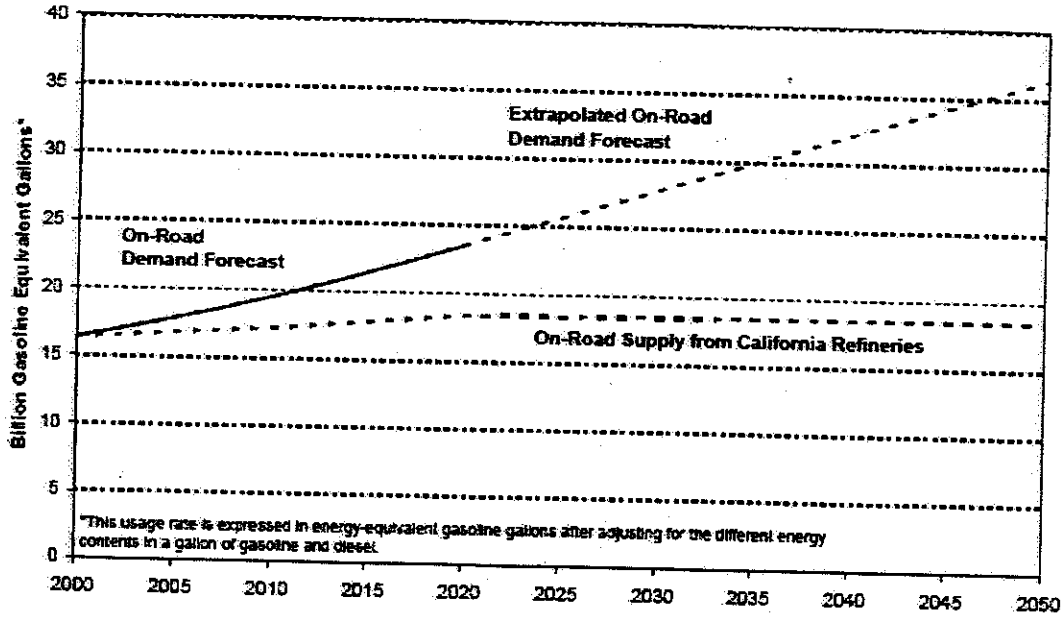
The Priority Reserve Fund, Rule 1309.1, which provides emission reduction credits for certain sources, allocated $12 million for implementation of the Chairman's School Bus Initiative. These funds were used for the purchase of new alternative-fueled school buses and retrofits of diesel buses with diesel particulate filters (DPFs) and diesel oxidation catalysts.

D. Role of Alternative Fuels

California's dependence on petroleum-based transportation fuels has become a major concern to the ARB and CEC over the last decade due to a number of factors. The state's petroleum refining infrastructure has not grown to keep up with the increasing demand for gasoline and diesel fuel. From a practical standpoint, the state's refining capacity has reached virtual full utilization, with only marginal incremental increases realized over the last five years. In contrast, diesel and gasoline annual demand continues to grow at 2.4 percent and 1.8 percent, respectively. Due to the constrained nature of the existing refining infrastructure, the state has grown increasingly dependent on imports of refined products.

The following figure illustrates the growing gap between in-state capacity and on-going fuel demand increases.

Figure 1 California On-Road Fuel Supply and Demand Forecast



In the summer of 2003, the CEC and ARB jointly adopted the following goals for the reduction in petroleum dependence pursuant to AB 2076 (ARB and CEC 2003):

- Reduced demand for on-road gasoline and diesel fuel of 15 percent below the 2003 levels by the year 2020, and to maintain this level of demand for the foreseeable future.
- Increased use of non-petroleum fuels to 20 percent of on-road fuel consumption by 2020 and to 30 percent by 2030.

These goals reflect the growing convergence of problems related to petroleum resource depletion, concerns over rising greenhouse gas emissions, and air pollution health affects. The continuing rise in global oil prices is one indication of the rising anxiety over the expected near term timing of the peak in global oil production. The combustion of petroleum-based fossil fuels has been directly associated rising carbon dioxide (CO_2) emissions, which on a global average basis, now exceed levels experienced over at least the past 100,000 years. Severe climatic alterations are now widely expected if CO_2 concentrations reach levels of 450 -550 parts per million (ppm) or higher (Hansen 2004).

There is also concern regarding the direct health effects of air pollutants, which result from petroleum fuel production, transport, distribution and end use. These latter concerns are especially pronounced due to the determination by the ARB in 1998 that diesel particulate is a TAC. More recent evidence linking diesel exhaust to asthma triggers in children, as well as other impacts, has focused special concern on diesel emission reductions.

Heavy-duty natural gas vehicles currently emit lower NOx and PM emissions compared to comparable diesel engines. Natural gas buses, for example, routinely exhibit an approximate 25 percent reduction in NOx, and already meet the 2007 PM standard for new engines. Natural gas engines are expected to continue to provide NOx emission reduction benefits relative to comparable diesel engines through 2009. Two manufacturers have announced plans to introduce natural gas engines in 2007 that meet the 2010 new on-road heavy-duty exhaust emission standard for NOx at 0.2 g/bhp-hr. Last year, U.S. EPA reported that leading diesel engine manufacturers are planning to meet the 2007 NOx emission standards through the averaging provisions afforded to them (U.S. EPA 2004a). As such, the majority of the diesel engines produced in the 2007 to 2009 timeframe will meet an average of 1.2 g/bhp-hr NOx. At this time, none of the diesel engine manufacturers have indicated production of diesel engines meeting the 2010 level of 0.2 g/bhp-hr (U.S. EPA 2004a). Diesel and natural gas engines will emit equivalent PM and toxic emissions beginning in 2007 due to new, more stringent emission standards taking effect.

Recent natural gas engine development efforts indicate that engines produced in the 2007 timeframe, will emit lower greenhouse gas emissions compared to their diesel counterparts, by as much as 17 percent. Alternative fuels such as natural gas also provide fuel diversification benefits that are helpful as California attempts to address its growing dependence on foreign oil imports to supply its burgeoning growth in gasoline and diesel demand. Diversity of supply enhances the security of supply, which has become a concern.

II. PUBLIC OUTREACH

A. Environmental Justice

On December 13, 2001, the Board approved Environmental Justice Policies and Actions, which formally established a framework for incorporating environmental justice into the ARB's programs, consistent with the directives of state law and policy (ARB 2001). "Environmental justice" is defined as the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies. These policies apply to all communities in California, but environmental justice issues have been raised more in the context of low-income and minority communities because of past land use policies and the cumulative impact of a concentration of emitting facilities in some neighborhoods.

To achieve this ambitious goal, the ARB has established a Community Health Program and emphasized community health issues in our existing programs. To provide people with the basic tools and information needed to understand and participate in air pollution policy planning, permitting, and regulatory decision-making processes, ARB has published "The Public Participation Guide to Air Quality Decision Making in California."

The Environmental Justice Policies are intended to promote the fair treatment of all Californians and cover the full spectrum of ARB activities. Underlying these policies is a recognition that we need to engage community members in a meaningful way as we carry out our activities. People should have the best possible information about the air they breathe and what is being done to reduce unhealthful air pollution in their communities. The ARB recognizes its obligation to work closely with all stakeholders; communities, environmental and public health organizations, industry, business owners, other agencies, and all other interested parties to successfully implement these Policies. Our outreach efforts, described in Section II.B, facilitate this objective. This proposal benefits these individuals and supports the ARB's Environmental Justice goals.

This regulatory proposal, if adopted, will provide air quality benefits by reducing exposure to NOx and PM emissions emitted by school buses. Diesel PM has been identified as a toxic air contaminant. NOx emissions contribute to respiratory impacts, fine particulate matter, and the formation of ozone. School buses operate in close proximity to students, teachers, and neighbors. Many schools provide bus services in heavily populated areas.

B. Outreach Efforts

1. South Coast Fleet Rules

Consistent with ARB's Environmental Justice Policy for strengthening the ARB's outreach efforts in all communities, the staff utilized many avenues to engage stakeholders in the rulemaking effort.

In October of 2004, a request for public comment concerning the SCAQMD's fleet rules was posted on the ARB website. We requested comment on whether ARB should submit the SCAQMD's fleet rules to EPA for a waiver of preemption, pursuant to section 209(b) of the CAA. We received thousands of comments, including over 4,800 electronic submittals. After a thorough review of the comments and consultation with the U.S. EPA, we made our decision to pursue a new rulemaking process for four fleet rules, with the generation of a new public record that would update relevant information on the effectiveness and costs of these rules.

Staff generated a webpage dedicated to the rulemaking effort. On this webpage, ARB provided notice of the rulemaking process with relevant background and contact information. Then staff generated a list serve from all those who had provided electronic comments. Along with those on ARB's mobile sources listserve, over 5,700 emails were sent to inform stakeholders of the rulemaking activity for all four fleet rule proposals originally undertaken by the ARB staff.

2. School Bus Regulatory Proposal for South Coast Region

Specific to the school bus regulatory proposal, ARB staff made site visits to seven school districts and one private school bus service contractor in the South Coast region. Staff participated in approximately eight conference calls with engine manufacturers and retrofit device manufacturers to discuss the status of current and future technologies. Additionally, staff visited a school district in the Sacramento County region to view two diesel buses that had been retrofitted with aftertreatment that reduces both NOx and PM. The staff also conducted a school bus working group meeting on March 10, 2005, to discuss with school districts, private school transportation providers, and school bus vendors, the ARB's preliminary concepts for its regulatory proposal.

A public workshop was held on April 7, 2005, in El Monte, which is located within the South Coast region. Hardcopies of the workshop notice and draft regulatory concepts were mailed to 413 addresses, and over 200 emails were sent to the working group/school district list. Targeted groups for hardcopy mailings included representatives on the ARB's mailing lists for Air Pollution Control Officers, environmental groups, the school bus stakeholders, and heavy-duty vehicle/engine manufacturers.

Workshop attendees included representatives from school districts, private school bus service contractors, school bus vendors, municipalities, engine manufacturers and marketers, aftertreatment manufacturers, natural gas refueling equipment manufacturers, alternative fuel distributors, environmental representatives, and other interested parties. These individuals participated both by providing data, commenting on the proposed regulation, and by participating in a lengthy question-and-answer session during the workshop.

To generate additional public participation and to enhance the information flow between ARB and interested persons, staff made the workshop notices, draft regulatory concepts, draft regulatory language, and workshop presentations available on the ARB webpage. Notice of the rulemaking activity and workshop were also posted on the SCAQMD's webpage.

III. NEED FOR EMISSION REDUCTIONS

The following sections discuss the status of air quality in the South Coast region, the impacts of air pollution, and thus the need to reduce emission to improve air quality.

A. Air Quality in the South Coast Air Quality Management District

Despite significant progress made in reducing harmful air emissions over the past 20 years, the District continues to experience serious air quality problems. Reductions of emissions from school buses would contribute to an overall reduction of motor vehicle emissions in the District.

B. Children's Exposure to Pollutants During School Bus Commutes

In 2003, the ARB sponsored a study conducted by researchers at the University of California Riverside and Los Angeles campuses to characterize the range of children's exposures to diesel vehicle-related pollutants and other vehicle pollutants during their commutes in school buses. The study measured pollutant concentrations inside five conventional diesel school buses over actual school bus routes in Los Angeles. For comparison, pollutant concentrations from a diesel bus equipped with a diesel particulate filter and a CNG bus were also measured. The major findings of this study were:

- Self-pollution, that is, the intrusion of the bus' own exhaust into the cabin after leaving the exhaust pipe, is a significant source of exposure. The effect was worse when the windows were closed and in older buses;
- Traffic density is critical to pollutant exposure;
- Cleaner buses, such as CNG-fueled buses or diesel-fueled buses equipped with particulate filters, showed significantly reduced on-board concentrations of diesel-related pollutants compared to conventional diesel buses;
- Most exposure occurs from commuting on the bus, not loading and unloading.

As a follow-up to this study, the ARB is now sponsoring an additional study by the same researchers to evaluate the mechanisms of self-pollution in school buses and possible mitigation measures to reduce self-pollution. We expect results of the study to be available in the fall of 2005. The ARB is committed to following up on the results of this important research to minimize or eliminate self-pollution from school buses.

IV. SOUTH COAST SCHOOL BUS FLEET CHARACTERIZATION

A. Bus Population and Emission Inventory

In 2000, the SCAQMD conducted a survey to identify the number of school buses operating in the four counties of Los Angeles, Orange, San Bernardino, and Riverside. The detailed data resulting from the survey provided valuable information regarding school bus fleet composition in the SCAQMD and was useful to the staff in developing this regulatory proposal. However, because the survey data was compiled in 2000, the staff used ARB's On-Road Mobile Source Emission Inventory Model EMFAC2002 (version 2.2 April 23, 2003) to estimate the current school bus population in the SCAQMD and the resulting emissions. The sections below discuss SCAQMD 2000 survey data and the ARB's EMFAC population and emission estimates.

1. Bus Population

a. SCAQMD 2000 Survey

Based on the SCAQMD 2000 survey results, there were 129 school districts in the District, of which 84 owned or operated either their entire or part of their fleet.

Twelve private school bus contractors supplied buses to the remaining school districts. The survey revealed that the total number of school buses was 9,417, of which 8,795 were in school bus fleets of 15 or more and thus would be subject to SCAQMD's Rule 1195. These totals include diesel, gasoline, and alternative-fueled buses used in all four counties by the school districts, private schools, and contractors.

Table 7 summarizes the school bus population, by fuel type, operated by school districts, private schools, and contractors affected by SCAQMD's Rule 1195, based on the SCAQMD's 2000 survey results.

Table 7. SCAQMD 2000 Survey Estimated Number of Affected School Buses by Fuel Type - SCAQMD 2000 Survey (Fleets of 15 or More)

	Diesel	Gasoline	Methanol	CNG	Electric	Total
School Districts	3,288	386	3	111	3	3,791
Contractors	4,844	45	0	2	0	4,891
Private Schools	60	52	0	1	0	113
Total	8,192	483	3	114	3	8,795

In addition, the survey also classified the affected diesel and gasoline population into medium-duty and heavy-duty buses. The distribution of affected gasoline and diesel school buses into medium-duty and heavy-duty buses is shown in Table 8.

Table 8. Distribution of Affected Diesel and Gasoline Population into Medium - Duty and Heavy - Duty Buses - SCAQMD 2000 Survey

DIESEL	Medium-Duty	Heavy-Duty	Total
School Districts & Private Schools	1,013	2,335	3,348
Contractors	2,656	2,188	4,844
Total	3,669	4,523	8,192
GASOLINE	**Medium-Duty**	**Heavy-Duty**	**Total**
School Districts & Private Schools	378	60	438
Contractors	38	7	45
Total	416	67	483
Total Gasoline & Diesel	4,085	4,590	8,675

b. EMFAC 2005 Population Estimates

According to EMFAC, the estimated school bus population in the SCAQMD for the 2005 calendar year is 9,209. The school bus category in EMFAC covers all buses that are registered as school buses with the DMV. EMFAC's output consolidates school buses of all GVWRs and thus does not differentiate the population into medium-duty and heavy-duty school buses. Moreover, EMFAC does not split the output by school districts, private schools, and contractors. Table 9 provides the estimated EMFAC baseline population of school buses in the SCAQMD.

Table 9. EMFAC2002 School Bus Population in Year 2005 for SCAQMD

	TOTAL
Gasoline	1,236
Diesel	7,973
Total	9,209

The 9,209 buses estimated in EMFAC for calendar year 2005 is ARB's best estimate of current school bus population in the SCAQMD. This estimate is slightly lower than the 9,417 buses identified in the SCAQMD survey in 2000. While CNG-fueled school buses are not accounted for separately in EMFAC, there are about 440 CNG-fueled school buses currently operating in the SCAQMD, based on updated school bus fleet information from SCAQMD.

c. Private Schools Affected by the Proposed Regulation

The 2000 survey indicated that there were six private schools with fleets of 15 or more that were subject to the SCAQMD's regulation. Those six schools had a total of 113 buses. Based on recent SCAQMD and ARB phone calls to school districts (in June 2005), there is now only one private school with a school bus fleet of 15 or more buses that would be subject to ARB's proposed regulation. This private school fleet contains a total of 21 buses.

2. Emission Inventory

In order to estimate the emissions of NOx and PM from all the school buses operating in the District, the EMFAC model was run for the 2005, 2007, and 2010 calendar years. The EMFAC model uses emission rates of medium-heavy duty engines to quantify the emissions from school buses. The baseline tons per day (TPD) emissions of NOx and PM from gasoline-fueled and diesel-fueled school buses are summarized in Table 10. Total emissions in calendar year 2010 from school buses in the SCAQMD are 4.60 tons per day (TPD) NOx and 0.17 TPD PM. Total school bus emissions, shown below, provide a gauge for the significance of the estimated emissions benefits in 2010 for this regulatory proposal.

Table 10. EMFAC2002 Baseline Emissions in the SCAQMD from Gasoline and Diesel School Buses (TPD)			
CY 2005	**Gasoline**	**Diesel**	**Total**
NOX	0.20	4.44	4.64
PM	0.01	0.17	0.18
CY 2007	**Gasoline**	**Diesel**	**Total**
NOX	0.18	4.45	4.63
PM	0.00	0.17	0.17
CY 2010	**Gasoline**	**Diesel**	**Total**
NOX	0.17	4.43	4.60
PM	0.00	0.17	0.17

B. CNG Refueling Infrastructure and Maintenance

1. School Bus Fueling Requirements

CNG fueling systems currently in use in the SCAQMD include time-fill (also known as "slow-fill"), fast-fill, vehicle refueling appliance, portable compressor station, and tube trailer systems.

School buses typically operate on fixed schedules at the beginning and end of the school day. Consequently, the evening and night are available for school bus maintenance and refueling. School districts and school bus service providers with smaller fleets of CNG-fueled buses often utilize time-fill refueling systems that take advantage of the eight to ten hours available to fuel their buses. Time-fill fueling systems are typically less expensive than alternative systems because they require less equipment (e.g., compressed gas storage tanks).

School districts and providers with larger fleets of CNG-fueled school buses, and school districts that share fueling facilities with other organizations or the public often utilize fueling systems with fast-fill capabilities. Refueling a school bus at a fast-fill facility typically takes 20 minutes or less. Refueling times depend on the remaining amount of fuel in the school bus and the storage capacity of the fueling site.

Time- and fast-fill systems have specific advantages that can be exploited by the users. For example, slower refueling will result in a more complete fill of the fuel tank (and consequently, provide a longer driving range), while rapid refueling

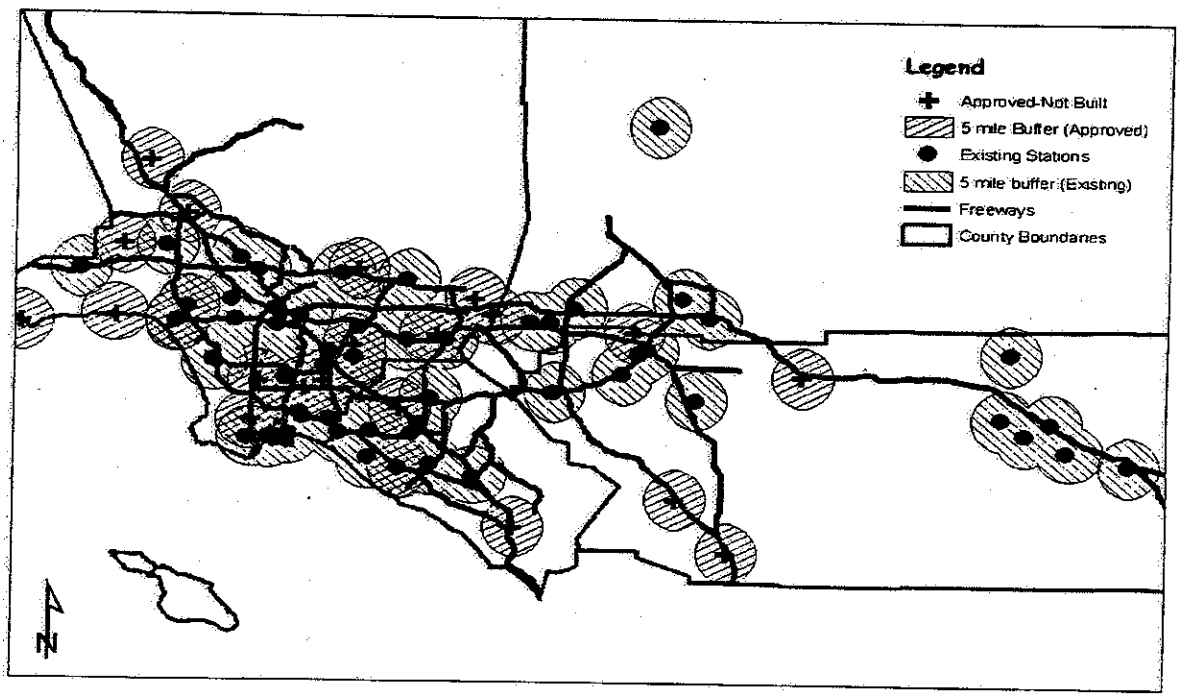
provides a quick turnaround and relieves the need to have personnel monitor the fueling process over an eight to ten hour period.

2. Existing Fueling Stations

SCAQMD regulations require public access to fueling stations built with alternative fuel incentive funding. However, "public access" to school district fueling stations typically refers to access for public fleets such as regional transit or municipal waste fleets. Private-citizen access to school district fueling facilities opens the district to liability and security issues that could encumber the use of their fueling stations.

SCAQMD alternate-fuel incentive programs have significantly increased the number of CNG fueling stations within their area of responsibility. There are more than 100 CNG fueling stations in the region that could provide fueling access to school districts and school bus providers. The following map (Figure 2) illustrates the locations of existing natural gas fueling stations in the SCAQMD (in Spring 2005) that are either fully operational or in the planning and permitting stage. The hatched-line circle drawn around each site is used to identify geographical areas in the region that have sufficient penetration of CNG fueling infrastructure to make CNG-fueled school buses a practical option at this time.

Figure 2 CNG Fueling Stations in the South Coast Air Basin



The web site www.cleancarmaps.com provides addresses and driving directions to available CNG and other alternative fueling stations in California, Nevada, and Arizona.

The SCAQMD reports nine school districts are not located within five miles of a CNG refueling station, as shown in Table 11.

Table 11. School Districts with No CNG Refueling within 5 Miles
Acton-Agua Dulce Unified School District
Bear Valley Unified School District
Capistrano Unified School District
Castaic Union School District
Desert Center
Nuview Union School District
Rialto Unified School District
Rim of the World Unified School District
Sulphur Springs

3. Fueling Infrastructure Costs

School bus fleet operators prefer to have an on-site, central fueling station to reduce overhead and labor costs (versus refueling offsite). The majority of school districts responding to a survey provided by the SCAQMD indicated that they owned, co-owned, or had access to a CNG refueling station (SCAQMD 2005).

Most of the school districts with central fueling stations received assistance funding from the SCAQMD and other regional and government agencies interested in the development of CNG fueling infrastructure in the South Coast Air Basin. The Governing Board of the SCAQMD authorized $12 million to assist in regional infrastructure development for natural gas fueling. Additional funding from other agencies is also available for this purpose. As more school bus fleets convert to CNG fuel, additional funding will be required in future years.

Analysis of school district surveys provided by the SCAQMD reveals that the costs to school districts for self-funded, dedicated CNG fueling sites can be cost prohibitive. Fast fill stations capable of refueling up to 20 school buses overnight can cost approximately $320,000 (SCAQMD 2005), while larger sites capable of fueling up to 50 CNG vehicles overnight can cost closer to $700,000. Time-fill infrastructure, which trades infrastructure cost for slower tank fills, can cost approximately one-third the price of fast-fill systems.

A few independent corporations produce CNG fueling systems that cost about $12,000 per CNG-fueled school bus (to time-fill a single bus). In a recent bid to develop the infrastructure needed for 34 CNG-fueled school buses in the South Coast Air Basin, it was estimated that up to $250,000 would be required for a combination of 20 time-fill units and one fast-fill unit. The estimated cost on a per-bus basis would be about $7,350 (SCAQMD 2001a).

Some school bus operators have maintenance or lease agreements with fuel infrastructure providers of CNG and diesel. This type of arrangement provides fuel access without the burdens of ownership, and typically costs around $760 per month in addition to the actual cost of the CNG fuel. In other cases, the provider installs and maintains the fueling station and the end user pays a small premium on the fuel price to pay for the station and accompanying maintenance costs.

4. Repair Facility Modification

California's building codes restrict CNG-fueled vehicle repair facilities from operation unless they meet strict guidelines to reduce the opportunity of an indoor fuel flash or explosion. Closed-door CNG school bus repair operations are only permitted in buildings built or modified specifically for that purpose, and must meet requirements for venting, deflagration venting, and access to rooms containing CNG equipment (CEC 1995).

The cost of repair facility upgrades can range from a few thousand dollars to over $200,000 depending on the conditions of the existing facility. Many existing school bus repair facility buildings do not meet building code standards for CNG-fueled vehicle repair. Consequently, code requirements have induced some school districts and school transportation providers to repair their CNG-fueled buses outdoors until money is secured to retrofit the repair buildings. In this process, some school districts have discovered that relatively low-cost alternatives to extensive repair facility upgrades prove completely adequate for their CNG-fueled bus repair needs.

The ARB staff spoke with several school districts in the South Coast region using CNG buses to better understand the end-users' experiences with and costs for alternative-fuel technology. One school district with 20 CNG buses reported using a canvas-type enclosure to service its CNG-fueled school buses at a total cost of approximately $15,000, which equates to $750 per bus. Another school district, which will soon have a total of 42 CNG-fueled school buses in its fleet, paid $50,000 for an outside hydraulic repair lift for CNG-fueled school bus maintenance and $15,000 for the associated cement pad, which equates to less than $1,600 per bus. At the high-end of the cost scale for repair facility modifications, a school district with about 95 CNG-fueled school buses performed an extensive upgrade to its repair facility at a cost of $350,000 to $400,000, or approximately $4,000 per bus.

5. Operating Costs

SCAQMD's analysis of school district survey data and information from the California Energy Commission (CEC 1995) indicate that, on average, CNG-fueled school bus operation costs one or two cents more per mile than diesel-fueled school bus operation. Based on SCAQMD's analysis, diesel-fueled school bus operation averages about 40 cents per mile for buses less than five years old. The analysis also indicated that there were noteworthy variations in costs between

school districts and operators throughout the air basin. This is the result of significant variations in administrative policies, purchasing operations, age of buses (including vehicles under warrantee), and other factors.

6. User Experience

CNG engine-specific parts are more expensive for school buses compared to engine parts for diesel-fueled school buses. Future increases in the numbers of CNG-fueled public works vehicles and school buses in the South Coast Air Basin will likely result in an eventual decrease in the cost of CNG school bus engine parts, and an increase in the cost of engine and emission control parts for diesel school buses and public works vehicles utilizing advanced electronics for pollution control. For the first few years after purchase (typically five years), many of the CNG-specific engine parts are under manufacturers warranty. Consequently, school bus engine parts under warrantee are replaced at the manufacturer's expense. SCAQMD staff has facilitated efforts to develop training programs for mechanics working on CNG-fueled engines, and has provided financial assistance to help cover the training materials or costs.

While some school districts in the South Coast region support and remain committed to alternative-fueled school buses, many other school districts oppose any requirements to purchase alternative-fueled school buses based primarily on cost issues.

V. South Coast Fleet Rule 1195

This section describes Rule 1195 and how it has been implemented over the last four years. ARB staff believes modifications are needed to reestablish exemptions that have sunset under Rule 1195, to ensure that rule compliance is dependent on the availability of external funding sources, and to clarify that the one private school bus fleet in the District would be subject to the regulation.

A. Requirements

Rule 1195 applies to school bus fleets operating in the District with 15 or more school buses. These fleets may be operated by public school districts, private schools, and by private companies that provide school transportation to public and private schools.

Under Rule 1195, school bus operators are required to purchase or lease gasoline-fueled or alternative-fueled buses when adding or replacing school buses in their fleets. Rule 1195 also contains provisions to retrofit specified percentages of in-use diesel school buses as part of the exemption process that fleet operators must use to acquire diesel school buses and as a means for delaying compliance with the purchase requirements.

Implementation is contingent on the availability of external funding to pay for:
1) the incremental purchase cost of lower-emitting alternative-fueled school buses;
2) the incremental purchase cost of new lower-emitting diesel buses equipped with

filters; and 3) some costs associated with alternative-fuel infrastructure and alternative-fuel maintenance facility upgrades. However, implementation of requirements to equip in-use diesel buses with ARB-verified diesel emission control devices is not contingent upon availability of external funding in all cases. Exemptions in Rule 1195 that allow the purchase of diesel buses based on the lack of external funding for alternative-fuel infrastructure and alternative-fuel maintenance facility upgrades have sunset and need to be reinstated in the ARB's proposed regulation.

The external funding necessary to cover incremental costs must be enough to pay for the difference in purchase cost between a rule-compliant new bus purchase and a diesel-fueled school bus equipped with a diesel emission matter control device (i.e., a DPF). If funding is not available, then the school bus fleet owner or operator may acquire a different bus type in the following order: 1) an intermediate diesel-fueled school bus as defined by the ARB's Lower-Emission School Bus Program Guidelines adopted in 2000; 2) a gasoline-fueled school bus; or finally 3) a diesel-fueled school bus with an ARB-verified diesel emission control device (DPF) installed. These purchase options are discussed below.

Purchase Options

Intermediate Diesel School Buses. Rule 1195 allowed for the purchase (or lease) of an "intermediate diesel school bus" as defined by the ARB's Lower-Emission School Bus Program Guidelines. These buses had certified NOx emissions of 3.0 g/bhp-hr (at a time when the current NOx standard was 4.0 g/bhp-hr) and certified PM emissions of 0.01 g/bhp-hr. Beginning October 2002, NOx emission standards ratcheted down to 2.4 g/bhp-hr for NOx plus NMHC (or 2.5 g/bhp-hr NOx plus NMHC with 0.5 g/bhp-hr NMHC cap); thus new "intermediate diesel school buses" are no longer available.

Gasoline-fueled School Buses. If external funding was not available for a intermediate diesel school bus during the time it was commercially available, Rule 1195 then required the fleet operator to consider a gasoline-fueled school bus.

Diesel-fueled School Buses with Aftertreatment. If a gasoline-fueled school bus is not a viable purchase option and a school district submits supporting documentation demonstrating the need for a diesel-fueled school bus, the school district may purchase (or lease) a diesel-fueled school bus equipped with a diesel emission control device (i.e., a DPF), if funding outside of the school bus fleet operator's fiscal budget is available. Without external funding to cover the cost of the diesel emission control device, the fleet operator is allowed to purchase a conventional diesel-fueled school bus without the diesel emission control device.

Additional Requirement for Diesel-fueled School Bus Purchases. If a school bus fleet operator receives an exemption to purchase a diesel-fueled school bus with or without a diesel emission control device, then Rule 1195 imposes an

additional requirement to annually retrofit 15 percent of a fleet's in-use diesel-fueled school buses with an ARB-verified diesel emission control device, if external funding is available.

B. Exemptions

1. Lack of Funding For Alternative-Fuel Fueling Stations and Alternative-Fuel Maintenance Facility Upgrade

Rule 1195 specified funding amounts, on a per school bus basis, that must be available to the school bus fleet operator to use for building a new alternative-fuel fueling station and to upgrade existing maintenance facilities to required standards to accommodate alternative-fueled school buses. If those funding amounts were not available, and the school district was not within five miles of an existing alternative-fuel fueling station, the school bus fleet operator was then able to use the exemption process to purchase a diesel-fueled school bus. As already stated, these funding provisions for specified funding amounts to assist in building alternative-fuel fueling stations and upgrading existing maintenance facilities have sunset under Rule 1195 and need to be reinstated.

2. Other Available Exemptions

Rule 1195 includes other exemption provisions to accommodate school bus fleets' differing transportation needs. The list below categorizes the other types of exemptions available to school bus fleets. The ARB's proposal retains these exemptions in concept, but with minor modifications in some cases.

- Lack of alternative-fueled engine/chassis/body configuration in a specific size or for a specific route
- A scrapping (i.e., bus retirement) provision to allow non-compliant pre-owned school bus purchases
- Exemptions for unforeseen circumstances, business mergers, prior contract agreements, and field trips

C. Implementation History

Implementation of the existing fleet rule over the last four years is a function of the requirements, available funding, and exemptions granted by the SCAQMD. This section discusses implementation to date including vehicles purchased, actual emission reductions, status of infrastructure, and exemptions.

1. Compliant Vehicle Purchases

SCAQMD staff reports purchases of 519 compliant vehicles from the adoption of Rule 1195 on April 20, 2001, through February 11, 2005 (see Table 12 below). SCAQMD staff also estimated 0.07 tons per day of NOx and 0.003 tons per day PM emission benefits from those four years of rule adoption. This includes both medium-duty and heavy-duty school bus purchases. The actual emission benefits

from Rule 1195 are significantly less than what the SCAQMD staff estimated in its April 2001 staff report.

Table 12. Rule 1195 Compliant School Bus Purchases, 2001 - 2005

Affected Fleet Population	Compliant Vehicles Purchased		NOx Reductions (tons/day)		PM Reductions (tons/day)	
	Actual	2001 Staff Report	Actual	2001 Staff Report	Actual	2001 Staff Report
8897	519	1342	0.07	0.15	0.003	0.011

Rule-compliant vehicles purchased were primarily buses used in public school bus fleets. Funding for rule-compliant school bus purchases over this period came from the state-funded Lower-Emission School Bus Program, the MSRC, and AQMD penalty settlement funds.

Table 13. Rule 1195 Exemptions Granted

Exemptions Granted				Non-Compliant Vehicles Purchased after April 28, 2004
4/01 to 4/04*		4/04 to 2/05*		
Public	Private Contractors	Public	Private Contractors	Private Contractors
64	995	6	0	243

*Rule 1195 was adopted on April 20, 2001. The U.S. Supreme Court decision regarding SCAQMD authority over private fleet purchases with respect to these fleet rules was noticed on April 28, 2004.

Most of the exemptions were issued due to lack of funding, followed by lack of model availability and lack of refueling infrastructure.

2. Medium-Duty School Bus Purchases

Table 13 includes medium-duty school bus purchases from 2001 through 2004. All of the 210 gasoline and alternative-fueled buses purchased since rule implementation were certified as ULEV. Of the 210 buses purchased, 185 were gasoline school buses and virtually all of these gasoline buses replaced diesel buses. The annual turnover rate for medium-duty school buses is much lower than the SCAQMD staff estimated in its staff report for Rule 1195. This is partially because of state school funding issues and the cyclical nature of school bus replacement schedules.

Medium-duty school buses have been ineligible for most of the funding programs discussed in Section I. Most of the state and local funding has been directed to replacement of heavy-duty school buses. However, a portion of the DMV fees can be used to fund medium-duty school buses.

SCAQMD's MSRC, which administers 30 percent of the DMV fees collected in the South Coast, has provided school bus funding for several years. The last funding cycle included medium-duty school buses. The MSRC program supports the purchase of alternative fuel school buses only. The MSRC has provided funding support for 24 medium-duty natural gas school buses. That funding was a flat $25,000 per bus, which was intended to cover the incremental cost of the natural gas bus and provide some funding to support fueling infrastructure. The MSRC creates a new work program each year. At the time this report was developed, the work program for 2005 - 2006 had not yet been completed.

The SCAQMD's Chairman's School Bus Initiative also provides funding support for alternative-fueled school buses. One medium-duty school bus has been purchased through this program so far. Another potential source of funding for medium-duty school buses could be air district collected fines and penalties.

VI. SUMMARY OF PROPOSED REGULATION

The proposed regulation has performance-based purchase requirements, dependent on the availability of external funding sources, that are approximately equivalent to the purchase/lease requirements of the SCAQMD Rule 1195. Additionally, the proposal would reinstate exemption options that have sunset in the SCAQMD rule. This section summarizes the proposed regulation and compares it to the SCAQMD's Rule 1195.

A. Requirements

This proposal specifies emission criteria for buses purchased or leased by public and private school bus fleets within the SCAQMD that operate 15 or more buses. These requirements include criteria for both medium-duty and heavy-duty school buses, newly manufactured and pre-owned. The proposed regulatory program is to be administered by the SCAQMD staff.

Like SCAQMD Rule 1195, the regulatory proposal provides exemptions, particularly for lack of external funding. If this funding is not available, the school bus fleet operator may apply for an exemption from these requirements.

Additional hardship exemptions are available based on the lack of availability of alternative-fuel refueling facilities or lack of funding for installation of refueling facilities. Exemptions may also be granted based on the lack of availability of the bus size required for a fixed route that meets the emission criteria, buses required for field trips, and the occasion when an urgent need arises for the quick acquisition of additional buses due to unforeseen circumstances. Additionally, there is a provision for the merger of two private bus fleets or the case where one fleet purchases another. These provisions apply only if both fleets are operating within the SCAQMD at the time of the purchase or merger.

The regulatory proposal includes a provision to reduce emissions from school buses currently operating in fleets. The proposal would require that owners and operators of public and private school bus fleets of 15 or more buses install ARB-verified diesel emission control methods on at least 25 percent of their buses that can utilize such methods each year, if external funding is available. This requirement differs from SCAQMD Rule 1195 in that it is a requirement independent of the exemption process.

Lastly, the regulatory proposal includes record keeping requirements for compliance auditing and enforcement.

1. Purpose

The purpose of the regulatory proposal is to reduce air toxic and criteria pollutant emissions by requiring public and private school bus fleet operators and owners to acquire less-polluting school buses when purchasing or leasing these vehicles for operation in the SCAQMD.

2. Definitions

A school bus means any vehicle that is used for the specific purpose of carrying students between home and school and to school activities. This applies to students through the twelfth grade. A medium-duty school bus is any school bus having a gross vehicle weight rating of from 6,000 to 14,000 pounds. A heavy-duty school bus is any school bus with a gross vehicle weight rating of over 14,000 pounds.

3. Purchase and Lease Requirements

a. Purchase and Lease Requirements for Newly Manufactured Vehicles

The regulatory proposal places purchase and lease requirements on operators of school bus fleets of 15 or more medium and/or heavy-duty school buses. This proposal requires that when adding to or replacing medium and heavy-duty school buses in an existing fleet, these fleet operators purchase or lease new school buses equipped with engines meeting a set of standards which have been given the designation of best engine selection/technology (BEST).

<u>Best Engine Selection/Technology (BEST) Purchase Criteria</u>

Medium-Duty: The BEST criterion for the purchase or lease of a newly manufactured medium-duty school bus is that the bus be equipped with a non-diesel engine certified as ULEV or cleaner. As previously discussed, diesel engines certify to engine-based standards, while gasoline engines typically certify to chassis-based standards. Both the engine standards and the chassis standards have a "ULEV" designation, however the chassis-based ULEV standard is more stringent than the engine-based ULEV standard. Therefore, requiring medium-

duty buses to be non-diesel buses certified as ULEVs is consistent with the BEST criterion.

There are currently ULEV certified gasoline-fueled buses available for use as smaller van or cutaway style medium-duty school buses which typically carry 10 to 24 students. The availability of an alternative-fueled bus for this application is uncertain. The larger medium-duty buses, with gross vehicle weigh ratings of 10,000 to 14,000 pounds and that carry from 30 to 35 students, are currently only available as diesel-fueled models. An alternative-fueled bus of this size is not expected to be commercially available before 2007.

Heavy-Duty: BEST criteria for the purchase or lease of a newly manufactured heavy-duty school bus include emission standards for both NOx and PM that require increasingly cleaner vehicles as the program progresses.

The standards for 2005-2006 model year engines require certification to the optional NOx plus NMHC standard of 1.8 g/bhp-hr and to the corresponding PM standard of 0.03 g/bhp-hr, as specified in title 13, CCR section 1956.8 (a)(2)(A). The bus engines currently available that are able to meet these standards would either be alternatively-fueled or, if diesel-fueled, would include a verified diesel emission control strategy that reduces both NOx and PM.

2007-2009 model year engine school bus purchases or leases require certification to a 0.2 g/bhp-hr maximum NOx family emission limit (FEL) and to the 0.01 g/bhp-hr required PM standard, specified in title 13, CCR, section 1956.8 (a)(2)(A) for 2007 and subsequent year engines. At this time, only alternative-fueled engines are expected to be able to meet 0.2 g/bhp-hr NOx FEL.

2010 and later model year school bus purchases and leases would also require certification to the required NOx standard of 0.2 g/bhp-hr and the required PM standard of 0.01 g/bhp-hr. Since this is the requirement for all newly manufactured heavy-duty engines in 2010, it is expected that both alternative-fueled and diesel-fueled buses will meet these standards and have equivalent emissions.

b. Purchase and Lease Requirements for Pre-Owned School Buses

When public or private school bus fleet operators with 15 or more school buses purchase or lease a pre-owned heavy-duty school bus, the regulatory proposal will require that school bus be repowered with a new engine that meets the BEST criteria. When public or private school bus fleet operators with 15 or more school buses purchase or lease a pre-owned medium-duty school bus, the regulatory proposal will require that they purchase or lease a school bus with an engine certified to the LEV emission levels or cleaner.

4. Exemptions from Purchase Requirements

The regulatory proposal includes provisions to exempt school bus fleets operators from the purchase requirements discussed above, based on the non-availability of grants and external funding required to implement the requirements, and based on hardship due to difficulty in the practical application of the regulatory proposal's requirements. Operators of public and private school buses may apply to the Executive Officer of the SCAQMD for an exemption from these purchases and/or lease requirements based on the reasons discussed in the following paragraphs.

a. Lack of Funding for Incremental Cost of BEST

These purchase and/or lease requirements are dependent on sufficient funding being available from grants or other external sources outside of the school bus fleet operator's fiscal budget to cover the incremental cost of complying with the regulatory proposal. The grant or external source funding must be enough to pay for the difference between the cost of the purchase required by the BEST criteria and the cost of a comparable standard purchase school bus. This differential cost includes costs of warranties comparable to base warranties for a comparable standard school bus.

If this funding is not available, then the school bus fleet operator may purchase a new bus not meeting the BEST requirements providing the bus purchased is equipped with a California-certified engine meeting a PM standard of 0.01 g/bhp-hr. This PM standard is an optional standard for the 2005-2006 model years. However, for the 2007-2009 model years, 0.01 g/bhp-hr will become the PM standard for all heavy-duty engines. Both International and Caterpillar will have an engine for use in school buses available for the 2005-2006 model years that will meet this standard through the use of a diesel particulate filter; it will have a purchase price higher than a standard diesel bus purchase. If, for the 2005-2006 model years, there is insufficient external incremental funding to purchase a California-certified engine meeting the PM standard of 0.01 g/bhp-hr, a fleet operator may purchase a standard heavy-duty school bus that does not meet the optional standard. This exemption covers both medium and heavy-duty engine purchases.

b. Lack of Available Infrastructure

It is expected that the only available engines that will meet the heavy-duty 2007-2009 model year BEST criteria will be alternative-fueled. A public or private school bus fleet operator may purchase or lease heavy-duty school buses that are not alternative-fueled if they can demonstrate that there is neither an alternative-fuel refueling station nor funds to provide a refueling facility available. The fleet operator must demonstrate that there is not an alternative-fuel refueling station within five miles of where the buses are stored or where bus maintenance is performed.

This exemption does not apply if funding for providing new refueling facilities of at least $13,000 per each alternative-fueled BEST school bus to be purchased or

leased is available from grants or other external sources. Several of the clean school bus incentive programs provide funds for significantly more than the incremental cost difference between the alternative-fueled bus and a standard purchase bus. Consequently, a provision has been included that this exemption does not apply if the external funding received by the fleet operator for the purchase of the alternative-fueled BEST bus exceeds the incremental capital cost of the bus purchase by at least $13,000 for building or expanding an alternative refueling station and up to an additional $4,000 for required maintenance facility upgrades. Required funding for maintenance facility upgrades is discussed in the following paragraph.

c. Lack of Funding for Maintenance Facility Upgrades

This exemption provides relief from the BEST purchase requirement if external funding beyond the fleet operator's fiscal budget of up to $4,000 per BEST bus is not available to upgrade an existing maintenance facility to meet the required standards to handle alternative-fueled bus technology. The cost of the facility upgrades required by different fleets when acquiring alternative-fueled buses since the adoption of the SCAQMD Rule 1195 have varied significantly depending on the configuration of their existing facilities and the number of alternative-fueled buses in their fleet. These upgrades and their associated cost per bus are discussed in Section IV.B.4. Due to this large variation, this exemption was not crafted to set a minimum funding requirement but instead caps the required exemption amount at a value that encompasses the facility upgrades that have been required by various fleets in the past few years. This exemption allows a public or private school bus fleet operator to purchase a diesel powered school bus with a California-certified engine meeting a PM standard of 0.01 g/bhp-hr. If, for the 2005-2006 model years, there is insufficient external incremental funding to purchase a California-certified engine meeting the PM standard of 0.01 g/bhp-hr, a fleet operator may purchase a standard heavy-duty school bus that does not meet the optional standard.

This exemption does not apply if the external funding received by the fleet operator for the purchase of the alternative-fueled BEST bus exceeds the incremental capital cost of the bus purchase by at least $13,000 for building or expanding an alternative refueling station and up to an additional $4,000 for required maintenance facility upgrades.

d. Lack of Available Engine/Chassis/Body Configuration

Exemptions to the purchase requirements may be granted if a school bus meeting BEST criteria is not commercially available in the required bus size or in a bus size or type required for use on a specific fixed bus route. If the exemption is granted for a 2005-2006 model year purchase, the fleet operator may purchase or lease a diesel-fueled bus with a California-certified engine meeting the PM standard of 0.01 g/bhp-hr. If the fleet operator does not receive external funding for the purchase of a California-certified engine meeting the PM standard, a school bus that does not meet the optional standard may be purchased. For the 2007-2009

model years, 0.01 g/bhp-hr will become the PM standard. Consequently, if an exemption is granted for these model years, the fleet operator may purchase or lease a new standard purchase diesel-fueled school bus.

e. Lack of Funding for A California-Certified Engine Meeting an Optional PM Standard

For the 2005-2006 model years, if there is insufficient external incremental funding to purchase a California-certified engine meeting the optional PM standard of 0.01 g/bhp-hr, a fleet operator may purchase a standard heavy-duty school bus that does not meet the optional standard.

f. Field Trips

Public and private school bus fleet operators may apply for an exemption from BEST purchase requirements for a specified number of buses that are used for transporting passengers on field trips if all of the other buses in the fleet meet the BEST criteria. The number of buses that may be exempt for field trip use is dependent on fleet size, as shown in Table 14 below.

Table 14. Number of Non Compliant Field Trip Buses Allowed

Fleet Size (School Buses)	Maximum # of Field Trip Buses
≥ 100	10% of fleet
51 < 100	10
≤ 50	5

The Executive Officer of the SCAQMD may allow a higher number of purchase exemptions for field trip buses if the fleet can provide three years of bus dispatch logs that show that a higher number of field trip buses are necessary.

g. Unforeseen Circumstances

Public and private school bus fleet operators may lease buses that do not meet BEST criteria if unforeseen circumstances arise that create a need for the fleet to operate additional buses. In order to lease buses that do not meet the BEST criteria, the fleet owner or operator must show that a BEST compliant bus cannot be deployed within one month from the date the bus order was placed. The owner or operator may lease the number of buses needed for the length of time required to purchase or lease BEST compliant buses. The lease time for the non-compliant buses may not be longer than the time remaining in the school year.

h. Mergers

If a private school bus fleet operator either forms a merger with another private school bus fleet operator or purchases another private school bus fleet then the transfer of ownership of school buses due to the merger or fleet purchase will not

be subject to BEST criteria if both private school bus fleets were already operating in the SCAQMD at the time of the purchase or merger.

i. Exemptions from Pre-Owned School Bus Purchase Requirements

Operators of public and private school bus fleets may apply for an exemption from these purchase requirements for a pre-owned bus if the oldest school bus in the operator's existing fleet is scrapped or permanently removed from operation in the fleet. The pre-owned school bus that is added to the fleet must utilize a verified diesel emission control method if it such a control method is available, and if grants or external funding is available for the incremental cost of the verified diesel emission control strategy.

5. Diesel Emission Control Methods for In-Use School Buses

Public or private school bus fleet operators with 15 or more school buses will be required to install verified diesel emission control methods on at least 25 percent of their in-use fleet that can utilize these control methods every year beginning January 1, 2006. This requirement only applies to school buses with engines for which an in-use control has been ARB-verified. The control method utilized must be the highest level of emission control that has been verified for the specific engine on which it will be used. If the original engine warranty is still in effect when the emission control strategy is installed, the installation of the emission control strategy must not jeopardize the original engine warranty.

If the emission control method is fuel-based, then the school bus operator must continue to use the fuel-based method as long as the bus is being operated in the fleet. If the operator wishes to discontinue using the fuel-based method, he must apply to the SCAQMD to change to another verified method for the remaining operating life of the bus.

6. Compliance, Auditing and Enforcement

The proposed regulation includes provisions requiring record keeping for purposes of determining compliance, auditing, and enforcement, functions which are to be performed by the SCAQMD. Specifically, fleet information including manufacturer, model, model year, and fuel type must be made available to the SCAQMD upon request to demonstrate compliance. Other records to be retained by the fleet operator include proof supporting exemptions and purchase records for fuel and fuel additives that are elements of an emission control method.

The proposal includes a provision prohibiting fleet owners from circumventing the regulation by creating multiple fleets under common ownership that contain less than 15 vehicles.

B. Differences Between South Coast Rule 1195 and Staff Proposal

The regulatory proposal differs from South Coast Rule 1195 in three primary areas and in other less significant ways, mainly in definitions and exemption requirements. The primary differences are summarized below.

- *Purchase requirements:* Rule 1195's purchase criteria require alternative-fueled vehicles for heavy duty, medium duty, and repowers whereas this proposal's purchase criteria are emission based.
- *Funding Exemption for requirement of an approved emission control device on diesel vehicles:* In multiple cases where Rule 1195 allows the purchase of a diesel bus due to an exemption, it requires that the bus be equipped with an approved diesel emission control device regardless of the availability of external funding. The proposal stipulates that, in all cases, external funding sources must be available for required purchases.
- *Exemptions*: The proposal reinstates two Rule 1195 exemptions that have sunset in addition to adding a new exemption. The reinstated exemptions are for non-availability of funding for refueling facilities and non-availability of an existing refueling facility within five miles. The proposal creates a separate exemption for availability of funding for maintenance facility upgrades.

The following delineates the minor differences.

- *Definitions:* Definitions of medium-duty and heavy-duty school buses in Rule 1195 include passenger capacity whereas this was omitted from the proposal in anticipation of decreased bus seating capacity when requirements for lap/shoulder restraint systems on larger school buses (primarily buses classified as heavy-duty) go into effect on July 1, 2005, under California law (Senate Bill 568, Statutes of 2001, Chapter 581).

- *Exemption requirements:*
  - Rule 1195 specifies a diesel vehicle with an approved control device as the baseline for determining incremental funding whereas the proposal specifies a standard purchase diesel vehicle (a diesel bus without an approved control device) for the 2005 – 2006 model years.
  - Rule 1195 links requirements for equipping the in-use diesel fleet with emission control devices to the exemption process as a means of delaying purchase requirements whereas this proposal's requirements are separate from the exemption process.
  - Rule 1195 requires that a pre-owned bus must be less than six years old if bought on the condition of scrapping the oldest bus in the fleet. The proposal does not include this maximum bus age requirement.

- *Compliance, auditing, and enforcement:* The proposal includes provisions not included in Rule 1195 for the use of fuel or fuel additives as a diesel emission control method and the corresponding requirements for record keeping for demonstrating compliance.

VII. AVAILABILITY & TECHNOLOGICAL FEASIBILITY

A. Technology Assessment: School Bus Engines

1. Heavy-Duty School Bus Engines

For years 2005 and 2006 there are three natural gas engine models available for school buses that meet the proposed standards for these years. However, only one of these engines is currently being installed in new school bus chassis. The emission levels for these three engines range from 1.5 - 1.8 g/bhp-hr of NOx + NMHC. John Deere's 2005 model year 6081H engine is certified to the 1.5 g/bhp-hr NOx + NMHC level and to 0.01 g/bhp-hr PM. This John Deere engine is currently found on Blue Bird and ThomasBuilt heavy-duty natural gas-fueled school buses of varying configurations.

In the near future it is anticipated that several other engine makes and models will become available that will meet or exceed ARB's optional NOx emission level. These additional engines are expected to provide expanded horsepower and torque ranges to meet the needs of a larger segment of the school bus market.

Currently there are no diesel-fueled engines available or anticipated for years 2005 and 2006 that will meet the proposed NOx emission level of 1.8 g/bhp-hr NOx + NMHC. Other fuel types such as propane-fueled engines are in production, but are certified to a less stringent standard of 2.5 g/bhp-hr NOx + NMHC.

In 2007, it is anticipated that there will be several engine models that will meet the 0.2 g/bhp-hr NOx FEL and 0.01 g/bhp-hr PM required standard. For school bus applications, fuel types for these available 2007 engines could be natural gas or propane. As engine manufacturers announce their intentions for 2007 model year engines, the availability of 0.2 g/bhp-hr NOx FEL engines will become clearer.

2. Medium-Duty School Bus Engines

There are currently ULEV-certified gasoline engines available for smaller medium-duty van or cutaway style school buses. These include the GM 4.8L and 6.0 L engines. These medium duty vehicle standards remain the same through 2010, and a presumption can be made that these engine/vehicle combinations will continue to be available.

The availability of natural gas engines for smaller medium-duty school buses is less certain. In the past, Ford had certified its natural gas E450 in a cutaway configuration for school buses. However, Ford will no longer produce the natural gas model of this engine. Although there is currently an aftermarket version of this engine undergoing ARB certification, Ford does not allow the engine to be used in its chassis. Therefore, the engine manufacturer of record would need to seek agreement from a chassis manufacturer to integrate the engine into a school bus configuration. Another aftermarket engine manufacturer is pursuing certification of

natural gas and propane GM 4.8L and 6.0L engines. Again, the engines would need to be integrated into a chassis and configured as a school bus before they could be considered commercially available.

Of the medium-duty school buses, the larger ones (30-35 passenger variety) are diesel-fueled. There are currently no ULEV versions of a 220-250 horsepower engine, which is typically used in this application. Navistar will offer their Green Diesel Technology school buses in 2005 and 2006. These buses utilize the Navistar DT 466 engine with EGR, and a passive regeneration particulate filter. Emission certification levels are expected to be 2.2 g/bhp-hr NOx and 0.01 g/bhp-hr PM. In 2007, this engine is expected to be certified to 1.2 g/bhp-hr NOx and 0.01 g/bhp-hr PM, and in 2010, the engines will be certified to the 0.2 g/bhp-hr NOx standard. Thus this engine will not meet the proposed emission standards until 2010.

John Deere is developing a natural gas engine with 250 horsepower which they plan to have available for the school bus market beginning in 2007. The design goal for this engine is 0.2 g/bhp-hr NOx.

B. Verified Aftertreatment Devices

Diesel engine aftertreatment devices currently verified for use in California can provide both NOx and PM emission reductions. However, the devices already verified do not apply to 2005 and later model year engines and future applicability is uncertain.

Currently there is only one device that has been verified for use in California that provides both NOx and PM emission reductions simultaneously. The Cleaire Alliance Longview is a lean NOx catalyst mated with a DPF that is designed for specific model year 1993 to 2003 engines. This device provides a 25 percent reduction in NOx emissions and an 85 percent or greater reduction in PM emissions. There is an approximate three percent fuel economy penalty associated with employing the Alliance Longview. The use of ultra low sulfur diesel fuel is required in conjunction with this device.

Plans for verifying the device for 2005 and 2006 model year engines are unclear, and the device is not capable of reducing NOx sufficiently to meet the proposed 2007 NOx standard. Other verified devices reduce PM, but do not reduce NOx, and thus do not offer a viable method of reducing emissions from a current diesel engine sufficiently to allow compliance with the proposed emission standards.

C. Future Aftertreatment and Retrofit Devices

Many advances are being made in the diesel retrofit device industry. New types of DPFs are being developed to apply to older model year engines and those vehicles that do not have the operational parameters that would allow for the use of currently verified DPFs.

Selective catalytic reduction (SCR) devices promise to provide large NOx emission reductions. The use of SCR technology has already been verified for use in California for off-road engines. SCRs have been employed in the power generation industry for many decades and it is considered a mature technology. SCRs require the use of a reductant normally urea but ammonia gas can also be used. The SCR process reduces NOx to nitrogen gas and oxygen.

NOx absorber technology is another of the options that is being pursued by engine manufacturers to meet the 2007 0.2 g NOx + NMHC/bhp-hr standard. It is entirely feasible that a retrofit NOx absorber unit could be developed once this technology has proven itself in the on-road heavy-heavy duty diesel engine market. However, technological hurdles remain that must be overcome for this technology to come to fruition.

The transit bus industry has already started to employ the use of gasoline electric hybrid powertrain systems on new buses. These devices are currently very expensive, but can significantly reduce emissions of NOx and PM as well as increase fuel economy. In the near future other types of hybrid retrofit technology may be developed and marketed such as diesel hydraulic and diesel electric hybrid systems.

Other emission reduction technology that is currently in service in the off-road engine market may one day be used in the on-road sector. Items such as emission reducing diesel fuel injectors or special formulations of diesel fuel may provide emission reductions for in use school buses. Once these devices have been verified to provide emission reductions reliably and effectively they will be available to school bus fleet managers as methods to reduce the emissions of NOx and PM.

VIII. REGULATORY ALTERNATIVES

The staff evaluated two alternatives to the existing regulatory proposal. Below is a brief summary of those alternatives and the staff's conclusion.

A. Do Not Adopt this Rule

One alternative considered by the staff was to not go forward with this regulatory proposal. In the absence of this regulation, much of the estimated emission benefits would still occur. Based on the May 2005 District Court ruling, the SCAQMD clearly has the authority to regulate the approximately 3800 buses in public school fleets with 15 or more buses. In addition, the SCAQMD maintains that it has the authority to regulate the 4800 school buses owned by private contractors that contract to public agencies (the public schools). Staff understands that the SCAQMD may begin enforcing its rule on private contractors to public schools in the near future.

There is still a risk of legal challenge, however, and SCAQMD has no authority over private schools. Adoption of this regulation would enable the SCAQMD to

regulate the 21 school buses owned by the one private school with more than 15 buses. Adoption of this regulation would serve as backup in the event of further legal challenge to their authority to regulate private contractors to public agencies. Staff rejected the no regulation alternative for the reasons cited above, and to provide the Board the opportunity to evaluate the proposal on its merits.

B. Allow School Bus Fleet Operators to Purchase/Lease Heavy-Duty School Buses Equipped with Engines with a Declared NOx FEL of 0.9 g/bhp-hr for Model Year 2007 through 2009

Another alternative to the staff's current proposal would be to set the BEST NOx heavy-duty engine emission level criterion for the 2007 through 2009 model years at 0.9 g/bhp-hr declared FEL, instead of 0.2 g/bhp-hr. It is possible an engine manufacturer may certify a diesel engine at the 0.9 g/bhp-hr level (25 percent below the standard required of other heavy-duty engines). It is possible, but not likely, that a NOx retrofit device could lower conventional diesel engine NOx emissions to the required standards. The 0.9 g/bhp-hr NOx BEST emission level criterion may also increase the availability of natural gas or propane engines that would be available, should diesel engines fail to meet the more stringent 0.2 g/bhp-hr NOx FEL alternative.

The staff presented this alternative at its April 7, 2005, public workshop to generate discussion amongst stakeholders and to spur the introduction of cleaner diesel technology prior to 2010. Comments presented at the workshop and thereafter through an informal comment period indicated that affected stakeholders were split on supporting the NOx FEL limit (environmental groups, the SCAQMD, alternative-fuel providers favored the lower NOx limit; school bus fleet operators favored the higher NOx limit). Since the workshop, the staff has learned that the one manufacturer of a verified diesel emission control strategy that reduces NOx emissions by 25 percent and would have allowed new diesel engines to meet the 0.9 g/bhp-hr NOx FEL does not have plans to apply for ARB verification to extend the emission control device for use on 2007 through 2009 model year engines. At this time, the staff is unaware of plans by any other manufacturer of a diesel emission control strategy to apply for verification for a device to reduce NOx emissions to the 0.9 g/bhp-hr NOx FEL.

Without a verified diesel emission control method that would allow new diesel engines to meet the 0.9 g/bhp-hr NOx FEL in the 2007 through 2009 timeframe, the only diesel engines expected to be commercially available are those that just meet mandatory emission standards. Thus this alternative is not viable. Accordingly, staff rejected this approach in favor of the more stringent NOx standard (0.2 g/bhp-hr) being targeted by several developers of alternative-fueled engines.

IX. ECONOMIC IMPACT

A. Legal Requirement

Sections 11346.3 and 11346.5 of the Government Code require state agencies proposing to adopt or amend any administrative regulation to assess the potential for adverse economic impact on California business enterprises and individuals. The assessment shall include consideration of the impact of the proposed regulation on California jobs; on business expansion, elimination, or creation; and on the ability of California businesses to compete in other states.

State agencies are also required to estimate the cost or savings to any state or local agency or school district in accordance with instructions adopted by the Department of Finance. This estimate is to include non-discretionary costs or savings to local agencies, and the costs or savings in federal funding to the state.

B. Affected Businesses

In developing this regulatory proposal, ARB staff evaluated the potential economic impacts on private businesses. The businesses directly affected by this regulatory proposal are private school bus fleets that operate within the SCAQMD and contain 15 or more buses. These fleets include one private school fleet and 12 private school bus contractor fleets. Because this regulatory proposal is structured to exempt school bus fleets from requirements if external funding is not available, the staff believes there will be no significant impact on small businesses. In addition, the proposed regulation exempts fleets with fewer than 15 buses, making it even less likely that small businesses will be impacted.

Businesses indirectly affected by the regulatory proposal are school bus manufacturers, diesel and alternative-fueled engine manufacturers, diesel retrofit manufacturers, alternative fuel providers, and alternative fuel refueling equipment manufacturers and installers.

C. Potential Impact on Businesses

This regulatory proposal requires that buses replaced or added to bus fleets operating in the SCAQMD be cleaner than required by current standards. However, a provision is included that specifies that compliance with the requirements of the proposal are contingent on the availability of grant funding or external sources of funding beyond that of the public or private school bus fleet's fiscal budget. Additionally, there are exemptions based on lack of funding for alternative fuel refueling infrastructure and maintenance facility upgrades. Consequently, the fiscal impact of the regulatory proposal on affected fleets is estimated to be minimal.

The fiscal impact on school bus fleets is primarily due to additional record keeping required to show compliance to the regulation and preparing paperwork for purchase exemption applications. The average cost per fleet has been estimated at $350 per year.

This regulatory proposal could indirectly impact the sale of school buses in SCAQMD. Sales of alternative-fueled buses may increase due to the purchase requirements of the proposal and SCAQMD's choice to fund only the purchase of new alternative-fueled buses. Additionally, these factors may impact the sales of bus manufacturers and engine manufacturers who market only diesel fueled buses and engines, possibly reducing sales. It is also possible that the lack of funding for diesel fueled buses may be a deterrent to fleet turnover in fleets with no current alternative-fueled buses and no reasonable access to refueling infrastructure. However, no evidence of an impact on fleet turnover is observable in the sales reported since the adoption of this fleet rule in 2001. However, sales data trends may be difficult to discern due to the cyclical nature and large variability in the rate of school bus sales.

Alternative fuel providers and refueling equipment manufacturers and installers may profit from increased business due to the increase in the number of alternative-fueled buses encouraged by the proposal.

The proposal option for retrofitting in-use diesel buses may increase the sales of diesel retrofit devices. As mentioned earlier in this report, approximately $25M in new funding has been earmarked through the 2005 – 2006 fiscal year state budget process to continue implementing the Lower-Emission School Bus Program. Approximately half of this funding may be available statewide for in-use diesel school bus retrofits. However, at the time the staff developed its cost and emission benefits analysis for this rulemaking, the state budget had not been finalized and approved; as such, this potential additional funding has not been factored into the ARB's analysis.

D. Potential Impact on Businesses Competitiveness

There is no expected impact on the ability of California businesses to compete in other states.

E. Potential Impact on Employment

No jobs are expected to be eliminated due to the regulatory proposal. Some jobs could potentially be created due to the regulatory proposal related to the increased use of alternative-fueled buses. This proposal could prompt the installation of new natural gas refueling facilities potentially creating jobs dealing with construction of the stations and installation of equipment. It could also potentially increase the demand for natural gas engine mechanics.

F. Potential Impact on Creation, Elimination, or Expansion

This regulatory proposal is not expected to impact the creation, elimination, or expansion of school bus fleets.

G. Potential Cost to Local and State Agencies

In developing this regulatory proposal, ARB staff evaluated the potential economic impacts on local and state agencies. The proposed requirements are not expected to result in an increase in costs for state and local agencies. Local government affected by this regulatory proposal are public school bus fleets that operate within the SCAQMD and contain 15 or more buses. There are 65 affected public school bus fleets in the SCAQMD.

Under Education Code title 1, division 1, part 10.8, section 17920 et seq., state mandated programs placed on public schools must be funded. Consequently, the incremental implementation cost for this regulatory proposal will be funded by public grants and funding sources external to the school bus fleet's fiscal budget. The sources of these funds are described in Section I.C.4. The costs that the different funds cover are discussed below. The implementation cost of this regulatory proposal is the cost differential between a standard purchase diesel bus and the purchase required by the proposal, any costs associated with providing refueling and maintenance facility upgrades required, and any increase in operating and maintenance costs for the new bus purchased. We anticipate expenditures between $5.3 and $6 million, which would only occur if external funding is available to the school bus fleet owner or operator.

1. Federal Regulations

There are no federal regulations comparable to the regulatory proposal. However, the reductions under this proposal directly help the SCAQMD to meet federal ambient air quality standards.

2. Implementation Cost

The number of buses that could be purchased from the incentive funding available was estimated in order to determine the implementation cost of the proposal. The total funding available from the incentive sources mentioned above is projected to be $11.1 million per year over the five years of the program. These funding sources are directed primarily at funding a substantial portion of the capital cost of clean bus purchases. It is estimated that between 90 and 93 new alternative-fueled buses will be funded per year based on the funds available and an estimate of the portion of the purchase price that will be funded. Section X.A presents the estimated emission benefits based associated with the purchase of these alternative-fueled buses.

The largest source of funding, the Lower Emission School Bus Program (LESB), is projected to provide approximately $9.33 million per year, based on current funding levels. These funds are only available to public school bus fleets. The LESB Program guidelines allow ten percent of the funds to be spent for alternative fuel refueling infrastructure. These guidelines cap the amount of money that the public school fleet contributes to the purchase price of the bus if they scrap a pre-1977 or pre-1987 school bus and replace it with the clean bus purchased. The public

school contribution cap is $10,000 for a pre-1977 bus scrapped and $25,000 for a pre-1987 bus scrapped. This funding source will fund approximately 65 to 68 new alternative-fueled buses per year assuming that 10 percent of the funds go towards infrastructure and the LESB Program funds the cost of the bus in excess of the public school bus fleet contribution cap.

The MSRC program, whose funds are available to both public and private fleets, is projected to provide $1.5 million per year for bus purchases. The MSRC program funds are estimated to fund approximately 25 buses based on a funding level of about $60,000 per bus.

The Clean Fuels Fund is projected to provide the remaining available funding of $325,000 per year. This funding will be used for required infrastructure upgrades to support the alternative-fueled bus purchases.

The incremental cost of this proposal was estimated based on the number of buses to be bought with expected funding and the incremental cost for each bus. $30.1 million is estimated to be the total incremental cost of the regulatory proposal over the five years that the requirements will be in effect. The sections below discuss the incremental cost estimate for new alternative-fueled buses. This cost includes all perceived cost increases due to replacing a standard diesel bus with an alternative-fueled bus.

SCAQMD has chosen to fund only the purchase of alternative-fueled buses. Consequently, no funding is currently available for either DPF retrofit of in-use diesel buses or new diesel school bus purchases. However, ARB staff prepared an implementation cost analyses for these scenarios in recognition that additional funding for these purchases could become available. Two scenarios for new diesel school bus purchases are presented in Appendix C. Retrofit of in-use diesel buses is discussed below.

The majority of the over 3,000 in-use diesel buses that can be retrofit with a DPF have been retrofitted. However, ARB staff estimates that approximately 1,300 of these 3,000 eligible buses have not been retrofit with a DPF. The vast majority of these remaining 1,300 buses are in private contractor fleets. The implementation cost to retrofit these remaining diesel buses is estimated to be a total of $15.6 million. This cost includes both the capital cost of the DPF as well as the maintenance cost of cleaning the DPF.

a. Cost Estimates for Heavy-Duty Alternative-Fueled Vehicles

The incremental cost for complying to the purchase requirements of this regulatory proposal are estimated to be approximately $65,000 to $66,500 per bus. These estimates considered differences in capital cost and operating and maintenance and include funds for refueling station installation and facility upgrades. These costs are summarized in Table 15 below. These costs were all calculated in 2005 dollars.

Table 15. Incremental Costs per Bus Over 25 Year Lifetime		
Model Year	***2005- 2006***	***2007-2009***
School Bus Capital Incremental Cost	$31,000	$29,300
Fueling Station Infrastructure	$13,000	$13,000
Maintenance Facility Upgrade	$4,000	$4,000
Replacement Fuel Tank	$15,000	$15,000
Operational Expenses[(a)]	$3,417	$3,417
Total	**$66,417**	**64,717**
(a) Incremental operational expenses = $0.01/mile X 13,666 miles X 25 years		

The incremental capital cost of an alternative-fueled bus was calculated to be $31,000 in 2005 and 2006 and $29,300 in 2007 through 2009. The incremental cost for an alternative-fueled bus purchase is expected to drop slightly in 2007 due to an increase in the cost of the standard diesel bus purchase. The standard purchase diesel bus capital cost, with DPF, is expected to increase by approximately $1,700 in 2007, from $113,00 to $114,700, due to technology advancements necessary to meet 2007 emission standards. The average capital cost of an alternative-fueled school bus of $144,000 was based on current costs.

The costs for refueling station installation and maintenance facility upgrade were set at the minimum required available funding amounts specified in the regulatory proposal. These values were $13,000 per bus for refueling station installation and $4,000 per bus for maintenance facility upgrade.

Natural gas fuel tanks have a life of 15 years. A school bus life of 25 years requires that the natural gas fuel tanks be replaced once during the life of the bus. The total cost of fuel tank replacement was estimated at $15,000.

Operating and maintenance costs were based on the yearly vehicle miles traveled (VMT), the school bus life, and an average increase in fuel and maintenance costs for alternative-fueled buses from a survey conducted by SCAQMD. An average of 13,666 vehicle miles traveled per year and a school bus life of 25 years were used based on data from the emissions inventory model, EMFAC 2002 V2.2, April 23, 2003. An increased operating and maintenance cost of $0.01 per mile was used to capture differences in fuel and maintenance costs as compared to operating a diesel bus. This value is the average difference for school buses less than 5 years old as reported in the school bus fleets survey conducted by SCAQMD (SCAQMD 2005). A lifetime operational cost differential of approximately $3,400 was calculated based on a $0.01/year operating cost increase combined with the average yearly VMT and a 25 year life.

b. Cost Estimates for Capital and Operating Costs of Medium-Duty School Buses

Although school districts are not mandated to provide general student transportation, they are mandated to provide transportation for special needs

students. It is this sector where medium-duty school buses are chiefly utilized. Often these buses are equipped with wheelchair accommodations and other special equipment. To deal with the increasing demand for special needs transportation, and provide transportation flexibility, some school districts are purchasing more larger medium-duty (30-35 passenger) school buses when they replace smaller (10-24 passenger) buses. These buses are configured in such a way that they can accommodate several wheelchairs or can be equipped with all ambulatory seating. These larger medium-duty buses are all diesel, heavy-duty vehicles, with a life expectancy of 15 years.

Capital Cost of Medium-Duty Buses

The current cost of a smaller (10-24 passenger) medium-duty gasoline cutaway school bus is about $50,000. A diesel version would be about $3,000 more. These smaller medium-duty buses have a 10-12 year life, whether they are diesel or gasoline. Although a diesel engine may not be at its useful life in ten years, the relatively light-duty cutaway chassis will reach its useful life in this timeframe. Typically, the old bus is used as a trade-in, with little value. Prior to Rule 1195 implementation, youth groups or churches often purchased these old buses. Since rule implementation, these old buses are sold out-of-state and in Mexico.

Larger (30-35 passenger) medium-duty school buses are diesel-fueled, on a heavier chassis with an approximate 15 year-life. The capital cost of a larger medium-duty diesel bus is about $75,000-$80,000. There are currently no gasoline or natural gas versions of a 30-35 passenger medium-duty school bus.

Operational Costs of Medium-Duty Buses

The assertion has been made that the cost of operation of gasoline school buses is higher than that of diesel buses. Although this assertion may have been true several years ago, it is not the case with current engines. Gasoline engines are completely computerized and the first tune-up is typically at 100,000+ miles. The difference in the cost of maintenance between current models of gasoline and diesel engines is negligible.

Miles-per-gallon is often cited as a cost factor between diesel and gasoline buses. New, gasoline smaller medium-duty school buses achieve 12-13 miles per gallon, versus 13-14 miles per gallon for a comparable diesel engine. If the average medium-duty school bus travels about 14,000 miles a year, a gasoline school bus would consume approximately 1,077 gallons of gasoline in a year and a diesel school bus would consume approximately 1,000 gallons of diesel fuel. The rack price of gasoline in April 2004 was $1.40 and the price of diesel was $1.10. The rack price is used for ease in comparison of fuel costs, and does not include any taxes. The annual fuel cost would be $1,508 for gasoline and $1,100 for diesel. In April 2005 the rack price of gasoline was $1.82 and the rack price of diesel was $1.75, making the annual fuel cost $1,960, gasoline, and $1,750, diesel. This is a $200-400/year difference in annual fuel costs between gasoline and diesel. However, with a lower capital cost of about $3,000 for gasoline smaller medium-

duty buses, the combined capital and operational costs of gasoline buses is about the same as their diesel counterparts.

Longevity of a diesel vs. gasoline school bus has been brought up as another cost issue. As stated previously, the useful life of a smaller medium-duty school bus, whether it is gasoline or diesel, is considered to be ten years. The useful life of a larger medium-duty diesel school bus is 15 years. There is no gasoline engine available for this size bus.

There are some natural gas smaller medium-duty buses in operation, although there is not currently an engine and chassis available for sale for natural gas operation. There should be no maintenance issues between gasoline smaller medium-duty buses and their natural gas counterparts.

Because of the low volume of natural gas school buses produced, parts have been relatively expensive. John Deere, a major natural gas engine manufacturer for the heavy-duty school bus market, has recognized this issue and is taking steps to ensure that parts will be more cost competitive in the future.

c. Cost Estimates for In-Use Diesel Retrofits

The cost for a DPF retrofit of an in-use diesel vehicle is placed at $12,000. This value was based on an $8,000 cost for the DPF and an additional $4,000 for providing for cleaning and baking the DPF as required for maintenance.

d. Costs to Individuals

The incremental cost for these clean bus purchases are being paid by a variety of funds described in Section I.C.4. The citizens of SCAQMD are paying these costs, primarily through DMV fees. The cost per individual can be based on the estimated implementation cost ($30.1 million for the 5 year program) and the population of SCAQMD (15.7 million). This cost is approximately $0.38 per individual per year.

X. ENVIRONMENTAL IMPACTS AND COST EFFECTIVENESS

A. Benefits within the South Coast Air Basin

Staff's estimates of the environmental effects of the proposal are summarized in the following sections. A full description of the factors that were used to determine the cost effectiveness of the proposed regulation is provided in Appendix C. To calculate cost effectiveness, both the emission benefit from the proposal and the incremental cost of the proposal must be considered.

1. Emission Reductions From New Heavy-Duty School Bus Purchases

Staff's estimates of this proposal's emission benefits from heavy-duty school bus purchases are shown in Table 16. The staff's emission reduction estimate is based on available external funding to purchase approximately 92 new heavy-duty school buses per year.

Table 16. Emission Benefits in 2010 from Regulatory Proposal: Heavy-Duty School Bus Purchases		
Year	**PM Reductions (TPY)**	**NOx Reductions (TPY)**
2005 - 2009	0.5	14

The regulatory proposal addresses model year purchases for 2005 through 2009. Similar to Rule 1195, the regulatory proposal would not provide PM emission benefits for new bus purchases for model years 2007 through 2009. However, the regulatory proposal's BEST standards include a NOx FEL requirement that is more stringent than the nominal standard that diesel engine manufacturers will certify to in the 2007 through 2009 timeframe and so provides a NOx benefit for new heavy-duty school bus purchases during this timeframe.

Based on available identified external funding, most of the estimated emission benefits from new heavy-duty school bus purchases would still occur in the absence of this proposed regulation. However, additional PM benefits could be achieved through the proposal's requirements for retrofits on in-use vehicles now that approximately $12.5 million has been earmarked in the 2005 – 2006 state budget to retrofit in-use diesel school buses throughout the state.

2. Emission Reductions From New Medium-Duty Bus Purchases

The proposed regulation requires that medium-duty school buses be replaced with non-diesel buses certified as ULEV. Based on actual medium-duty school bus purchases within the District between 2002 and 2004, about 70 new medium-duty school buses are purchased annually. If the replacement buses are gasoline-fueled and simply meet the emission standards, emission benefits will be small. If natural gas-fueled buses are available, there may be additional benefits. However, the availability of natural gas engines for medium-duty school buses is uncertain, as discussed previously in this report. The natural gas engine currently available for smaller medium-duty buses is no longer being produced, and all of the larger medium-duty buses available are diesel-fueled.

The SCAQMD staff estimated the maximum emission reductions to date from medium-duty school bus purchases to be about 12 tons per year NOx and 0.5 tons per year PM. Based on the uncertainty of natural gas engine availability, the future emission benefits from the medium-duty school bus requirements in this proposal could range from zero to 12 tons per year NOx and from zero to 0.5 tons per year PM from 2005 through 2009. The staff expects the benefits to be near the lower end of this range due to the current unavailability of natural gas engines in the medium-duty school bus market.

Though the NOx emission reductions for model years 2005 through 2009 are estimated to be small, there would still be a PM and HC benefit from the replacement of diesel-fueled buses with gasoline-fueled or natural gas-fueled buses. The discussion in Section IX.G.2 illustrates that there is little if any real additional cost to a school district for the purchase and operation of gasoline versus diesel medium-duty school buses. Therefore, the proposed regulation requires the use of gasoline-fueled and alternative-fueled medium-duty school buses where feasible and provided they are available.

3. Emission Reductions From In-Use Diesel Bus Retrofits

DPF retrofit of in-use diesel buses would provide additional emission benefits. As mentioned previously, approximately $25M in new funding has been earmarked through the 2005 – 2006 fiscal year state budget process to continue implementing the Lower-Emission School Bus Program. Approximately half of this funding may be available statewide for in-use diesel school bus retrofits. However, at the time the staff developed its emission benefits analysis for this rulemaking, the state budget had not been finalized and approved; as such, the portion of this additional funding that is available to the South Coast region has not been factored into the ARB's analysis.

However, ARB staff has estimated the emission benefit possible from a DPF retrofit scenario in recognition that additional funding for this purpose could become available. ARB staff estimates that there are approximately 1,300 buses that are eligible for DPF retrofit which have not yet been retrofitted. DPF retrofit of these 1,300 buses would provide an additional emission benefit of approximately 3.4 TPY of PM and 5.3 TPY of non-methane hydrocarbons in 2010.

4. Benefits of the Proposal

The regulatory proposal would reduce approximately 346 tons of NOx by 2033, the end of the 25 year life of the last school buses with reduced NOx emissions purchased in 2009. Approximately 13 tons of PM would be reduced by 2030, the end of the 25 year life of the last school buses with reduced PM emissions purchased in 2006.

B. Cost-Effectiveness of Proposed Regulation

For the Scenario One analysis it was assumed that 92 CNG school buses would be funded each year starting in 2005 and going through 2009. The emission benefits and costs that were associated with these school buses were then determined.

The cost effectiveness calculated for Scenario One was determined to be $60,000 per ton of NOx reduced and $405,000 per ton of PM reduced.

For the Scenario Two analyses it was assumed that 325 in-use school buses could be retrofitted with DPFs every year for four years starting in 2006. It was assumed that the DPF would have a lifetime of 11 years. Since the majority of the public school bus fleet has already been retrofitted with diesel particulate filters, it was assumed that the remaining school buses in the air district eligible for retrofits with DPFs would be those school buses operated by private bus contractors providing services to the public schools.

The cost effectiveness calculated for Scenario Two was determined to be $380,000 per ton of PM reduced.

C. Potential Negative Impacts

1. Creation of Nitrogen Dioxide by Passive Catalyzed Diesel Particulate Filters

Passive catalyzed diesel particulate filters use the heat in the engine exhaust, with the assistance of a catalyst, to burn off particulate matter collected in the filter. Most passive filters use platinum group metal catalysts to oxidize NO in the exhaust gas to NO_2, which burns particulate matter captured in the filter. Nitrogen dioxide can burn diesel particulate matter at higher rates, and at lower temperatures, than oxygen, increasing the rate of filter regeneration.

The platinum group catalyst in a passive filter can significantly increase the fraction of NO_2 in the exhaust. Typical engine out NOx emissions are composed of 5 to 15 percent NO_2. The filter catalyst can increase the NO_2 fraction to more than 50 percent of the total NOx in the exhaust (Dieselnet 2004). In principal, NO_2 is reduced to NO and N_2 in the process of burning the PM. However, filter regeneration rates are higher if there is excess NO_2 so, in practice, the amount of NO_2 in the exhaust may be significantly increased. Measurements of NOx emissions (NO and NO2) from heavy-duty diesel vehicles equipped with passive catalyzed filters have shown an increase in the NO_2 fraction, though total NOx emissions remain approximately the same.

Increased levels of exhaust NO_2 are a concern due to its high toxicity. NO_2 acts mainly as an irritant affecting the mucous membranes of the eyes, nose, throat, and respiratory tract. Extremely high-dose exposure (as in a building fire) to NO_2 may result in pulmonary edema and diffuse lung injury. Continued exposure to high NO_2 levels can contribute to the development of acute or chronic bronchitis. Low level NO_2 exposure may cause increased bronchial reactivity in some asthmatics, decreased lung function in patients with chronic obstructive pulmonary disease and increased risk of respiratory infections, especially in young children (U.S EPA Indoor Air Quality website).

Atmospheric modeling results suggest that an increase in engine out NO_2 emissions could have a negative air quality impact on the ambient ozone, nitric acid, and NO_2 levels. However, the analysis showed that the disbenefit of a

modest increase in engine out NO_2 emissions is offset by the reductions in PM and NMHC emissions achieved by the catalyzed diesel particulate filter (ARB 2002). Consequently, a maximum allowable NO_2 increase has been set by the ARB verification procedure for in-use strategies to control diesel engine emissions.

The ARB verification procedure for in-use strategies to control diesel engine emissions specifies that post-control NO_2 emission must not exceed 20 percent of the total baseline (pre-control) NOx emissions beginning January 1, 2007. However, prior to 2007, there are no requirements on the increase of NO_2 emission for in-use strategies in California.

2. Toxics from Diesel-Fueled and Alternative-Fueled Engines

Historically diesel engines were perceived as having higher PM emissions and other deleterious compounds known to have adverse health effects than similar natural gas engines. Natural gas engines were typically thought of as "low emission", as emitting less PM and NOx, than their diesel counterparts (Ahlvik et al 2000; Clark et al 1995; Clark et al 1999; Ayala et al 2002). However, with the advent of aftertreatment technologies such as diesel oxidation catalysts and diesel particulate filters, and the fact that vehicle exhaust is a complex composition of many compounds, not just PM and NOx, the assumption that natural gas engines are inherently less polluting than diesel equipped with aftertreatment was called into question.

To this end, the ARB led a multi-agency research effort to compare emissions from diesel and natural gas urban bus engines. The study evaluated natural gas and diesel urban bus engines with and without exhaust aftertreatment. Summarized in Table 17 is a comparison of emissions based on this study, applied to school bus engines and the emission standards they must meet. As shown in the table, the comparison of emissions varies by year depending on the applicable emission standards (that diesel engines typically meet with a small margin of safety) and the actual emission levels of natural gas engines

For NOx, natural gas engines remain cleaner through 2009 (assuming a 0.2 g/bhp-hr natural gas engine usable in school buses is certified in 2007). In 2010 and beyond, NOx emissions of diesel and natural gas engines are expected to be the same. Natural gas engines currently emit less PM and toxics than a diesel engine, but beginning in 2007, the emissions will be the same because all diesel engines will use a particulate filter that reduces both PM and toxics greatly.

Table 17. Emission Comparison: Diesel Truck Engine vs. Natural Gas Truck Engine

Model Year Truck	Truck Emission Standards (g/bhp-hr)		Natural Gas, Compared to Diesel, Is Typically:		
	NOx	PM	NOx	PM	Other Toxics
Mid-1990s to 2002 (diesel w/o filter and NG w/o catalyst)	4	0.1	50% cleaner	60% cleaner	Varies
Today (2003 - 2006) (diesel w/o filter and NG w/ catalyst	~2.2	0.1	25% cleaner	80% cleaner	Less
2007 (diesel w/ filter and NG w/ catalyst	1.2	0.01	80% cleaner[1]	Same	Same
2010 (diesel w/ filter + absorber and NG w/ 3-way catalyst	0.2	0.01	Same	Same	Same

(1) Several natural gas engines that may have application to school buses are expected to comply with the 2010 0.2 g/bhp-hr NOx standard by 2007, in which case they would be about 80% cleaner. For other natural gas engines the NOx emissions will likely be the same as diesel.

3. Ammonia Slip from Selective Catalytic Reduction

A potential environmental issue is the emissions of ammonia from selective catalytic reduction systems that may be used as retrofits or as part of new engine technology to meet BEST levels. A selective catalytic reduction system injects ammonia or urea into the exhaust gas stream to react with NOx in the presence of a catalyst. Such systems, if not carefully designed or calibrated could potentially release excess ammonia into the atmosphere. In general, the possibility of ammonia slip increases with the desired NOx reduction, as more ammonia must be used to reduce more NOx. However, given the relatively modest percentage reductions expected (80 percent reduction to reduce a 1.2 g/bhp-hr engine to 0.2 g/bhp-hr), highly aggressive SCR systems will likely not be necessary.

Furthermore, careful calibration and use of a clean-up oxidation catalyst can virtually eliminate ammonia slip. To ensure that ammonia emissions do not become a problem, the diesel emission control system verification procedure on requires that ammonia slip not exceed 25 parts per million on average. Although there are no SCR systems currently verified for on-road use, there is one verified

for off-road use. Several companies have expressed interest in verifying SCR systems for on-road use in the near future.

4. Ash Management

Diesel particulate filter technology may generate a new hazardous waste stream. The carbonaceous component of the PM captured by the filter is burned off when the filter regenerates. Any inorganic components left behind after regeneration as ash in the filter must eventually be cleaned from the filter. Based on preliminary data from two samples, the ash may be classified as hazardous waste because of its zinc content.

Ash collected from a diesel engine using a typical lubrication oil and no fuel additives has been analyzed and is primarily composed of oxides of the following elements: calcium, zinc, phosphorus, silicon, sulfur, and iron. Zinc is the element of primary concern because, if present in high enough concentration, it can make a waste a hazardous waste. Title 22, CCR, section 66261.24 establishes two limits for zinc in a waste: 250 milligrams per liter for the Soluble Threshold Limit Concentration and 5,000 milligrams per kilogram for the Total Threshold Limit Concentration. The presence of zinc at or above these levels would cause a sample of ash to be characterized as a hazardous waste.

Under California law, it is the generator's responsibility to determine whether their waste is hazardous or not. Applicable hazardous waste laws are found in the Health and Safety Code, division 20; title 22, CCR, division 4.5; and title 40 of the Code of Federal Regulations. Staff recommends owners who install a diesel particulate filter on a vehicle contact both the manufacturer of the DECS and the California Department of Toxic Substances Control (DTSC) for advice on waste management.

ARB staff has consulted with personnel of the DTSC regarding management of the ash from diesel particulate filters. DTSC personnel have advised ARB that it has a list of facilities that accept waste from businesses that qualify as a conditionally exempt small quantity generator. Such a business can dispose of a specific quantify of hazardous waste at certain Household Hazardous Waste events, usually for a small fee. An owner who does not know whether or not he qualifies or who needs specific information regarding the identification and acceptable disposal methods for this waste should contact the California DTSC. Information can be obtained from local duty officers and from the website: http://www.dtsc.ca.gov.

XI. ISSUES

A. School Transportation Funding and School Bus Ridership

One issue raised by multiple school districts is inadequate transportation funding, and the corresponding decline in school bus ridership. School funding advocates blame, in part, Proposition 13, which was passed in 1978. Proposition 13 reduced property taxes by about 57 percent, and made new state and local taxes difficult to

pass (California Educator 2005). In contrast, Proposition 98, passed in 1988, guarantees that schools and community colleges receive a minimum amount (about 40 percent) of revenue from state taxes and local property taxes (California Educator 2005).

Today, education represents 54 percent of the state's general fund, or about $45 billion (FACSNET 2005). Nonetheless, state reimbursement for school bus transportation (as a percentage) has decreased since the late 1970s (Surface Transportation Policy Project et.al. 2003). The state provides transportation funding at an average rate of 46 percent of the total cost of pupil transportation services (with a range from zero to 100 percent for some schools) (CSPTA 2004).

Funding for school transportation services comes from school district general funds. There are insufficient special state or local funding sources designated for this non-mandated service. School transportation must compete for both capital and operating funds with mandated school district responsibilities, and the need for funding to go directly to support classroom needs. School transportation officials cope with this lack of funding in various ways. Many school districts have increased the distance criteria for providing home to school transportation services to students so that fewer buses are needed. Because general home to school transportation is not state-mandated, some school districts do not provide transportation themselves but rely on public transportation or parent-provided transportation. One choice school districts make is to keep existing buses operating as long as possible to avoid the capital expenditure of purchasing new school buses. Because of state school funding issues in the last two years, school districts often opt to continue operation of these buses rather than purchase new buses. The result is an aging fleet of buses. Because of the low annual mileage of school buses, the buses continue to operate reliably and have relatively few maintenance issues. However, these older buses have very high emissions.

As previously mentioned, school districts are not required to provide free bus service. An exception to this is transportation of special needs children (Surface Transportation Policy Project et.al. 2003). Faced with tight budgets, some school districts are reducing the amount of school transportation they provide. Thus, the percentage of school children riding school buses is on the decline. In fact, California is almost last in the percent of students riding the bus – scoring only behind Minnesota, Hawaii, and the District of Columbia (School Transportation News Buyer's Guide 2005). As shown in Table 18, less than 16 percent of enrolled kindergarten through twelfth grade (K-12) students ride the school bus.

While ARB staff acknowledges that transportation funding is tight and that school bus ridership has declined, that is true across the state, not just in the South Coast. The pertinent issue is how this proposed rulemaking impacts transportation costs. The proposed rulemaking is structured such that purchases are required only if funding is available. The proposed rulemaking restores some of the exemptions that had sunset under the SCAQMD rule. For these reasons, ARB staff believes

the proposed rule would have a neutral or positive effect on school districts' transportation costs. A separate argument is that available funds would go farther and would replace more school buses if the purchase of less expensive diesel buses was allowed. Staff acknowledges this point. However air quality incentive funds are tied to measureable improvements in air quality, which can only be obtained by going beyond conventional technology to the most advanced (or BEST) technology available.

Table 18. School Bus Ridership By State

State	Enrollment	Transported	Buses	% Student Ridership
Alabama	732,462	366,297	8,291	50.0
Alaska	137,000	43,300	1,020	31.6
Arizona	1,008,418	320,318	6,045	31.8
Arkansas	443,536	321,860	5,357	72.6
California	**6,244,408**	**992,649**	**26,171**	**15.9**
Colorado	757,668	294,931	6,550	38.9
Connecticut	625,645	480,300	6,000	76.8
Delaware	145,752	105,603	1,684	72.5
District of Columbia	78,842	3,856	692	**4.9**
Florida	2,591,033	1,025,921	20,344	39.6
Georgia	1,522,720	1,218,879	17,194	80.0
Hawaii	176,000	24,000	900	**13.6**
Idaho	254,037	111,824	2,638	44.0
Illinois	2,020,939	1,031,065	16,000	51.0
Indiana	1,080,668	752,004	12,736	69.6
Iowa	526,614	257,546	5,200	48.9
Kansas	498,505	200,294	5,581	40.2
Kentucky	650,000	459,628	9,650	70.7
Louisiana	835,799	495,933	8,067	59.3
Maine	221,195	180,240	2,764	81.5
Maryland	866,743	605,154	6,783	69.8
Massachusetts	957,926	631,272	8,500	65.9
Michigan	1,891,969	823,281	17,213	43.5
Minnesota	934,832	18,087	10,292	**1.9**
Mississippi	491,623	430,779	6,954	87.6
Missouri	893,146	555,283	11,311	62.2
Montana	148,801	64,478	2,535	43.3
Nebraska	316,315	72,400	2,500	22.9
Nevada	381,045	182,328	2,083	47.8
New Hampshire	230,887	151,600	2,726	65.7
New Jersey	1,579,461	567,346	21,781	35.9
New Mexico	352,208	168,878	2,390	47.9

Table 18. School Bus Ridership By State

State	Enrollment	Transported	Buses	% Student Ridership
New York	3,355,500	2,598,035	47,742	77.4
North Carolina	1,347,247	719,600	13,374	53.4
North Dakota	101,137	43,249	2,355	42.8
Ohio	2,045,252	1,280,067	18,297	62.6
Oklahoma	590,711	345,042	7,257	58.4
Oregon	551,368	272,761	6,321	49.5
Pennsylvania	2,129,792	1,538,799	28,353	72.3
Rhode Island	180,000	92,000	1,480	51.1
South Carolina	723,147	365,162	6,631	50.5
South Dakota	95,440	44,595	1,650	46.7
Tennessee	528,802	465,419	8,106	88.0
Texas	4,255,821	1,477,444	35,082	34.7
Utah	490,191	165,280	2,329	33.7
Vermont	104,600	102,000	1,300	97.5
Virginia	1,176,557	917,711	12,200	78.0
Washington	1,008,487	484,606	9,316	48.1
West Virginia	299,516	220,325	2,966	73.6
Wisconsin	868,867	590,000	10,000	67.9
Wyoming	86,117	32,390	1,424	37.6
TOTALS	49,584,319	25,515,357	482,357	51.5

2005 School Transportation News Buyer's Guide, National Association of State Directors of Pupil Transportation Services, 2005.

Data for most states is from the 2003-04 school year, but for some, including California, data is for the 2002-03 school year, and a few states have 2001-02 data.

B. Funding Split between Alternative-Fuel and Lower-Emitting Diesel Purchases

With the adoption of the Lower-Emission School Bus Program Guidelines (Guidelines) in December 2000, the Board designated two-thirds of the new bus purchase funding for alternative-fuel school buses and one third of the funding for diesel school buses equipped with particulate filters and operating on ultra low sulfur diesel fuel. The Board's intent was for this policy to be implemented on a regional basis; therefore, air districts with distinct funding allocations were required to award funds consistent with the designated funding split, to the extent possible. This policy was practical to implement during the first two years of the Lower-Emission School Bus Program (the 2000-2001 and 2001-2002 fiscal years) when it

was significantly funded through the state budget process. While funding was provided for the program for the next two fiscal years through Proposition 40 (the voter-approved initiative to conserve natural resources) and Assembly Bill 425 (Statutes of 2002, Chapter 379), the total amount was significantly reduced, which made it impractical to maintain the funding split on a regional basis.

With the program's guideline revision in May 2003, the Board modified its policy to maintain the funding split between alternative-fuel and diesel purchases as a statewide goal, rather than a region-specific mandate. At that time, the SCAQMD opted to target its funding allocation entirely to alternative-fuel purchases as a way to introduce the lowest-emitting technologies into the region. As a result, some school districts within the jurisdiction of the SCAQMD have argued that the district's alternative-fuel only funding policy is not consistent with the goals of the ARB's Guidelines. It is the ARB staff's belief that the existing Guidelines are not intended to restrict the SCAQMD's ability to fund only alternative-fuel school bus purchases. Therefore, in conjunction with presenting this regulatory proposal to the Board, the staff will recommend to the Board that it clarify its funding policy to explicitly provide the SCAQMD the flexibility and authority to target funds subject to requirements of the Guidelines (e.g., AB 923 funds) solely on alternative-fuel purchases. In practice, this means that the SCAQMD is expected to allocate slightly over $9 million per year from its AB 923 funds to new, alternative-fuel school bus purchases and associated refueling infrastructure.

C. Federal Clean Air Act Waiver of Preemption Challenges

Some workshop commenters challenged California's authority to adopt and enforce fleet regulations in SCAQMD based on federal statutory preemption. Federal Clean Air Act section 209(a) preempts states and localities from adopting or enforcing any standard relating to the control of emissions from new motor vehicles or new motor vehicle engines. Notwithstanding this general preemption of state authority for new engines and new vehicles, CAA section 209(b) expressly authorizes U.S. EPA's Administrator to waive the preemption for California.

One challenge is based on the view that ARB will not be able to obtain a waiver of preemption for state standards under CAA section 209(b) because the Board's regulations are subject to the requirements of CAA section 202(a)(3)(C). Section 202(a)(3)(C) requires that in adopting standards, U.S. EPA's Administrator is to provide specified periods of lead-time and stability to classes or categories of new heavy-duty vehicles or engines. As the text of the provision itself dictates, the provision is not applicable to California:

> Any *standard promulgated or revised under this paragraph* and applicable to classes or categories of heavy-duty vehicles or engines shall apply for a period of no less than 3 model years beginning no earlier than the model year commencing 4 years after such revised standard is promulgated. [Italics added for emphasis.]

The text states that "standards promulgated or revised under this paragraph," that is, under CAA section 202(a), must provide the specified lead-time and stability. In the person of the Administrator, U.S. EPA prescribes standards under 202(a). Clearly the provisions apply to U.S. EPA.

California, however, does not promulgate its standards under the grant of authority in section 202(a). California promulgates vehicular emission standards under grants of authority in state law[1] and under the waiver of federal preemption of state standards contained in CAA section 209(b). Since section 202(a)(3)(C) is only applicable to standards promulgated under section 202(a) and since California does not promulgate its standards under 202(a), the provision does not apply to California. And, if the provision does not apply, its specified lead-time and stability requirements do not apply to California.

The inapplicability of CAA section 202(a)(3)(C) to the standards that California promulgates is also consistent with the legislative history of the CAA and the waiver of federal preemption. The legislative history of the waiver provision has emphasized that California is to have "the broadest possible discretion in selecting the best means to protect the health of its citizens." H.R.REP No. 95-294, at 302-02, quoted in Motor and Equipment Manufacturers Association, Inc. v. Environmental Protection Agency.[2] Other courts have also frequently noted that Congress consciously chose to permit California to blaze its own trail.[3]

A second challenge is based on the view that U.S. EPA will need to grant waivers of preemption under CAA section 209(b) prior to the enforcement of any aspect of the proposals. ARB already has waivers of preemption for all of the types of emissions and categories of new engines and new vehicles to which the proposed regulations would apply. For this reason, any new waiver would be needed only for those aspects of the regulations for which California has never before been granted a waiver of preemption. For any aspect of the regulations for which waivers have already been granted, ARB's practice has been to request confirmation that the regulations are within the scope of the previous waivers and to pursue enforcement against new engines and vehicles already covered by the waiver of preemption. For those aspects of the proposal that apply to in-use engines and vehicles, no waiver of preemption is needed since the preemption applies only to new vehicles and new vehicle engines.

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[1] California Health & Safety Code Division 26.

[2] 627 F.2d 1095, at 1110 (D.C.Cir. 1979).

[3] Ford Motor Co. v. EPA, 606 F.2d 1293, at 1297 (D.C.Cir. 1979); Engine Manufacturers Association v. U.S. EPA, 88 F.3d 1075, at 1080 (D.C.Cir. 1996), Motor and Equipment Manufacturers Association, Inc. v. Nichols, 142 F.3d 449, at 463 (D.C.Cir. 1998).

D. Waiver Process Will Delay Regulation Implementation

When the U.S. Supreme Court ruled that a purchase requirement is, in fact, an emission standard under the federal Clean Air Act, implementation of the District rule required a waiver of federal preemption. The ARB determined that only the state can request a waiver of federal preemption, and that the rule subject to the request must be adopted by the state. This is the principle reason for this proposal being brought before ARB for consideration.

Stakeholders have pointed out that it can take several years following Board adoption before a waiver is received from U.S. EPA. This does not usually create a problem because most requests for a waiver involve a regulation that includes lead time to develop new knowledge and will be implemented in three to four years. In the case of this proposed regulation, the emission benefits of the regulation accrue only from now until the end of 2009. If the waiver process takes several years, much of the emission benefit of the regulation will be lost.

The ARB staff believes the rule qualifies as "within the scope" of a previous waiver. In such instances, ARB can implement the rule immediately. However, the Engine Manufacturers Association disagrees with the staff's position, and may challenge our waiver request. Discussions with U.S. EPA also have not resulted in a definitive picture of how it will approach ARB's waiver request. Thus, there is uncertainty regarding when the regulation, if adopted, can be implemented. Any substantial delay will reduce the emission reductions achieved.

XII. SUMMARY AND STAFF RECOMMENDATION

Board adoption of the new sections 2024 and 2024.1, title 13, California Code of Regulations, as set forth in the proposed Regulation Order in Appendix A, would enact in state regulation a fleet rule affecting school bus operators in the South Coast Air Quality Management District. Based on the May 2005 lower court ruling, the SCAQMD has the authority to regulate the approximately 3800 buses in public school fleets with 15 or more buses. Staff understands that the SCAQMD also intends to begin again enforcing its rule on private contractors to public schools in the near future.

Adoption of this regulation would enable the SCAQMD to regulate the 21 school buses owned by the one private school with more than 15 buses. Adoption of this regulation would also serve as backup in the event of further legal challenge to the SCAQMD's authority to regulate private contractors to public agencies. Staff rejected the no regulation alternative for the reasons cited above, and to provide the Board the opportunity to evaluate the proposal on its merits.

As stated previously, based on the identified funding available for new bus purchases, the staff estimates that the proposal would result in a 0.04 ton per day NOx reduction and a 0.001 ton per day PM reduction in the SCAQMD in 2010.

The staff estimates the total incremental cost for implementation of the new bus purchase requirements of the proposal at $30.1 million for 2005 through 2009. If costs are split between NOx and PM reductions, the cost effectiveness is approximately $60,000 per ton of NOx and $405,000 per ton of PM reduced. The cost effectiveness of this rule is less favorable compared to cost effectiveness values for other NOx and PM control measures that have been recently approved by the Board.

XIII. REFERENCES

A Public Participation Guide to Air Quality Decision Making in California. Air Resources Board, Available at: http://www.arb.ca.gov/ch/public_participation_guide.pdf

Ahlvik and Brandberg 2000. Ahlvik, P.J.E., Brandberg, A.R.L., "Relative Impact on Environment and Health from the Introduction of Low Emission City Buses in Sweden," SAE Tech. Paper 2000-01-1882, 2000.

ARB 2001. Air Resources Board, Policies and Actions for Environmental Justice, approved on December 13, 2001. Available at: http://www.arb.ca.gov/ch/ejpolicies_121301.pdf

ARB 2002. Air Resources Board, Briefing Paper on Interim Results and Tentative Conclusions For ARB's Study of Emissions from "Late-model" Diesel and CNG Heavy-duty Transit Buses", April 2002

ARB 2005. Air Resources Board, Review of the California Ambient Air Quality Standard For Ozone, California Environmental Protection Agency, Vol I, March 11, 2005.

ARB and CEC 2003. Air Resources Board and California Energy Commission, Reducing California's Petroleum Dependence, Final Adopted Report, August, 2003. Available at:: http://www.energy.ca.gov/reports/2003-08-14_600-03-005.PDF

ARB and OEHHA 1998. Air Resources Board and Office of Environmental Health Hazard Assessment, Executive Summary for the "Proposed Identification of Diese Exhaust as a Toxic Air Contaminant", April 22, 1998. Available at: http://www.arb.ca.gov/toxics/dieseltac/finexsum.pdf

Ayala et.al. 2002. Ayala, A., N.Y. Kado, R.A. Okamoto, B.A. Holmen, P.A. Kuzmicky, R. Kobayashi, and K.E. Stiglitz, "Diesel and CNG Heavy-duty Transit Bus Emissions over Multiple Driving Schedules: Regulated Pollutants and Project Overview," Journal of Lubricants and Fuels, 2002, SAE Transactions, Vol. 111, pp 735-747 (Also SAE Tech. Paper 2002-01-1722)

California Educator 2005. California Educator, excerpted from "California's school funding went from first . . . to among the worst. What went wrong?" February 2005, which attributes the information to Education Week, and notes that it is based on the regional cost of living.

CEC 1995. California Energy Commission Resource Guide, Publication Number P500-95-004, June 1995 California Energy Commission Publications Unit, 1516 Ninth Street, MS-13, Sacramento, CA 95814

Clark et.al. 1995. Clark, N. N., Gadapati, C. J., Kelly, K., White, C. L., Lyons, D. W., Wang, W., Gautam, M., and Bata, R., "Comparative Emissions from Natural Gas and Diesel Buses," SAE Tech. Paper 952746, 1995.

Clark et.al. 1999. Clark, N. N., M. Gautam, B. L. Rapp, D. W. Lyons, M. S. Graboski, R. L. McCormick, T. L. Alleman, and P. Norton, "Diesel and CNG Transit Bus Emissions Characterization By Two Chassis Dynamometer Laboratories: Results and Issues," SAE Tech. Paper 1999-01-1469, 1999.

CSPTA 2004. California State Parent Teacher Association resolution on "School transportation: equitable and adequate funding" adopted May 2004.

Dieselnet 2004. http://www.dieselnet.com/tech/dpf_regen.html , "Diesel Filter Regeneration", Revision 2004.11a

FACSNET 2005. Foundation for American Communications, a nonprofit educational organization, from on-line article "Sorting through the blame game in the California state budget crisis" posted on May 16, 2005.

Hansen 2004. Dr. James Hansen, "Defusing the Global Warming Time Bomb." Sci. Amer. 290, no. 3, 68-77, 2004. Available at: http://pubs.giss.nasa.gov/docs/2004/2004_Hansen1.pdf

SCAQMD 2001a. Rule 1195 Staff Report, Proposed Rule 1195—Clean On Road School Buses. Author: Ali R. Ghasemi, SCAQMD, April 2001

SCAQMD 2001b. Board meeting document: Agenda Number 37, Adopt Proposed Rule 1195 – Clean On-Road School Buses, 20 April 2001

SCAQMD 2005. Draft White Paper: Results of School Bus and Infrastructure Survey, January 2005. Author: Von Loveland

School Transportation News Buyer's Guide 2005. School Transportation News Buyer's Guide, National Association of State Directors of Pupil Transportation Services, 2005. Available at: http://www.stnonline.com/stn/data_statistics/2003-04_schoolyear.htm

Surface Transportation Policy Project et.al. 2003. Surface Transportation Policy Project, the Transportation and Land Use Coalition, and the Latino Issues Forum, from "Can't get there from here: the declining mobility of California's children and youth" September, 2003.

U.S. EPA Indoor Air Quality website. Sources of Indoor Air Pollution – Nitrogen Dioxide (NO2), htttp://www.epa.gov/iaq/no2.html

U.S. EPA 2004. U.S. Environmental Protection Agency. Highway Diesel Progress Review Report 2 (EPA420-S-04-001). March 2004. Available at: http://www.epa.gov/otaq/regs/hd2007/420s04001.pdf

XIV. AVAILABILITY OF TECHNICAL SUPPORT DOCUMENT

An electronic version of the technical support document for the proposal is available at http://www.arb.ca.gov/regact/scschl05/scschl05.htm. If you would like a hard copy of this document, please fill out this form and mail or fax it to:

Public Information Office
California Air Resources Board
P.O. Box 2815
Sacramento, CA 95812
Fax: (916) 445-5025

Please mail the **TECHNICAL SUPPORT DOCUMENT: PROPOSED REGULATION FOR THE PROPOSED SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT FLEET RULES** to:

Name:_____

Address:_____

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APPENDIX A

PROPOSED REGULATION ORDER

PROPOSED REGULATION ORDER

Add the following sections to title 13, California Code of Regulations, to read as set forth on the following pages:

Section 2024	School Buses Operated in the South Coast Air Quality Management District
Section 2024.1	Determining Compliance for School Buses

Note: The entire text of sections 2024 and 2024.1 set forth below is new language proposed to be added to the California Code of Regulations. Subsection headings are shown in italics and should be italicized in Barclays Code of Regulations.

PROPOSED REGULATION ORDER

Adopt new sections 2024 and 2024.1, title 13, California Code of Regulations, to read:

§ 2024. School Buses Operated in the South Coast Air Quality Management District

(a) *Purpose.* To reduce air toxic and criteria pollutant emissions, this regulation requires public and private school bus fleet operators and owners to acquire less-polluting school buses when purchasing or leasing these vehicles for operation in the South Coast Air Quality Management District.

(b) *Applicability.* Sections 2024 and 2024.1 apply to public and private school bus fleets that operate within the jurisdiction of the South Coast Air Quality Management District (District). The public or private school bus fleet owner/operator shall comply with the requirements of section 2024.1 for a school bus fleet of 15 or more medium- and/or heavy-duty school buses. Compliance with the requirements of section 2024.1 is contingent on the availability of grant funding or external sources of funding beyond that of the public school district's or private school transportation company's fiscal budget as authorized under Education Code title 1, division 1, part 10.8, section 17920 et seq.

(c) *Definitions.* The definitions in section 2020 shall apply to sections 2024 and 2024.1. In addition, the following definitions apply to section 2024 and 2024.1.

(1) "Executive Officer" means the Executive Officer of the South Coast Air Quality Management District, unless otherwise specified.

(2) "Heavy-duty school bus" means any school bus having a gross vehicle weight rating greater than 14,000 pounds.

(3) "Low-emission vehicle" or "LEV" means any vehicle certified to low-emission standards set forth in sections 1960.1(h)(2) and 1961(a)(1), title 13, California Code of Regulations.

(4) "Medium-duty school bus" means any school bus having a gross vehicle weight rating of more than 6,000 pounds and up to 14,000 pounds.

(5) "Public or private school bus fleet operator" means a person who owns, leases, or operates school buses or is responsible for administering and managing school bus transportation services.

(6) "Repowered school bus" means an existing, pre-owned school bus that has been converted to run on an alternative fuel or repowered with a new alternative-fueled engine.

(7) "School bus" means any vehicle used for the express purpose of transporting students through Grade 12 from home to school and to any school sponsored activities as defined in California Vehicle Code section 545.

(8) "Ultra-low-emission vehicle" or "ULEV" means any vehicle certified to ultra-low-emission standards set forth sections 1960.1(h)(2) and 1961(a)(1), title 13, California Code of Regulations.

NOTE: Authority cited: Sections 39600, 39601, 39658, 43013 and 43018, Health and Safety Code. Reference: Sections 39002, 39003, 39658, 38667, 43000, 43010, 43013, 43018, 43101, 43102, 43104, 43105 and 43700, Health and Safety Code.

§ 2024.1. Determining Compliance for School Buses

(a) *Purchase and Lease Requirements for School Buses in the South Coast Air Quality Management District.*

(1) When adding to or replacing heavy-duty school buses in an existing fleet, public or private operators with 15 or more school buses shall purchase, lease, or contract for new school buses equipped with engines meeting the best engine selection/technology (BEST) requirements as follows:

(A) A California-certified engine that meets the applicable criterion specified in subsection (a)(2), or

(B) A California-certified engine with a verified diesel emission control strategy that reduces emissions of NOx and PM to the applicable criterion specified in subsection (a)(2) as determined by the verified performance of the strategy and engine combination.

(2) *BEST criteria for heavy-duty engines.* The best engine selection/technology for heavy-duty engines is defined by the following criteria:

(A) *2005-2006 Model-Year Engines*: An engine certified to the optional NOx plus NMHC standard of 1.8 g/bhp-hr or lower and to the optional PM standard of 0.03 g/bhp-hr as specified in title 13, CCR, section 1956.8 (a)(2)(A).

(B) *2007-2009 Model-Year Engines*: An engine certified to the 2007 and subsequent standards specified in title 13, CCR, section 1956.8(a)(2)(A),

provided the declared NOx FEL of the engine does not exceed 0.2 g/bhp-hr.

(C) *2010 and Subsequent Model-Year Engines*: An engine certified to the standards specified in title 13, CCR, section 1956.8(a)(2)(A).

(3) *BEST criteria for medium-duty engines.* When adding to or replacing medium-duty school buses in an existing fleet, public or private operators with 15 or more school buses shall purchase, lease, or contract for new medium-duty school buses meeting BEST requirements as follows:

(A) *2005-2009 Model Year Engines*: A new medium-duty school bus shall be equipped with a non-diesel engine certified as ULEV or cleaner.

(4) *Exemptions from BEST for purchases of new school buses.* An operator of public or private school buses may apply to the Executive Officer for an exemption from the provisions of subsections (a)(1) and (a)(3) for the following reasons:

(A) *Lack of funding for the incremental cost of BEST.*

1. *Purchases of heavy-duty school buses.* A public or private school bus fleet operator may purchase a heavy-duty school bus that does not meet BEST requirements under subsection (a)(1) of this rule, if grant funding or external sources of funding beyond that of the school bus fleet operator's fiscal budget is not available for either purchase option provided in subsection (a)(1) to fully offset the differential purchase cost {including costs of warranties comparable to base warranties for a comparable school bus purchase not meeting the requirements of subsection (a)(1)} of either of the BEST school bus purchase options as provided in subsection (a)(1) compared to the cost of a comparable school bus not meeting the requirements of subsection (a)(1), provided the bus purchased is equipped with a California-certified engine meeting a PM standard of 0.01 g/bhp-hr as specified in title 13, CCR, section 1956.8 (a)(2)(A), except as provided in subsection (a)(4)(E).

2. *Purchases of medium-duty school buses.* A public or private school bus fleet operator may purchase a medium-duty school bus that does not meet BEST requirements under subsection (a)(3), if grant funding or external sources of funding beyond that of the school bus fleet operator's fiscal budget s not available to fully offset the differential purchase cost {including costs of warranties comparable to base warranties for a comparable school bus purchase not meeting the requirements of subsection (a)(3)} of the BEST school bus compared to the cost of a comparable school bus not meeting the requirements of

subsection (a)(3), provided the bus purchased is equipped with a California-certified engine meeting a PM standard of 0.01 g/bhp-hr as specified in title 13, CCR, section 1956.8 (a)(2)(A), except as provided in subsection (a)(4)(E).

(B) *Lack of available infrastructure.* Upon demonstration to the Executive Officer that an alternative-fuel refueling station for an alternative-fueled BEST school bus is not available within five miles of the vehicle storage or maintenance yards, and the public or private school bus fleet operator has not received external funding (beyond the school bus fleet operator's fiscal budget) of at least $13,000 for each alternative-fueled BEST school bus purchased or leased to build a new alternative-fuel refueling station or expand an existing refueling station, a public or private school bus fleet operator may purchase school buses that are not alternative-fueled BEST school buses. This exemption does not apply provided the external funding received by the school bus fleet operator for the purchase of the alternative-fueled BEST school bus is at least $13,000 more than the incremental capital cost of the BEST bus, plus up to an additional $4,000 more to cover necessary maintenance facility upgrades, plus funding to cover additional reasonable operating and maintenance costs.

(C) *Lack of funding for maintenance facility upgrades.* If the BEST school bus is an alternative fuel bus, and if a public or private school bus fleet operator does not receive external funding beyond the school bus fleet operator's fiscal budget of up to $4,000 per BEST bus to upgrade an existing maintenance facility to meet the required standards to handle alternative-fuel bus technology, the school bus operator may purchase a diesel-powered school bus equipped with a California-certified engine meeting a PM standard of 0.01 g/bhp-hr as specified in title 13, CCR, section 1956.8 (a)(2)(A), except as provided in subsection (a)(4)(E). This exemption does not apply provided the external funding received by the school bus fleet operator for the purchase of the alternative-fueled BEST school bus is at least $13,000 more than the incremental capital cost of the BEST bus, plus up to an additional $4,000 more to cover necessary maintenance facility upgrades, plus funding to cover additional reasonable operating and maintenance costs.

(D) *Lack of available engine/chassis/body configuration.* Upon demonstration to the Executive Officer that a BEST school bus is not available in a specific bus size or could not be used on a specific fixed bus route, a school bus that does not meet the requirements of subsections (a)(1) or (a)(3), but which is equipped with a California-certified engine meeting a PM standard of 0.01 g/bhp-hr as specified in title 13, CCR, section 1956.8 (a)(2)(A), may be purchased in that specific bus size or as needed for the specific fixed bus route, except as provided in subsection (a)(4)(E).

(E) *Lack of funding for a California-certified engine meeting an optional PM standard.* For the 2005 - 2006 model years, a public or private school bus fleet operator may purchase a school bus equipped with a diesel-powered engine that does not meet an optional PM standard of 0.01 g/bhp-hr as specified in title 13, CCR, section 1956.8 (a)(2)(A), provided external funding beyond a school bus fleet operator's fiscal budget is not available for the incremental cost of the engine meeting the optional PM standard.

(F) *Field trips.* For the purpose of transporting passengers on field trips outside of the jurisdiction of the District and when the remainder of the fleet consists of school buses that meet the requirements of subsections (a)(1) and (a)(3), public and private school bus fleets shall only contain school buses that do not meet the requirements of subsections (a)(1) and (a)(3), in accordance with the table below. The Executive Officer may consider a higher number on a case-by-case basis, if the public or private school bus fleet can demonstrate, based on three (3) years of bus dispatch logs, that a higher number of field trip buses is necessary.

Fleet Size (School Buses)	Maximum # of Field Trip Buses
≥ 100	10% of fleet
51 < 100	10
≤ 50	5

(G) *Unforeseen circumstances.* If during the year that the school is in session, a public or private school bus fleet operator needs additional school buses due to unforeseen circumstances to operate during that school year, the operator may lease or contract for the needed quantity of school buses that do not comply with the provisions of subsections (a)(1) and (a)(3) for the months necessary to purchase or lease school buses compliant to sections (a)(1) and (a)(3), not to exceed the remaining portion of the school year, if a demonstration is made that the rule-compliant school bus cannot be deployed by the school bus fleet operator within one month from the date of order.

(H) *Mergers.* For purposes of this rule, a private school bus fleet operator is not deemed to have purchased, leased, added to, or formed a new fleet if the private school bus fleet operator, as part of a purchase or merger with another private school bus fleet operator that provides contracted school bus transportation services, transfers ownership of school buses that are already operating in the District at the time of purchase or merger.

(5) *Purchases of pre-owned school buses.*

(A) *Pre-owned heavy-duty school buses.* Public or private operators with 15 or more school buses shall purchase, lease, or contract for a school bus repowered with a new engine meeting the BEST emission standard criteria specified in subsection (a)(2), when adding to or replacing heavy-duty school buses in an existing fleet.

(B) *Pre-owned medium-duty school buses.* Public or private operators with 15 or more school buses shall purchase or lease a school bus equipped with an engine certified as LEV or cleaner.

(6) *Exemptions for purchases of pre-owned school buses.* An operator of public or private school buses may apply to the Executive Officer for an exemption from the provisions of subsection (a)(5) for the following reason:

(A) A public or private school bus fleet operator may purchase a pre-owned school bus that does not meet the requirements of subsection (a)(5) if the oldest school bus in the operator's existing school bus fleet is scrapped or otherwise removed permanently from operation. Eligible pre-owned school buses shall be equipped with a verified diesel emission control strategy, if external funding beyond a school bus fleet operator's fiscal budget is available for the incremental cost of a verified diesel emission control strategy.

(b) *Diesel Emission Control Strategies for School Buses in the South Coast Air Quality Management District.*

(1) To reduce emissions from in-use diesel school buses, public or private operators that own or lease 15 or more school buses shall install on at least 25 percent of the eligible school buses on an annual basis beginning January 1, 2006, the highest level verified diesel emission control strategy per title 13, California Code of Regulations, section 2702(f), Table 1, that is verified for a specific engine, and which the diesel emission control strategy manufacturer or authorized dealer agrees can be used on a specific engine and school bus combination, without jeopardizing the original engine warranty in effect at the time of installation.

(2) If using a fuel-based verified strategy to meet the requirements of (b)(1), the fleet operator must continue that strategy for the life of the school bus, or upon discontinuing the fuel-based strategy, apply to the District for approval to install or employ a different verified strategy for the life of the school bus.

(c) *Compliance Auditing and Enforcement.*

(1) The fleet operator shall provide, at the request of the District, any files and/or records created to comply with subdivisions (a) and (b), including fleet-specific information, such as a list of official Department Motor Vehicle registrations, principal vehicle location, manufacturer, model-year, model, and fuel type of each school bus in an operator's fleet. This provision shall not apply for records that have been in existence for more than one (1) year.

(2) Any school bus fleet operator seeking an exemption under subsections (a)(4) and (a)(6) shall supply proof that vehicle or fleet is exempted from the requirements of this rule upon request by the District.

(3) Any school bus fleet operator seeking an exemption under the provisions of subsections (a)(4) and (a)(6)) that pertain to external funding availability shall apply for external funding or to external funding sources, identified annually by and with the assistance of the Executive Officer and demonstrate that funding is not available prior to the purchase or lease of school buses as allowed under subsections (a)(4) and (a)(6).

(4) Any school bus fleet operator using fuel or fuel additives as a diesel emission control strategy under the provisions of subdivision b, shall retain all records of purchase for the most recent 5 years that demonstrate usage, and provide to the District upon request.

(5) Circumvention of this rule is prohibited, including artificially creating fleets under common ownership of smaller than 15 vehicles, without sufficient business justification.

(d) *Non-Compliance.* The Executive Officer may bring an action for civil penalties as specified in state law and regulations, including, but not limited to, Health and Safety Code Section 39674, for any violation of this section.

(e) *Severability.* Each provision of this section is severable, and in the event any provision is held invalid, the remainder shall remain in full force and effect.

NOTE: Authority cited: Sections 39600, 39601, 39658, 43013 and 43018~~658~~, Health and Safety Code. Reference: Sections 39002, 39003, 39658, 38667, 43000, 43010, 43013, 43018, 43101, 43102, 43104, 43105 and 43700, Health and Safety Code.

APPENDIX B

IMPACTS OF DIESEL PARTICULATE MATTER

Impacts of Diesel Particulate Matter

Background

The California Legislature granted ARB the authority to identify toxic air contaminants (TACs) and establish airborne toxic control measures (ATCMs) to reduce risk. In controlling TACs, the Board is directed to address specific issues pursuant to the need for regulation (H&SC section 39665). These requirements were addressed in detail in the Diesel Risk Reduction Plan (DRRP) (ARB 2000), including the extent of present and anticipated future emissions, the estimated levels of human exposure, and the risks associated with those levels. The DRRP describes the physical and chemical characteristics of diesel particulate matter (PM) and the contribution to emissions by present sources, as well as the costs, availability, technological feasibility of control measures, and the potential adverse health or environmental impacts.

Particulate matter is the general term for tiny airborne particles. Diesel PM, emitted from engines that burn diesel fuel, is a complex mixture that consists of dry solid fragments, solid cores with liquid coatings and small droplets of liquid. These tiny particles vary greatly in shape, size and chemical composition and can be divided into several size fractions. Coarse particles are between 2.5 and ten microns in diameter, and arise primarily from natural processes, such as wind-blown dust or soil. Fine particles are less than 2.5 microns in diameter and are produced mostly from combustion or burning activities and are termed $PM_{2.5}$. Particles with an aerodynamic diameter less than or equal to a nominal ten microns (about 1/7 the diameter of a single human hair) are termed PM_{10}; PM_{10} is a criteria air pollutant for which federal and state ambient air quality standards have been set. Diesel PM is a subset of PM_{10}.

Ambient Air Quality Standards for Particulate Matter

Both the ARB and U.S. EPA have established standards for the amount of PM_{10} in the ambient air. These standards define the maximum amount of particles that can be present in outdoor air without threatening the public's health and welfare. California's current PM_{10} standard is more protective of human health than the corresponding national standard. Standards for $PM_{2.5}$ have also been established to further protect public health. These standards are shown in Table 1 below.

Table 1. State and National Particulate Matter Standards			
California Standard		**National Standard**	
PM_{10}			
Annual Arithmetic Mean	20 $\mu g/m^3$	Annual Arithmetic Mean	50 $\mu g/m^3$
24 Hour Average	50 $\mu g/m^3$	24 Hour Average	150 $\mu g/m^3$
$PM_{2.5}$			
Annual Arithmetic Mean	12 $\mu g/m^3$	Annual Arithmetic Mean	15 $\mu g/m^3$
24 Hour Average	No separate State standard	24 Hour Average	65 $\mu g/m^3$

California's ambient air quality standards are designed to protect the most sensitive sub-populations, such as children, the elderly, or people with pre-existing disease such as cardiac patients or asthmatics.

Identification of Diesel Particulate Matter as a Toxic Air Contaminant

After ten years of extensive research and public outreach, ARB identified diesel PM as a toxic air contaminant (TAC) in August 1998. As part of the identification process, Office of Environmental Health Hazard Assessment (OEHHA) evaluated the potential for diesel exhaust to affect human health.

OEHHA found that exposures to diesel PM resulted in an increased risk of cancer and an increase in chronic non-cancer health effects, including a greater incidence of cough, labored breathing, chest tightness, wheezing, and bronchitis (ARB 2000). OEHHA estimated, based on available studies, that the potential cancer risk for exposure to diesel PM in concentrations of one microgram per cubic meter ($\mu g/m^3$) ranged from 130 to 2400 excess cancers per million.

The ARB's Scientific Review Panel (SRP) approved OEHHA's determinations concerning health effects and approved the range of risk for PM from diesel-fueled engines, concluding that a value of 300 excess cancers per million people, per $\mu g/m^3$ of diesel PM, was appropriate as a point estimate of unit risk for diesel PM.

OEHHA also concluded that exposure to diesel PM in concentrations exceeding five $\mu g/m^3$ can result in a number of long-term chronic health effects. The five $\mu g/m^3$ value is referred to as the chronic reference exposure value for diesel PM. The SRP supported OEHHA's conclusion and noted that the reference exposure value may need to be lowered further as more data emerge on potential adverse chronic effects of diesel PM.

Physical and Chemical Characteristics of Diesel Particulate Matter

Diesel PM is the non-gaseous portion of the exhaust from a diesel-fueled compression ignition engine. PM emissions result primarily from incomplete combustion of fuel in the cylinder and lubrication oil that has entered the cylinder incidentally. Secondarily produced diesel PM is formed as a result of

atmospheric reactions with diesel NOx emissions. Diesel PM consists of several constituents, including an elemental carbon fraction, a soluble organic fraction, and a sulfate fraction. Approximately 98 percent is smaller than 10 microns in diameter.

Diesel PM is a mixture of materials containing over 450 different components, including vapors and fine particles coated with organic substances. The State of California considers more than 40 chemicals in diesel exhaust as TACs. Table 2 below lists those chemicals.

Table 2. Substances in Diesel Exhaust Listed by California as Toxic Air Contaminants

Acetaldehyde	Manganese compounds
Acrolein	Mercury compounds
Aniline	Methanol
Antimony compounds	Methyl Ethyl Ketone
Arsenic	Naphthalene
Benzene	Nickel
Beryllium compounds	4-Nitrobiphenyl
Biphenyl	Phenol
Bis[2-ethylhexyl]phthalate	Phosphorus
1,3-Butadiene	Polycyclic organic matter, including polycyclic aromatic hydrocarbons (PAHs) and their derivatives
Cadmium	
Chlorine	
Chlorobenzene	
Chromium compounds	
Cobalt compounds	Propionaldehyde
Creosol isomers	Selenium compounds
Cyanide compounds	Styrene
Dibutylphthalate	Toluene
Dioxins and dibenzofurans	Xylene isomers and mixtures
Ethyl benzene	o-Xylenes
Formaldehyde	m-Xylenes
Inorganic lead	p-Xylenes

Note: California Health and Safety Code section 39655 defines a TAC as "an air pollutant which may cause or contribute to an increase in mortality or in serious illness, or which may pose a present or potential hazard to human health."

Sources and Ambient Concentrations of Diesel Particulate Matter

PM emissions from diesel-fueled engines come from on-road and off-road vehicles, stationary engines, portable engines. As shown in Table 3 below, in the year 2000, outdoor diesel PM concentrations were 1.8 $\mu g/m^3$ and projected to be 1.5 $\mu g/m^3$ in 2010 after accounting for current regulations. After including indoor

concentrations of diesel PM, total exposure was 1.26 $\mu g/m^3$ in 2000 and projected to be 1.05 $\mu g/m^3$ in 2010.

Table 3. Estimated Exposure of Californians to Diesel Particulate Matter for 2000, 2010, and 2020 (ARB 2000)

Exposure Location	Estimated Average Air Exposure Concentration – 1990 ($\mu g/m^3$)	Estimated Average Air Exposure Concentration ($\mu g/m^3$) and Potential Risk (excess cancers/million)					
		2000		2010		2020	
		Conc.	Risk	Conc.	Risk	Conc.	Risk
Outdoor Ambient	3.0	1.8	540	1.5	450	1.2	360
Indoor	2.0	1.2	360	1.0	300	0.8	240
Total	2.1	1.26	380	1.05	315	0.84	252

Health Effects of Diesel Particulate Matter

Diesel PM has been linked to a wide range of serious health problems. Particles that are deposited deep in the lungs can result in lung cancer; increased hospital admissions; increased respiratory symptoms and disease; decreased lung function, particularly in children and individuals with asthma; alterations in lung tissue and respiratory tract defense mechanisms; and premature death. Increased PM exposure causes increased cardiopulmonary mortality risk as demonstrated in a validity and causality analysis of 57 epidemiological studies. (Dab et al. 2001). Significant positive associations exist between lung cancer incidence and the number of days per year that respirable particulates (PM_{10}) exceeded several thresholds (Beeson et al.1998).

Statewide Risk Reduction Goal of Diesel Risk Reduction Plan

As noted above, diesel PM is emitted from a variety of sources, including on- and off-road diesel-fueled vehicles and stationary engines. On a statewide basis, the average potential cancer risk associated with diesel PM emissions is 540 potential cases per million statewide, with the potential risk in the South Coast Air Basin estimated to be 1,000 per million people. Compared to other air toxics the Board has identified and controlled, diesel PM emissions are estimated to be responsible for about 70 percent of the total ambient air toxics risk. In addition to these general risks, diesel PM can also present elevated localized or near-source exposures. Depending on the activity and nearness to receptors, these potential risks can range from small to 1,500 per million or more.

The goal of the Board (ARB 2000) is to reduce diesel PM emissions and the associated cancer risk by 75 percent in 2010 and 85 percent in 2020. The proposed Clean On-Road School Bus Regulation is one of a group of regulations being developed to achieve the emission reduction goals of the ARB of protecting the health of Californians by reducing the cancer risk from diesel PM and complying with legal requirements to control a TAC. Other benefits associated with reducing diesel PM emissions include increased visibility, less

material damage from soiling of surfaces, and reduced incidence of non-cancer health effects, such as bronchitis, asthma, and allergy. The emission reductions obtained from this regulation will result in lower ambient PM levels and significant reductions of exposure to primary and secondary diesel PM. Lower ambient PM levels and reduced exposure, in turn, would result in a reduction of the prevalence of the diseases attributed to PM and diesel PM, including reduced incidences of hospitalizations for cardio-respiratory disease, and prevention of premature deaths.

References:

ARB 2000. Air Resources Board, "Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles," October 2000. Available at: http://www.arb.ca.gov/diesel/documents/rrpapp.htm

Beeson et al.1998. Feeson, W. Lawrence, Abbey, David D., Knutsen, Synnove F., "Long-term Concentrtaions of Ambient Air Pollutants and Incident Lung Cancer in California Adults:Results from the AHSMOG Study," Environmental Health Perspectives 106:813-822, 1998

Dab et.al. 2001. Dab, Willian, Segala, Claire, Dor, Frederic, Festy, Bernard, Lameloise, Phillipe, Le Moullec, Yvon, Le Tertre, Alain, Medina, Sylvia, Quenel, Phillipe, Wallaert, Benoit, Zmirou, Denis, "Air Pollution and health: Correlation or Causality? The Case of the Relationship between Exposure to Particles and Cardiopulmonary Mortality," Journal of the Air and Waste Management Association, 51:220-235, 2001.

APPENDIX C

EMISSION BENEFITS AND COST EFFECTIVENESS ANALYSIS METHODOLOGY

Emission Benefits and Cost Effectiveness of Proposed Rule

The cost of an emission control measure is generally assessed in terms of dollars-per-pound, or dollars-per-ton, of air emissions reduced. This is referred to as the cost effectiveness. This appendix discusses the factors that were used to determine the cost effectiveness values estimated for this regulatory proposal. To calculate cost effectiveness, both the emission benefit from the proposal and the incremental cost of the proposal must be determined.

Costs

Many factors were taken into account in order to estimate the cost effectiveness for the proposed rule. The costs considered in determining cost effectiveness include capital costs for both vehicle and infrastructure and operational costs. Only the incremental cost is used to determine the cost effectiveness of the proposed rule. The incremental capital cost for a CNG school bus is based on the differential cost for a CNG school bus in comparison to the cost of a conventional diesel fueled school bus. The incremental costs associated with infrastructure, maintenance, labor, and fuel costs for a CNG fueled school bus are based on comparisons to conventional diesel fueled school buses.

Incremental capital costs were generated using costs annualized over the life of the school bus and then discounted to present value. An annualized capital cost was calculated using a capital recovery factor based on a five percent discount interest rate. The annualized portion of the capital costs was then added to the annualized portion of the incremental operational cost. This sum was then discounted using the present value of money concept. A total cost associated with the proposed rule as it relates to cost effectiveness was then calculated by summing these discounted annual costs over the lifetime of the bus. It was assumed that the lifetime of a public school bus operating within the air district was 25 years.

Emission Reductions

The emission reductions calculated for the different scenarios analyzed were based on the difference between baseline emission standards for each model year and the certification emission standard for the emission reduction strategy being used. In order to calculate the tons of oxides of nitrogen (NOx) and particulate matter (PM) reduced per year, an average annual mileage for the school buses was assumed as well as factors to convert brake-horsepower hours to miles traveled and to account for the reduction in NOx and PM emissions due to the use of ARB diesel as compared to EPA diesel fuel. In those cases where the NOx emission standard is stated as a limit for the combination of NOx and non methane hydrocarbons (NMHC), a factor is used to estimate the fraction of the emission limit value that could be attributed to NOx.

The following values and factors were used for all of the scenarios, where appropriate. The average number of miles traveled per school bus in the South Coast Air Quality Management District was determined from ARB's On-Road Mobile Source Emission Inventory Model EMFAC2002 (version 2.2 April 23, 2003) to be 13,666 miles per year. A conversion factor of 2.3 brake-horsepower-hr per mile was used which is consistent with Carl Moyer Program methodology (ARB 2003) for medium heavy-duty diesel engines. Fuel conversion factors of 0.87 for NOx and 0.90 for PM were used to account for the lower emission potential of CARB diesel fuel as compared to EPA diesel fuel. NOx fractions used to determine the NOx portion of a NOx + NMHC standard were 0.95 for diesel and 0.8 for CNG fueled vehicles.

Scenarios Analyzed

In total, four scenarios were analyzed and are presented in this appendix. However, only two of the four, Scenarios One and Two, are presented in the body of the report. Scenario One was considered the most relevant because it is consistent with SCAQMD's choice to fund only alternative-fueled vehicles. Scenario Two was included in the main report because it was based on receiving funding specifically for DPF retrofits, which is a possible occurrence. The other two scenarios (Scenarios A and B) assume that the Lower Emission School Bus Program's state funding is allocated in a proportion consistent with the Lower Emission School Bus Guidelines of two thirds to alternative-fueled vehicles and one third to diesel fueled vehicles. These two scenarios are not discussed in the report because they are not probable funding allocation scenarios for the SCAQMD.

The number of vehicles purchased or retrofit in each scenario was based on the projected funding available from the incentive sources discussed in Chapter IX of the staff report and an estimate of the portion of the purchase price that would be funded. These funding sources are directed primarily at funding a substantial portion of the capital cost of clean bus purchases and consequently the funded amount is generally significantly higher than the incremental capital cost of the purchase. The assumed funded amounts were estimated based on approximate current bus prices minus the school district cost share assuming that they are replacing either a pre 1987 bus or a pre 1977 bus. The school district cost share is $25,000 if a pre1987 bus is replaced and $10,000 if a pre 1977 bus is replaced. Sales tax was included at seven percent.

Scenario One

For the Scenario One analysis it was assumed that 92 new CNG school buses would be funded each year starting in 2005 and going through 2009. This was based on the funds available and an estimate of the portion of the purchase price that will be funded. The funding sources and allocations are given in Table 1.

Table 1 Funding Sources and Allocations for Scenario 1					
Funding Source	Projected Annual Funding	Allocation		Assumed State Contribution /bus	Number of buses purchased
		Infrastructure	CNG buses		
Lower-Emission School Bus (AB 923)	$9.33 mil	10%	90%	~$127K	67
MSRC	$1.5 mil	0%	100%	$60K	25
Clean Fuels Fund (AB2766)	$325K	100%	0%	--	N/A
Total	$11.155 mil	--	--	--	92

The emission benefits and costs that were associated with these school buses were then determined. Both PM and NOx emission benefits would be realized for the 2005 and 2006 model years. However, in 2007 through 2009, no PM benefits will be realized because the PM emission standard for heavy duty engines will drop down to the level of the CNG buses. These standards are shown in Table 2 below.

Table 2 Emission Standards and Certification Levels				
Model Year	NOx + NMHC (g/bhp-hr)		PM (g/bhp-hr)	
	Standard	CNG Certification	Standard	CNG Certification
2005-2006	2.5	1.5	0.1	0.01
2007-2009	1.2[a]	0.2[b]	0.01	0.01

(a) most engines will conform to the fleet NOx average of approximately 1.2 g/bhp-hr NOx +NMHC
(b) Level applies to NOx only

The cost effectiveness values calculated for Scenario One were determined to be $60,000 per ton of NOx and $405,000 per ton of PM, as show in Table 3. These cost effectiveness values are based on the assumption that half the costs of the model years 2005 and 2006 vehicles are attributed to NOx reductions and half to PM reductions and all costs for the model years 2007 through 2009 vehicles are attributed to NOx reductions.

Table 3 Scenario 1: 92 New CNG Buses/yr (05-09)			
Pollutant	Reductions (tons)	Cost	C/E
NOx	346	$30.1M	$60,000/ton
PM	13		$405,000/ton

The incremental capital costs and operational costs are described in the following paragraphs.

Capital Costs

The incremental capital costs associated with Scenario One were calculated on a per bus basis. These costs include the incremental cost of the initial purchase price of the bus, infrastructure required for refueling, maintenance facility upgrades, and replacement of the CNG onboard fuel tanks after 15 years of service.

The incremental capital cost for the CNG school bus was estimated at $31,000 for model years 2005 and 2006, and $29,300 for model years 2007-2009. This difference in capital costs for the school bus takes into account the fact that conventional diesel school buses will become more expensive in model years 2007-2009 in order to comply with the new 2007 federal emission standard for heavy-duty diesel engines. The capital cost for a new 2007 diesel bus with an OEM equipped DPF was based on estimates previously made for the purchase price of a new heavy duty engine meeting 2007 standards, corrected for inflation to 2005 dollars. The incremental cost, compared to a diesel engine meeting 2004 standards, was estimated to be an increase of $1,705. This resulted in a decrease in incremental capital cost for a CNG bus from $31,000 down to $29,300.

CNG fueled school buses require specialized refueling infrastructure that may not be available to all fleets. The regulatory proposal specifies an allowance of $13,000 per bus to either upgrade or install a refueling system. This amount was used as the incremental capital cost for refueling infrastructure.

Servicing CNG fueled school buses require upgrades to maintenance facilities that were originally developed to service diesel fueled school buses. The $4,000 per bus allowance for maintenance facility upgrades was used as the incremental cost for upgrading school bus maintenance facilities to allow routine maintenance to be performed on CNG fueled school buses.

CNG school buses require that the onboard natural gas fuel be stored in high pressure gas cylinders. These cylinders have a lifetime of 15 years and after that time they must be replaced. It was assumed that $15,000 would cover the cost of fuel cylinder replacement after 15 years of service. The replacement cylinders were assumed to last for the 10 remaining years of the school bus's useful life.

Operational Expenses

The incremental cost of operating a CNG fueled school bus in comparison to a conventional diesel fueled school bus was set at $0.01 per mile on average based on data from the South Coast Air Quality Management District's Results of School Bus and Infrastructure Survey, Draft White Paper, January 2005 (SQAQMD 2005). This value accounts for fuel cost, vehicle repair cost and the

normal cost of maintenance. Some school districts reported per mile costs larger then $0.01 and some school districts reported a net savings on a per mile basis. This average value was used in combination with an average annual mileage of 13,666 miles per year to calculate an incremental annual operational cost of $3416 for CNG school bus operation.

Scenario Two

Scenario Two deals with the retrofit of in-use diesel buses with diesel particulate filters (DPF). It is estimated that there are approximately 1300 diesel school buses in use in the SCQMD that are eligible for DPF retrofit but do not yet have DPFs. Currently there is no funding specified for these DPF retrofits, however funding could become available at some later date.

The analysis assumed that 325 in-use school buses could be fitted with diesel particulate filters every year for four years starting in 2006, resulting in a total of 1300 retrofits. It was assumed that the DPFs would have a lifetime of 11 years and that the buses would travel 13,666 miles per year, as determined from EMFAC2002. Since the majority of the public school bus fleet has already been retrofitted with DPFs, it was assumed that the remaining eligible school buses in the air district would be those school buses operated by private school bus contractors providing services to the public schools. Private school bus contractors tend to operate their school buses for fewer years then public schools before they are sold. Staff assumed that once DPF retrofitted private school buses were sold they would still operate within the air district under a different capacity, either as a public school bus or as a church bus, or a bus used in the transport of agricultural workers, or in some other capacity.

The emission reduction with the DPF was assumed to be an 85 percent reduction in PM and a 95 percent reduction in hydrocarbon (HC) emissions. These reductions were based on an engine certified to a 0.1 g/bhp-hr PM standard and a 0.125 g/bhp-hr HC standard.

The cost effectiveness calculated for Scenario Two was determined to be $380,000 per ton of PM, as shown in Table 4 below.

Table 4 Scenario 2: DPF Retrofits on 1,300 Buses (06-09)
No funding for retrofits specifically allocated

Pollutant	Reductions (tons)	Cost	C/E
PM	38	$15.6M	$380,000/ton

Capital Costs

The DPF was assumed to cost $8,000 per unit installed.

Operational Costs

Operational incremental costs for the diesel bus with DPF were assumed to include DPF baking and deashing once every two years at a cost of $800 per event. Typically, DPFs are designed to catalytically oxidize the collected PM using the heat generated by the engine's exhaust during normal operation. Such filters are described as passive because they do not require the external addition of heat to burn off the collected PM. School buses however, do not always reach the require operating temperature to light-off the collected PM. Therefore, it was assumed that a DPF installed on a school bus would need to have periodic baking to achieve temperature to burn off collected PM. DPFs regardless of the vehicles operating cycle will need to have collected ash removed from the filter and disposed of properly.

School districts may choose to purchase a DPF baker to reduce their costs, however that was not considered in this analysis.

DPFs require the use of ultra low sulfur diesel fuel (ULSDF). The incremental cost for the use of ULSDF was not considered since the use of ULSDF is already widespread within California and will be the only diesel fuel available in California in 2007.

Scenario A

Scenario A was developed to determine the emission benefits and cost effectiveness if the Lower Emission School Bus Program's funding was split to include some funding for cleaner diesel buses. This scenario assumed that this funding was proportioned between alternative-fueled and diesel fueled buses in a ratio of two-thirds of the funds to purchase new CNG school buses and one-third to purchase new diesel school buses equipped with original equipment manufacturer (OEM) supplied DPFs. Beginning with the model year 2007, standard purchase diesel school buses will be equipped with DPFs by the engine manufactures in order to comply with the national 0.01 g PM per bhp-hr emission standard. Therefore, in this scenario the two-thirds one-thirds funding split would only be relevant for model years 2005 and 2006 school buses. Starting in 2007 all of the funding would go toward the purchase of new CNG school buses.

There would be adequate funding for 69 new CNG school buses and 27 new diesel school buses equipped with OEM supplied DPFs in 2005 and 2006 assuming that one third of the Lower Emission School Bus Program's funding was allocated to the diesel school buses and two thirds to the CNG. The funding allocation for 2005 and 2006 is shown in Table 5 below. The funding allocation for 2007 through 2009 was assumed to be similar to that given for Scenario One in Table 1, previously presented. Given these assumed allocations, there would be adequate funding for 92 CNG school buses per year for 2007 through 2009.

Table 5 Scenario A: Funding Sources and Allocations for 2005-2006						
Funding Source	Projected Annual Funding	Allocation			Assumed State Contribution /bus	Number of buses purchased
		Infrastructure	CNG buses	Diesel Buses w/ DPF		
Lower-Emission School Bus (AB 923)	$6.22 mil	10%	90%	--	~$127K	44
	$3.11 mil	--	--	100%	~$112K	27
MSRC	$1.5 mil	0%	100%	0%	$60K	25
Clean Fuels Fund (AB2766)	$325K	100%	--	--	--	N/A
Total	$11.155 mil	--	--	--	--	69 CNG 27 Diesel

This scenario used the 13,666 average vehicle miles traveled per year derived from EMFAC2002 and the assumed public school bus lifetime of 25 years.

The emission reductions achieved with a new diesel bus with OEM supplied DPF would include PM, down to 0.01 g/bhp-hr, but not NOx. The emission reductions achieved with a new CNG bus would include both NOx and PM, as shown in Table 2, presented earlier in this appendix.

The cost effectiveness calculated for Scenario A was determined to be $60,000 per ton of NOx and $423,000 per ton of PM, as shown in Table 6 below. These cost effectiveness values are based on the assumption that half the costs for the model years 2005 and 2006 CNG-fueled vehicles are attributed to NOx reductions and half to PM reductions. All of the costs of the model years 2005 and 2006 diesel vehicles are attributed to PM reductions. Similarly, all of the costs for the model years 2007 through 2009 CNG-fueled vehicles are attributed to NOx reductions.

Table 6 Scenario A: 69 New CNG buses and 27 new Diesel buses w/DPF/yr (05-09): 92 new CNG buses/yr (07-09)			
Pollutant	Reductions (tons)	Cost	C/E
NOx	307	$28.4M	$60,000/ton
PM	13		$423,000/ton

Capital Costs

The capital costs associated with Scenario A were calculated on a per bus basis.

Diesel

The incremental capital cost for a new model year 2005 or 2006 diesel bus with an OEM equipped DPF was assumed to be approximately the same as a DPF retrofit, or $8,000.

CNG

The incremental capital costs for a new CNG bus include the incremental cost of the initial purchase price of the bus, infrastructure required for refueling, maintenance facility upgrades, and replacement of the CNG onboard fuel tanks after 15 years of service.

The incremental cost of the purchase price for a CNG school bus was estimated at $31,000 for model years 2005 and 2006, and $29,300 for model years 2007-2009. This difference in the incremental capital costs for the CNG school bus takes into account the fact that conventional diesel school buses will become more expensive in model years 2007-2009 in order to comply with the new 2007 federal emission standard for heavy-duty diesel engines.

CNG fueled school buses require specialized refueling infrastructure that may not be available to all fleets. The regulatory proposal specifies an allowance of $13,000 per bus to either upgrade or install a refueling system. This amount was used as the incremental capital cost for refueling infrastructure.

Servicing CNG fueled school buses require upgrades to maintenance facilities that were originally developed to service diesel fueled school buses. The $4,000 per bus allowance for maintenance facility upgrades was used as the incremental cost for upgrading school bus maintenance facilities to allow routine maintenance to be performed on CNG fueled school buses.

CNG school buses require that the onboard natural gas fuel be stored in high pressure gas cylinders. These cylinders have a lifetime of 15 years and after that time they must be replaced. It was assumed that $15,000 would cover the cost of fuel cylinder replacement after 15 years of service. The replacement cylinders were assumed to last for the 10 remaining years of the school bus's useful life.

Operational Expenses

Diesel

Operational incremental costs for the diesel bus with DPF were assumed to include DPF baking and deashing once every two years at a cost of $800 per event. Typically, DPFs are designed to catalytically oxidize the collected PM using the heat generated by the engine's exhaust during normal operation. Such filters are described as passive because they do not require the external addition of heat to burn off the collected PM. School buses however, do not always reach the require operating temperature to light-off the collected PM. Therefore, it was assumed that a DPF installed on a school bus would need to have periodic

baking to achieve temperature to burn off collected PM. DPFs regardless of the vehicles operating cycle will need to have collected ash removed from the filter and disposed of properly.

School districts may choose to purchase a DPF baker to reduce their costs, however that was not considered in this analysis.

DPFs require the use of ultra low sulfur diesel fuel (ULSDF). The incremental cost for the use of ULSDF was not considered since the use of ULSDF is already widespread within California and will be the only diesel fuel available in California in 2007.

CNG

The incremental cost of operating a CNG fueled school bus in comparison to a conventional diesel fueled school bus was set at $0.01 per mile on average based on data from the South Coast Air Quality Management District's Results of School Bus and Infrastructure Survey, Draft White Paper, January 2005 (SQAQMD 2005). This value accounts for fuel cost, vehicle repair cost and the normal cost of maintenance. Some school districts reported per mile costs larger then $0.01 some school districts reported a net savings on a per mile basis. This average value was used in combination with an average annual mileage of 13,666 miles per year to calculate an incremental operational cost of $3416 for CNG school bus operation.

Scenario B

Scenario B is similar to Scenario A in that it assumes that the Low Emission School Bus funding is split between alternative-fueled and diesel fueled bus purchases in a ratio of two-thirds for alternative-fueled and one-third for diesel fueled. This scenario was developed in order to determine the emission benefits and cost effectiveness if the one-third funding for diesel fueled purchases was applied to new diesel school buses equipped with the Cleaire Alliance Longview.

The Cleaire Alliance Longview is a lean NOx catalyst mated with a DPF. The ARB verified the Cleaire Longview system for specific 1993 through 2003 model year diesel engines used with on-road applications operating on ultra low sulfur diesel fuel. Cleaire has expressed an interest to extend this verification to encompass model years 2004 through 2006 diesel engines.

Beginning with the model year 2007 school buses, standard purchase diesel school buses will be equipped with DPFs by the engine manufactures in order to comply with the national 0.01 g PM per bhp-hr emission standard. Consequently, equipping a new diesel bus with the Cleaire would not be applicable. Therefore, in this scenario, similar to Scenario A, the two-thirds one-thirds funding split would only be relevant for model years 2005 and 2006 school buses. Starting in 2007 all of the funding would go toward the purchase of new CNG school buses for this scenario.

It was estimated that in 2005 and 2006 there would be adequate funding for 69 CNG school buses and 25 new diesel school buses retrofitted with the Cleaire Alliance Longview. These funding allocations are shown in Table 7 below. The funding allocation for 2007 through 2009 was assumed to be similar to that given for Scenario One in Table 1 presented previously. Given these assumed allocations, there would be adequate funding for 92 CNG school buses per year.

Table 7 Scenario B: Funding Sources and Allocations for 2005-2006

Funding Source	Projected Annual Funding	Allocation			Assumed State Contribution /bus	Number of buses purchased
		Infrastructure	CNG buses	Diesel Buses w/ Cleaire		
Lower-Emission School Bus (AB 923)	$6.22 mil	10%	90%	--	~$127K	44
	$3.11 mil	--	--	100%	~$123K	25
MSRC	$1.5 mil	0%	100%	0%	$60K	25
Clean Fuels Fund (AB2766)	$325K	100%	--	--	--	N/A
Total	$11.155 mil	--	--	--	--	69 CNG 25 Diesel

The emission reductions assumed for this scenario for new diesel buses with the Cleaire Alliance Longview are a 25 percent reduction in NOx emissions and an 85 percent reduction in PM emissions.

The emission reductions assumed for the new CNG buses are illustrated in Table 2, presented earlier in this appendix.

This scenario used the 13,666 average vehicle miles traveled per year derived from EMFAC2002 and the assumed public school bus lifetime of 25 years.

The cost effectiveness values calculated for Scenario B were determined to be $61,000 per ton of NOx and $390,000 per ton of PM. These cost effectiveness values are based on the assumption that half the costs for the model years 2005 and 2006 vehicles are attributed to NOx reductions and half to PM reductions. All of the costs for the model years 2007 through 2009 vehicles are attributed to NOx reductions.

Table 8 Scenario A: 69 New CNG buses and 27 new Diesel buses w/Cleaire Alliance Longview /yr (05-09): 92 new CNG buses/yr (07-09)

Pollutant	Reductions (tons)	Cost	C/E*
NOx	328	$29.5M	$61,000/ton
PM	13		$390,000/ton

Capital Costs

The capital costs associated with Scenario B were calculated on a per bus basis.

Diesel

Model years 2005 and 2006 new diesel fueled school buses would be retrofitted with the Cleaire Alliance Longview system. The Cleaire Alliance Longview was assumed to cost $19,000 installed. The Longview has a useful life of about 11 years in a typical school bus duty cycle within the South Coast Air Quality Management District. Since the useful life of a school bus has been determined to be 25 years, a second Longview will need to be installed in year 12 or 13 of the bus's life to extend the calculated emission reductions from this device until the end of the school bus's useful life. It was assumed that the replacement Longview would cost $19,000 in 2005 dollars.

CNG

The incremental capital costs for a new CNG bus include the incremental cost of the initial purchase price of the bus, infrastructure required for refueling, maintenance facility upgrades, and replacement of the CNG onboard fuel tanks after 15 years of service.

The incremental cost for the initial purchase price of the CNG school bus was estimated at $31,000 for model years 2005 and 2006, and $29,300 for model years 2007-2009. This difference in capital costs for the CNG school bus takes into account the fact that conventional diesel school buses will become more expensive in model years 2007-2009 in order to comply with the new 2007 federal emission standard for heavy-duty diesel engines.

Since CNG fueled school buses require specialized fueling infrastructure that is more expensive then standard diesel fueling infrastructure it was assumed that $13,000 per bus would be sufficient for fueling system upgrades.

Servicing CNG fueled school buses require upgrades to maintenance facilities that were originally developed to service diesel fueled school buses. It was assumed that $4,000 per bus would provide sufficient funding to upgrade school bus maintenance facilities to allow for routine maintenance to be performed on CNG fueled school buses.

CNG school buses require that the on board natural gas fuel be stored in high pressure gas cylinders. These cylinders have a lifetime of 15 years and after that time they must be replaced. It was assumed that $15,000 would cover the cost of fuel cylinder replacement after 15 years of service. These replacement cylinders were assumed to last for the 10 remaining years of the school buses useful life.

Operational Expenses

Diesel

There is a three percent fuel economy penalty associated with the use of the Longview. EMFAC2002 provides an average fuel economy for diesel fueled school buses within the South Coast Air Quality Management District of 6.46 miles per gallon. The average annual miles travel of 13,666 miles and an average diesel fuel cost of $1.79/gallon were used to determine an incremental cost for this fuel penalty of $114/year.

The Longview requires the use of ultra low diesel fuel (ULSDF). The incremental cost for the use of ULSDF was not considered since the use of ULSDF is already widespread within California and will be the only diesel fuel available in California in 2007.

Since the Cleaire Longview has a lean NOx catalyst coupled with a DPF, normal DPF maintenance must be performed. The lean NOx catalyst alone does not provide temperatures high enough to burn off the collected PM within the DPF. Engine exhaust temperature must be high enough to catalytically oxidize the collected PM. School buses however, do not always reach the require operating temperature to light-off the collected PM. Therefore, it was assumed that a DPF installed on a school bus will need to have periodic baking to achieve temperature to burn off collected PM. DPFs regardless of the vehicles operating cycle will need to have collected ash removed from the filter and disposed of properly. It was assumed that DPF baking and deashing would need to be done once every two years at a cost of $800 per event.

CNG

The incremental cost of operating a CNG fueled school bus in comparison to a conventional diesel fueled school bus was set at $0.01 per mile on average based on data from the South Coast Air Quality Management District's Results of School Bus and Infrastructure Survey, Draft White Paper, January 2005 (SQAQMD 2005). This value accounts for fuel cost, vehicle repair cost and the normal cost of maintenance. Some school districts reported per mile costs larger then $0.01 and some school districts reported a net savings on a per mile basis. This average value was used in combination with an average annual mileage of 13,666 miles per year and a 25 year bus life to calculate a lifetime incremental operational cost of $3417 for CNG school bus operation.

References:

ARB 2003. The Carl Moyer Memorial Air Quality Standards Attainment Program Guidelines (The Carl Moyer Program), September 30, 2003, Air Resources Board. Available at : http://www.arb.ca.gov/msprog/moyer/2003cmpfinal.doc

SCAQMD 2005. Draft White Paper: Results of School Bus and Infrastructure Survey, January 2005. Author: Von Loveland

APPENDIX D

SCAQMD RULE 1195: CLEAN ON-ROAD SCHOOL BUSES

(Adopted April 20, 2001)

RULE 1195. CLEAN ON-ROAD SCHOOL BUSES

(a) Purpose

For public and private fleets of school buses operating in the South Coast Air Quality Management (District), this rule requires, that when adding or replacing school buses in their fleet, public and private school bus fleet operators acquire alternative-fueled school buses when procuring or leasing new school buses or to retrofit used or existing school buses with a California Air Resources Board (CARB) approved control device(s) to reduce air toxic and criteria pollutant emissions.

(b) Applicability

This rule applies to those school bus fleets with 15 or more school buses, operating in the District by public and private entities. This rule shall not apply to vehicles or services pursuant to subdivision (e) or to school bus fleets located outside of the District that transport passengers that reside outside of the District into the District for purposes of field trips or other student-related events.

(c) Definitions

For purposes of this rule, the following definitions shall apply:

(1) ALTERNATIVE-FUELED ENGINE OR SCHOOL BUS means any engine or school bus that uses compressed or liquefied natural gas, propane, methanol, electricity, fuel cells, or other advanced technologies that do not rely on diesel fuel, and has been certified by the CARB.

(2) APPROVED CONTROL DEVICE(S) is an exhaust control device(s) that is verified or certified by CARB to reduce particulate matter and possibly other precursor emissions. For the purposes of this rule, a new school bus equipped with approved control devices means that the engine family has been certified by CARB. A pre-owned school bus equipped with approved control devices means that the device has been verified or certified by CARB. To be considered fitted with an approved control device(s), all diesel

exhaust from the vehicle must be vented through such a device(s) that has been fitted at the time of vehicle purchase or fitted by a certified device installer at the time the device is delivered to the operator. The vehicle equipped with such a control device must use diesel fuel with a sulfur content no greater than 15 ppm by weight.

(3) HEAVY-DUTY VEHICLE means any vehicle having a gross vehicle weight of at least 14,000 pounds.

(4) LOW-EMISSION VEHICLE (LEV) means any vehicle certified to low-emission standards set forth in the "California Exhaust Emission Standards and Test Procedures for 1988-2000 Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles" and "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles," as incorporated by reference in Sections 1960.1(k) and 1961(d), Title 13, California Code of Regulations.

(5) MEDIUM-DUTY VEHICLE means any vehicle having a gross vehicle weight of more than 6,000 pounds and less than 14,000 pounds.

(6) PUBLIC OR PRIVATE SCHOOL BUS FLEET OPERATOR is a person who owns, leases, or operates substantially school buses in the District. A person is any public or private entity responsible for administering and managing school bus transportation services.

(7) REPOWERED SCHOOL BUS means an existing, pre-owned school bus that has been converted to run on an alternative fuel or repowered with a new alternative-fueled engine.

(8) SCHOOL BUS means any vehicle used for the express purpose of transporting students through Grade 12 from home to school as defined in California Vehicle Code Section 545. For the purposes of this rule, a school bus can be a Type A (A-I or A-II), B, C, or D school bus. A Type A or B school bus typically runs on either gasoline or diesel fuel and is considered a medium-duty vehicle. A Type A school bus is a conversion or body constructed upon a van-type or cutaway front-section vehicle with a left side driver's door with a gross vehicle weight rating of more than 10,000 pounds

(Type A-I) or a gross vehicle weight rating less than 10,000 pounds (Type A-II). A Type A school bus is capable of transporting 10 to 24 passengers. A Type B school bus is a conversion or body constructed upon a van or front-section vehicle chassis, or stripped chassis, with a gross vehicle weight rating of more than 10,000 pounds. A Type C school bus is a heavy-duty vehicle with a front mounted engine and is capable of transporting 42 to 72 passengers. A Type D school bus is a heavy-duty vehicle and is capable of transporting 66 or more passengers.

(9) ULTRA-LOW-EMISSION VEHICLE (ULEV) means any vehicle certified to ultra-low-emission standards set forth in the "California Exhaust Emission Standards and Test Procedures for 1988-2000 Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles" and "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles," as incorporated by reference in Sections 1960.1(k) and 1961(d), Title 13, California Code of Regulations.

(10) VEHICLE means any self-propelled, motorized device that is permitted to operate on public roads through Department of Motor Vehicle registration.

(d) Fleet Requirements

Beginning 90 days after adoption of this rule,

(1) For public or private school bus fleet operators with 15 or more school buses, additions or replacement of school buses to an existing fleet, or formation of a new fleet, by a public or private school bus fleet operator shall be by purchase or lease of:

(A) For newly manufactured Type A or B school buses that are considered medium-duty vehicles, certified by CARB as equivalent ULEV or cleaner non-diesel powered school buses, when adding or replacing vehicles to their vehicle fleet.

(B) For newly manufactured Type B, C or D school buses that are considered heavy-duty vehicles, alternative-fueled school buses, when adding or replacing school buses to

their vehicle fleet.

(C) For existing, pre-owned Type A or B school buses that are considered medium-duty vehicles, certified by CARB as equivalent LEV or cleaner non-diesel powered school buses, when adding or replacing vehicles to their vehicle fleet.

(D) For existing, pre-owned Types B, C or D school buses that are considered heavy-duty vehicles, repowered school buses or alternative-fueled school bus, when adding or replacing school buses to their vehicle fleet.

(2) Public or private school bus fleet operators with 15 or more but less than 50 school buses may begin compliance with the provisions of Paragraph (d)(1):

(A) Beginning July 1, 2002 if the operator equips 25 percent of the school buses in the existing fleet with approved control devices no later than March 1, 2002. The diesel-powered school bus must be equipped with an approved control device if the school bus relies on diesel fuel. The school bus fleet operator may apply for external funding if available, to cover the cost to equip the school bus.

(B) Beginning July 1, 2003 if the operator equips an additional 25 percent of the school buses in the existing fleet with approved control devices no later than January 1, 2003. The diesel-powered school bus must be equipped with an approved control device if the school bus relies on diesel fuel. The school bus fleet operator may apply for external funding if available, to cover the cost to equip the school bus.

(e) Exemptions

The provisions of this rule shall not apply to the following:

(1) A public or private school bus fleet operator may purchase a Type A or B school bus that is not certified by CARB as ULEV or cleaner; or a Type C or D school bus that is not an alternative-fueled school bus as required under subdivision (d) of this rule, if sufficient grant funding or external sources of funding beyond that of the school bus fleet operator's fiscal budget is not available to

fully offset the differential purchase cost (including costs of warranties comparable to base warranties provided with a comparable diesel purchase) of an alternative-fueled school bus that complies with subdivision (d) compared to the cost of a new [or, pre-existing if the purchase is considered under subparagraphs (d)(1)(C) or (d)(1)(D)] diesel-powered school bus equipped with an approved control device. The operator shall purchase an "intermediate diesel school bus" as defined in the latest version of the Statewide Lower-Emission School Bus Program (adopted by CARB December 2000) if funding is available for such a purchase. The intermediate diesel school bus must be certified by CARB as part of the Statewide Lower-Emission School Bus Program. If funding is not available, the operator shall consider the viability of a gasoline-powered school bus and demonstrate to the Executive Officer by submitting supporting documentation as to the reasons for the need to purchase a diesel-powered school bus if the diesel-powered school bus is the final choice. A demonstration of need may be based upon safety of fuel usage, additional cost to deploy a gasoline refueling infrastructure, commercial unavailability, or other similar reasons. The diesel-powered school bus must be equipped with an approved control device if external funding beyond the school bus fleet operator's financial budget is made available. In addition, to the extent external funding is available to equip existing diesel-powered school buses with approved control device, the operator shall equip at a minimum 15 percent of the existing diesel school buses with approved control devices on a yearly basis until the entire fleet of existing diesel-powered school buses that are capable of operating with approved control devices are equipped with such devices.

(2) Notwithstanding subparagraph (e)(1) and prior to January 1, 2004, if a public or private school bus fleet operator does not receive external funding (beyond the school bus fleet operator's financial budget) of at least $13,000 until April 1, 2003, and then $8,000 per alternative-fuel school bus purchased to build a new alternative-fuel refueling station and to upgrade an existing maintenance facility to required standards to handle alternative-fueled school

buses, the school bus fleet operator may purchase a diesel-powered school bus. For the purpose of this provision, any external funding other than funds to cover the incremental cost of the purchase of the alternative-fueled school bus offered by a publicly-funded incentives program, shall be considered to be available to cover the cost of a new alternative-fuel refueling station. If the school bus is diesel powered, the school bus shall be equipped with an approved control device if external funding beyond the school bus fleet operator's financial budget is made available. In addition, to the extent external funding is available to equip existing diesel-powered school buses with approved control device, the operator shall equip at a minimum 15 percent of the existing diesel school buses with approved control devices on a yearly basis until the entire fleet of existing diesel-powered school buses that are capable of operating with approved control devices are equipped with such devices.

(3) Upon demonstration to the Executive Officer that an alternative-fueled or gasoline-powered engine/chassis/body configuration is not commercially available in a specific bus size or could be used on a specific fixed bus route, a diesel-powered school bus equipped with an approved control device may be purchased in that specific bus size or as needed for the specific fixed bus route.

(4) A public or private school bus fleet operator may purchase a pre-owned school bus that does not meet the requirements of subdivision (d) if the oldest school bus in the operator's existing school bus fleet is scrapped or otherwise removed permanently from operation. The pre-owned school bus must be less than six (6) years old at the date of purchase. The pre-owned school bus shall be equipped with an approved control device at the expense of the school bus fleet operator. However, the school bus fleet operator may apply for external funding to offset any additional costs if such funding is available.

(5) If during the year that school is in session, a public or private school bus fleet operator needs additional school buses due to unforeseen circumstances to operate during that school year, the operator may lease the needed quantity of school buses that do

not comply with the provisions of subdivision (d) for the months necessary to purchase or lease school buses compliant to subdivision (d), not to exceed the remaining portion of the school year, if a demonstration is made that the rule-compliant school bus cannot be deployed by the school bus fleet operator within one month from the date of order.

(6) For purposes of this rule, a private school bus fleet operator is not deemed to have purchased, leased, added to, or formed a new fleet if the private school bus fleet operator, as part of a purchase or merger with another private school bus fleet operator that provides contracted school bus transportation services, transfers ownership of school buses that are already operating in the District at the time of the purchase or merger.

(7) Contract agreements signed prior to the date of adoption of this rule for the purchase or lease of school buses. The operator should consider equipping the diesel-powered school buses purchased under this provision with approved control devices to the extent that external funding is available for the approved control device. This provision shall not apply to unsigned options to be executed at a future date under the contract agreement.

(8) Prior to January 1, 2003 and upon demonstration to the Executive Officer that an alternative-fuel refueling station for alternative-fueled school buses is not available within five miles of the vehicle storage or maintenance yards and the public or private school bus fleet operator has not received external funding (beyond the school bus fleet operator's fiscal budget) of at least $13,000 per alternative-fueled school bus purchased to build a new alternative-fuel refueling station, a public or private school bus fleet operator may purchase or lease school buses that are not alternative-fueled school buses as required under subdivision (d) if this rule. The operator shall purchase an "intermediate diesel school bus" as defined in the latest version of the Statewide Lower-Emission School Bus Program (adopted by CARB December 2000) if funding is available for such a purchase. The intermediate diesel school bus must be certified by CARB as part of the Statewide Lower-Emission School Bus Program. If funding is not available,

the operator shall consider the viability of a gasoline-powered school bus and demonstrate to the Executive Officer by submitting supporting documentation as to the reasons for the need to purchase a diesel-powered school bus if the diesel-powered school bus is the final choice. A demonstration of need may be based upon safety of fuel usage, additional cost to deploy a gasoline refueling infrastructure, commercial unavailability, or other similar reasons. The diesel-powered school bus must be equipped with an approved control device if the school bus relies on diesel fuel.

(9) For the purpose of transporting passengers on field trips outside of the jurisdiction of the District and when the remainder of the fleet consists of school buses that meet the requirements of subdivision (d), no more than 10 percent of the school buses for school bus fleets of 100 or more, or five (5) school buses for school bus fleets with 50 or less school buses or ten (10) school buses for school bus fleets with between 51 and 100 school buses, that do not meet the requirements of Subdivision (d) of this rule may be part of the fleet at any given time. Such vehicles shall be equipped with approved control devices if the vehicles are diesel-powered and external funding is available.

(f) Compliance Auditing and Enforcement

(1) The fleet operator shall provide at the request of the District any files and/or records created to comply with subdivision (d) including fleet-specific information, such as a list of official Department of Motor Vehicles registrations, principal vehicle location, and manufacturer, model-year, model, and fuel type of each fleet vehicle. This provision shall not apply for records that have been in existence for more than one (1) year.

(2) Any fleet operator seeking an exemption under subdivision (e) shall supply proof that their vehicle or fleet is exempted from this rule when requested by the District.

(3) Any fleet operator seeking an exemption under those portions of subdivision (e) that pertain to external funding availability shall apply for external funding or to external funding sources, identified annually by and with the assistance of the Executive Officer and

demonstrate that funding is not available prior to the purchase or lease of school buses as allowed under subdivision (e).

(4) Circumvention of this rule is prohibited, including artificially creating fleets under common ownership of smaller than 15 vehicles, without sufficient business justification.

(g) Severability

If any provision of this rule is held by judicial order to be invalid, or invalid or inapplicable to any person or circumstance, such order shall not affect the validity of the remainder of this rule, or the validity or applicability of such provision to other persons or circumstances. In the event any of the exceptions to this rule is held by judicial order to be invalid, the persons or circumstances covered by the exception shall instead be required to comply with the remainder of this rule.

TITLE 13. CALIFORNIA AIR RESOURCES BOARD

NOTICE OF PUBLIC HEARING TO CONSIDER PROPOSED AMENDMENTS TO THE DIESEL PARTICULATE CONTROL MEASURE FOR ON-ROAD HEAVY-DUTY RESIDENTIAL AND COMMERCIAL SOLID WASTE COLLECTION VEHICLES: FLEET RULE FOR THE SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

The Air Resources Board (ARB or Board) will conduct a public hearing at the time and place noted below to consider amendments to the Diesel Particulate Control Measure for On-Road Heavy-Duty Residential and Commercial Solid Waste Collection Vehicles regulations. The proposed amendments would require owners of solid waste collection vehicles (collection vehicles) that operate in the South Coast Air Quality Management District (SCAQMD or District) to purchase low emission technology when purchasing or leasing collection vehicles, provided that compliant technology is commercially available at the time of purchase.

DATE:	September 15-16, 2005
TIME:	9:00 a.m.
PLACE:	South Coast Air Quality Management District Auditorium 21865 E. Copley Drive Diamond Bar, California 91765

This item will be considered at a two-day meeting of the Board, which will commence at 9:00 a.m., September 15, 2005, and may continue at 8:30 a.m., September 16, 2005. This item may not be considered until September 16, 2005. Please consult the agenda for the meeting, which will be available at least 10 days before September 15, 2005, to determine the day on which this item will be considered.

If you have a disability-related accommodation need, please go to http://www.arb.ca.gov/html/ada/ada.htm for assistance or contact the ADA Coordinator at (916) 323-4916. If you are a person who needs assistance in a language other than English, please contact the Bilingual Coordinator at (916) 324-5049. 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 amendment to title 13, California Code of Regulations, section 2021.2.

Background: The Air Resources Board (ARB or Board) is the state agency responsible for protecting public health and the environment from the harmful effects of air pollution. The ARB has the sole responsibility for controlling emissions from vehicular sources, except as otherwise provided by law.

The SCAQMD is the sole and exclusive local agency within the South Coast Air Basin and the desert portion of Riverside County in the Salton Sea Air Basin with responsibility for comprehensive air pollution control. The South Coast Air Basin has been designated as a serious nonattainment area for particulate matter (PM) and an extreme nonattainment area for ozone. In 1987, the Legislature enacted Health and Safety Code section 40447.5, which authorizes SCAQMD to adopt regulations that require operators of 15 or more public and commercial fleet vehicles, when adding or replacing vehicles, to purchase vehicles that are capable of operating on methanol or other equivalently clean-burning alternative fuel.

Under its Clean Fleets program, SCAQMD adopted seven fleet rules during the years 2000 and 2001. These rules were developed to gradually shift public agencies and certain private entities to lower emissions by requiring them to acquire alternative fuel vehicles whenever an operator with 15 or more vehicles purchased or leased vehicles for replacement or addition to its fleet. One of these seven rules is Rule 1193 concerning solid waste collection vehicles.

Shortly after the District adopted its fleet rules, the Engine Manufacturers (EMA) and the Western States Petroleum Association (WSPA) sued the District in federal court challenging its authority to adopt the rules. In April 2004, the United States Supreme Court ruled that it appears likely that at least certain aspects of the fleet rules were preempted by section 209(b) of the federal Clean Air Act. The Supreme Court remanded the case back to the federal District Court to determine whether some parts of the fleet rules could be characterized as state purchasing decisions and, if so, whether preemption applied. In response to this decision, SCAQMD requested that ARB submit the District's rules to the United States Environmental Protection Agency (U.S. EPA) for a waiver of preemption pursuant to section 209(b) of the Clean Air Act. The ARB requested public comment and consulted with U.S. EPA regarding the legal requirements for obtaining a waiver for a rule adopted by a local government. The ARB staff concluded that the fleet rules, as written and adopted by SCAQMD, would not receive a section 209(b) waiver because these rules have not been adopted by ARB as state regulations (applicable within the boundaries of SCAQMD).

When the State Legislature adopted Health and Safety Code section 40447.5, it intend that SCAQMD have the authority to adopt and implement clean fuel fleet rules. Accordingly, ARB staff has reviewed the information and prepared the present proposal, which through the state rulemaking process, is meant to support the intent of the State Legislature.

Meanwhile, on May 5, 2005, the federal District Court ruled that, under the "market participant" doctrine, the SCAQMD fleet rules are not preempted to the extent they

apply to purchasing decisions made by state and local governmental entities. However, the District Court has not yet addressed questions of whether the fleet rules are preempted as they apply to private entities under contract with state or local governments or to used or leased vehicles. It is also possible that EMA or WSPA could appeal the "market participant" decision.

Proposed Amendments: If adopted by the Board, the proposed amendments would require all owners of solid waste collection vehicles operating in the SCAQMD, whether owned or operated by public agencies or private companies, to purchase the lowest emitting trucks available. Staff projects that the lowest emitting trucks will operate on alternative-fuel (most likely natural gas) through the 2009 model year. For 2010 and subsequent model years, staff projects emissions from diesel and natural gas vehicles to be equivalent.

The amendments to ARB's existing solid waste collection vehicle regulations would insert specific purchasing requirements based on a performance standard of 0.20 grams per brake horsepower-hour (g/bhp-hr) for oxides of nitrogen (NOx) and 0.01 g/bhp-hr for particulate matter (PM). The performance standard could be met by a new engine as certified or a new engine plus a verified emission control system. In developing this proposal, staff has worked to obtain current, objective information on the challenges, cost-effectiveness, and emission benefits from the various technology options.

Staff expects a small positive impact on emissions from solid waste collection vehicles as a result of this proposal. Reductions in NOx will be about 0.3 tons per day, on average, over the 15-year life of the rule. The cumulative NOx reduction through the year 2020 amounts to about 1,590 tons, or about four percent of the total NOx emissions from SCAQMD collection vehicles from 2006 to 2020. Staff expects only a very small reduction in PM emissions attributable to the regulations, as PM emissions from all heavy-duty diesel and alternative-fuel engines are required to be the same from the 2007 model year onward.

COMPARABLE FEDERAL REGULATIONS

Although U.S. EPA sets emission standards for diesel and gasoline engines, U.S. EPA does not separately regulate solid waste collection vehicles or their engines. Federal emission standards for engines are codified in title 40, Code of Federal Regulations, part 86.

AVAILABILITY OF DOCUMENTS AND AGENCY CONTACT PERSONS

The Board staff has prepared a Staff Report: Initial Statement of Reasons (ISOR) for the proposed regulatory action, which includes a summary of the economic and environmental impacts of the proposal. The staff has also prepared a technical support document (TSD) that summarizes technology available and feasible for compliance with the proposal.

Copies of the staff ISOR, TSD, and the full text of the proposed regulatory language, in underline and strikeout format to allow for comparison with the existing regulations, may be accessed on the ARB's website 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 September 15, 2005.

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 ARB's website listed below.

Inquiries concerning the substance of the proposed regulations may be directed to the designated agency contact persons, Mr. Richard Varenchik by email at rvarench@arb.ca.gov or by phone at (626) 575-6730, or to Ms. Annette Hebert by email at ahebert@arb.ca.gov or by phone at (626) 575-6973.

Further, the agency representative and designated back-up contact persons to who nonsubstantive inquiries concerning the proposed administrative action may be directed are Ms. Artavia Edwards, Manager, Board Administration & Regulatory Coordination Unit, (916) 322-6070, or Ms. Alexa Malik, Regulations Coordinator, (916) 322-4011. 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 contact persons.

This notice, the ISOR, and all subsequent regulatory documents, including the FSOR, when completed, are available on the ARB Internet site for this rulemaking at http://www.arb.ca.gov/regact/scswcv05/scswcv05.htm.

COSTS TO PUBLIC AGENCIES AND TO BUSINESSES AND PERSONS AFFECTED

The determinations of the Board's 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 create costs or savings to a state agency, but not in federal funding to the state, and will create costs or a mandate to a local agency or school district which is 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. The proposed action may result in costs to local agencies operating collection vehicles, but those costs are expected to be recovered through appropriate fare increases.

In developing this regulatory proposal, ARB staff evaluated the potential economic impacts on representative private persons or businesses. Staff estimates that the total additional cost owners would incur by complying with the proposal would range from $31.6 million to $82.7 million over 15 years (2006 through 2020). The high cost estimate assumes the purchase of alternative-fuel (liquefied natural gas) trucks, and includes differential costs for the vehicle, operations and maintenance, and new fueling stations. Of the $82.7 million, about $56 million (or about two thirds) comes from additional capital costs, while the remaining $27 million comes from additional operations and maintenance costs. The ARB estimates the total cost per household, over the 2006 to 2020 timeframe, would be approximately $15 dollars, or $1 dollar annually.

The Executive Officer has made an initial determination that the proposed regulatory action will not have a significant statewide adverse economic impact directly affecting businesses, including the ability of California businesses to compete with businesses in other states, or on representative private persons. The proposed requirements could have a positive impact on manufacturers and distributors of alternative-fuel engines, alternative-fuel vehicle components, alternative fuels and fueling stations, and diesel emission control systems. The proposed amendments apply equally to all owners of solid waste collection vehicles that operate within SCAQMD regardless of where their companies are based.

In accordance with Government Code section 11346.3, the Executive Officer has determined that the proposed regulatory action may affect the creation or elimination of jobs within the State of California, the creation of new businesses or elimination of existing businesses within the State of California, or the expansion of businesses currently doing business within the State of California. Staff expects that the proposed regulations would result in the expanded use of alternative fuels, related technologies, and diesel emission control systems. To meet increased demand for these products, there would likely be job creation. A detailed assessment of the economic impacts of the proposed regulatory action can be found in the ISOR.

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

Before taking final action on the proposed regulatory action, the Board must determine that no reasonable alternative considered by the board or that has otherwise been identified and brought to the attention of the Board 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.

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

no later than 12:00 noon, September 14, 2005, 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: scswcv05@listserv.arb.ca.gov, and received at ARB **no later than 12:00 noon, September 14, 2005.**

Facsimile transmissions are to be transmitted to the Clerk of the Board at (916) 322-3928 and received at ARB **no later than 12:00 noon, September 14, 2005.**

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 Board encourages members of the public to bring to the attention of 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, and 39658, Health and Safety Code. This action is proposed to implement, interpret and make specific sections 39002, 39003, 39650 through 39675, 43000, 43013, 43018, 43101, 43102, 43104, 43105, and 43700, Health and Safety Code.

HEARING PROCEDURES

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 ARB's 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: July 19, 2005

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.

State of California

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

AIR RESOURCES BOARD

STAFF REPORT: INITIAL STATEMENT OF REASONS

PROPOSED AMENDMENTS TO THE DIESEL PARTICULATE CONTROL MEASURE FOR ON-ROAD HEAVY-DUTY RESIDENTIAL AND COMMERCIAL SOLID WASTE COLLECTION VEHICLES:

FLEET RULE FOR THE SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

Date of Release: July 29, 2005
Scheduled for Consideration: September 15-16, 2005

This report has been reviewed by the staff of the Air Resources Board and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Air Resources Board, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

State of California

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

AIR RESOURCES BOARD

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AIR QUALITY MANAGEMENT DISTRICT

July 29, 2005

TABLE OF CONTENTS

EXECUTIVE SUMMARY 1
I. INTRODUCTION 4
A. Background for this Rule Proposal 4
1. ARB's Statewide Solid Waste Collection Vehicle Rule 5
2. SCAQMD Rule 1193 5
3. Legal Challenge to the District Fleet Rules 6
4. Proposed Amendments 7
B. ARB Regulatory Authority 7
C. Current Regulations and Voluntary Programs 8
1. Federal Regulations 8
a. Current Standards 9
b. New Engine Standards for 2007 and Beyond 9
2. California Regulations 10
a. New Heavy-Duty Engine Requirements 10
b. In-Use Heavy-Duty Engine Requirements 10
3. Local Regulations 11
a. General Air District Authority Over Mobile Sources 11
b. Specific South Coast Air Quality Management District Authority Over Mobile Sources 12
4. Voluntary and Incentive Programs 12
a. Federal Incentives 13
b. State Incentives 13
c. Local Funding 14
II. PUBLIC OUTREACH 15
A. Environmental Justice 15
B. Outreach Efforts 16
1. South Coast Fleet Rules 16
2. South Coast Collection Vehicle Proposal 17
III. NEED FOR EMISSION REDUCTIONS 18
A. Ozone 18
B. Particulate Matter (PM) 18
IV. NEED FOR MODIFICATIONS 19
A. Air Quality In The South Coast District: 20
B. Comparison of Rule 1193 to ARB's Solid Waste Collection Vehicle Rule 20
V. INVENTORY OF SOLID WASTE COLLECTION VEHICLES AND EMISSIONS 20
A. Engine Inventory 21
B. Emission Inventory 21
VI. SUMMARY OF PROPOSED CONTROL MEASURE 22
A. Options for Compliance 22
B. Purchase Requirements 22
C. Exemptions 23
VII. ENGINE AVAILABILITY & TECHNOLOGICAL FEASIBILITY 23
A. Current Engine Availability 24
B. 2007 to 2009 Engine Availability 24

a. Diesel-fueled Engines 25
b. Alternative-fuel Engines 26
C. Long Term Engine Availability (2010 and beyond) 27
D. Alternative Fuel Experiences by End-Users 29
E. Diesel Emission Control Systems for Collection Vehicles 30
1. Lean NOx Catalyst 30
2. Selective Catalytic Reduction 31
VIII. REGULATORY ALTERNATIVES (No Alternative Recommended) 31
A. Do Not Adopt This Regulation 31
B. Rely On Voluntary Compliance 31
C. Adopt a NOx level of 0.9 g/bhp-hr for 2007-2009 purchases 32
IX. ECONOMIC IMPACT 33
A. Legal Requirement 33
B. Affected Businesses 33
C. Estimated Costs to Public and Private Collection Vehicle Owners 34
D. Potential Impact on Other Businesses 35
E. Potential Impact on Business Competitiveness 35
F. Potential Impact on Employment 36
G. Potential Impact on Business Creation, Elimination or Expansion 36
H. Potential Cost to Local and State Agencies 36
I. Cost to the Average Household Receiving Waste Collection Service 37
X. ENVIRONMENTAL IMPACTS AND COST EFFECTIVENESS 38
A. Benefits Within the South Coast Air Quality Management District 38
B. Cost-Effectiveness of Proposal 39
C. Potential Negative Impacts 39
1. Toxics from Diesel and Alternative Fuel Engines 39
2. Ammonia Slip from Selective Catalytic Reduction 40
XI. ISSUES 41
A. Proposal is a De Facto Alternative-Fuel Standard 41
B. Issues Related to Federal Clean Air Act Waiver of Preemption 42
C. Waiver Process Will Delay Rule Implementation and Reduce Benefits Achieved 44
XII. STAFF RECOMMENDATION 44
XIII. REFERENCES 45
XIV. AVAILABILITY OF TECHNICAL SUPPORT DOCUMENT 45

TABLES

Table 1. Federal Emission Standards for New Heavy-Duty Trucks 8
Table 2. California Optional, Low NOx Emission Standards for New Heavy-Duty Trucks and Urban Buses 10
Table 3. SCAQMD Collection Vehicle Emissions Inventory (tons/day) 21
Table 4. MY 2005 Certified Alternative-Fuel Engines for Collection Vehicles 24
Table 5. Estimated Cost of Compliance with Proposal 35
Table 6. Estimated Cost to Public Fleets 37
Table 7. Collection Vehicle NOx Emissions and Reductions - SCAQMD 38
Table 8. Emission Comparison - Diesel Truck vs Natural Gas Truck 40

APPENDICES

APPENDIX A: PROPOSED REGULATORY LANGUAGE
APPENDIX B: ENGINE AND EMISSIONS INVENTORY
APPENDIX C: SOLID WASTE COLLECTION COMPANY SURVEY
APPENDIX D: COST ANALYSIS METHODOLOGY

EXECUTIVE SUMMARY

The Air Resources Board (ARB) is the state agency responsible for protecting public health and the environment from the harmful effects of air pollution. The ARB has the sole responsibility for controlling emissions from vehicular sources except as provided by law. The ARB oversees all air pollution control efforts in California, including the activities of 35 independent local air districts, and works in cooperation with the districts and the U.S. Environmental Protection Agency (U.S. EPA) on strategies to attain state and federal ambient air quality standards and to reduce air toxic emissions. The ARB has the sole responsibility for controlling emissions from vehicular sources, except as otherwise provided by law.

The SCAQMD is the sole and exclusive local agency within the South Coast Air Basin and the desert portion of Riverside County in the Salton Sea Air Basin with responsibility for comprehensive air pollution control. The South Coast Air Basin has been designated as a serious nonattainment area for particulate matter (PM) and a severe nonattainment area for ozone. In 1987, the Legislature enacted Health and Safety Code section 40447.5, which authorizes SCAQMD to adopt regulations that require operators of 15 or more public and commercial fleet vehicles, when adding or replacing vehicles, to purchase vehicles that are capable of operating on methanol or other equivalently clean-burning alternative fuel.

Under its Clean Fleets program, the SCAQMD adopted seven fleet rules during 2000 and 2001. These rules were developed to gradually shift public agencies and certain private entities to lower emissions by requiring them to acquire alternative fuel vehicles whenever an operator with 15 or more vehicles purchased or leased vehicles for replacement or addition to its fleet. One of these seven rules is Rule 1193 which addresses solid waste collection vehicles.

Shortly after the District adopted its fleet rules, the Engine Manufacturers (EMA) and the Western States Petroleum Association (WSPA) sued the District in federal court challenging its authority to adopt the rules. In April 2004, the United States Supreme Court ruled that it appears likely that at least certain aspects of the fleet rules were preempted by section 209(b) of the federal Clean Air Act. The Supreme Court remanded the case back to the federal District Court to determine whether some parts of the fleet rules could be characterized as state purchasing decisions and, if so, whether preemption applied. In response to this decision, SCAQMD requested that ARB submit the District's rules to the United States Environmental Protection Agency (U.S. EPA) for a waiver of preemption pursuant to section 209(b) of the Clean Air Act. The ARB requested public comment and consulted with U.S. EPA regarding the legal requirements for obtaining a waiver for a rule adopted by a local government. The ARB staff concluded that the fleet rules, as written and adopted by SCAQMD, would not receive a section 209(b) waiver because these rules have not been adopted by ARB as state regulations (applicable within the boundaries of SCAQMD).

When the State Legislature adopted Health and Safety Code section 40447.5, it intend that SCAQMD have the authority to adopt and implement clean fuel fleet rules. Accordingly, ARB staff has reviewed the information and prepared the present proposal, which through the state rulemaking process, is meant to support the intent of the State Legislature.

Meanwhile, on May 5, 2005, the federal District Court ruled that, under the "market participant" doctrine, the SCAQMD fleet rules are not preempted to the extent they apply to purchasing decisions made by state and local governmental entities. However, the District Court has not yet addressed questions of whether the fleet rules are preempted as they apply to private entities under contract with state or local governments or to used or leased vehicles. It is also possible that EMA or WSPA could appeal the "market participant" decision.

If adopted by the Board, the regulation proposed in this rulemaking would require all owners of solid waste collection vehicles operating in the District, whether owned or operated by public agencies or private companies, to purchase the lowest emitting trucks available. Staff projects that the lowest emitting trucks will be alternative-fueled, most likely natural gas, through the 2009 model year. Subsequently, staff projects emissions from diesel and natural gas vehicles will be equivalent.

The proposal would amend ARB's existing solid waste collection vehicle rule to include a specific purchasing requirement, for SCAQMD jurisdiction only, based on a performance standard of 0.20 grams per brake horsepower-hour (g/bhp-hr) NOx and 0.01 g/bhp-hr PM. The performance standard could be met by a new engine as certified or a new engine plus a verified emission control system. In developing this proposal, staff has worked to obtain current, objective information on the challenges, cost-effectiveness, and emission benefits from the various technology options.

Staff expects a small emissions benefit from this proposal. NOx reductions will be about 0.3 tons per day over the 15-year life of the regulation. The cumulative NOx reduction through the year 2020 amounts to about 1,590 tons, or about 4 percent of the total NOx emissions from District collection vehicles from 2006 to 2020. Staff expects only a very small reduction in PM emissions attributable to this rule, as PM emissions from all new heavy-duty diesel and alternative-fuel engines are required to be the same from the 2007 model year onward.

The cost of the proposal to the District's public and private waste collection vehicle owners through 2020 is approximately $83 million, based on the use of liquefied natural gas engines for compliance. The cost effectiveness of the rule will be $52,000 per ton NOx, which is less favorable than other recently adopted state rules. Reductions in PM are negligible, thus staff did not calculate cost effectiveness for PM. Staff expects there will be benefits to those businesses that manufacture natural gas engines and that sell natural gas.

The proposed amendments, as described herein, are consistent with the authority of ARB to control emissions from mobile sources. The proposed amendments to title 13, CCR, section 2021.2, adding subsection 2021.2 (g), are set forth in the proposed Regulation Order in Appendix A. Information on how to access the Technical Support Document for this rule making can be found at the end of this report.

I. INTRODUCTION

The Air Resources Board (ARB or Board) seeks to provide clean, healthful air to the residents of California. The ARB is the state agency responsible for protecting public health and the environment from the harmful effects of air pollution. The ARB oversees all air pollution control efforts in California, including the activities of 35 independent local air districts, and works in cooperation with the districts and the U.S. Environmental Protection Agency (U.S. EPA) on strategies to attain State and federal ambient air quality standards and to reduce air toxic emissions.

The South Coast Air Quality Management District (SCAQMD or District) is the local governmental agency primarily responsible for air quality assessment and improvement in the South Coast Air Basin and the desert portion of Riverside County in the Salton Sea Air Basin. The South Coast Air Basin, which includes Orange County and the non-desert portions of Los Angeles, Riverside and San Bernardino Counties. The district is designated as a serious nonattainment area for particulate matter (PM10 - particulate matter under 10 microns) and is severe nonattainment area for the eight hour ozone standard. The Coachella Valley, located in the desert portion of Riverside County, is classified as a serious nonattainment area for PM10 and a moderate nonattainment area for ozone.

A. Background for this Rule Proposal

The collection of waste materials obviously has important societal benefits. Indeed, waste collection could be considered one of this nation's first environmental industries, critical to healthy conditions in any area where people gather to live, work, and play. Most waste collection trucks run on diesel fuel, however, and are sources of polluting engine exhaust emissions. Waste collection trucks contribute to these emissions by making multiple runs through California's residential and business communities on trash collection days.

Emissions from diesel trucks that contribute to air pollution include oxides of nitrogen (NOx), particulate matter (PM), carbon monoxide (CO), and hydrocarbons (HC). NOx and PM are the primary emissions of concern from diesel engines. NOx and HC contribute to the atmospheric formation of ozone and fine particles. CO is a colorless, odorless gas that reduces the ability of the body to transport oxygen to cells. Diesel PM is a toxic air contaminant – a cancer-causing pollutant that also has significant short- and long-term negative cardiovascular impacts.

Following the identification of diesel PM as a toxic air contaminant, ARB staff developed comprehensive strategies for reducing diesel PM. The result was the "Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles" (Diesel Risk Reduction Plan, or DRRP), which was approved by the Board in September 2000 (ARB 2000b). This plan directs staff to develop measures to reduce

diesel PM emissions from new and in-use diesel-fueled engines and vehicles. Consistent with the plan, the Board has adopted more stringent emission standards for new diesel engines and has required cleaner diesel fuel. The Board has also begun adopting rules requiring the retrofit or modernization of existing diesel engines used in on-road and off-road vehicles and equipment, and stationary engines.

1. ARB's Statewide Solid Waste Collection Vehicle Rule

On September 25, 2003, the Board adopted a measure to reduce diesel PM emissions from on-road heavy-duty residential and commercial solid waste collection vehicles. This rule requires owners to achieve significant PM reduction from their existing in-use trucks that collect solid waste for a fee. Owners are required to apply best available control technology (BACT) to their collection trucks by specified implementation dates. The implementation is phased-in from 2004 through 2010 in groups determined by the age of the engines (engine model years) in each group.

BACT used in the implementation process is defined as one of the following:

- A new diesel engine certified to a 0.01 g/bhp-hr PM standard;
- An existing diesel engine retrofitted with the highest level (most effective) ARB-verified PM control device; and
- An alternative-fuel engine, such as compressed or liquefied natural gas

Owners were required to begin implementation by December 31, 2004, through application of BACT to 10 percent of their 1988 through 2002 model year (MY) engines. Staff will present an update on the progress of implementation to the Board in late 2005.

2. SCAQMD Rule 1193

Under its Clean Fleets Program, the District adopted seven fleet rules during 2000 and 2001 with the goal of gradually shifting public agencies and certain private entities to lower emission and alternative-fuel vehicles whenever a fleet operator purchases or leases a vehicle for replacement or addition to a fleet. The District adopted these rules under its legislative authority [Health & Safety Code (HSC) section 40447.5(a)], which authorizes the district to regulate public and certain commercial operators of fleets of 15 or more vehicles. The adopted rules apply to transit buses, school buses, solid waste collection vehicles, airport shuttles and taxis, street sweepers, light- and medium-duty publicly-owned vehicles, and heavy-duty publicly-owned vehicles.

One of these rules, Rule 1193 - Clean On-Road Residential and Commercial Refuse Vehicles - applies to the trucks that collect trash from the homes and businesses within the District. Rule 1193 requires an owner of 15 or more waste collection vehicles, including transfer trucks, to acquire only alternative-fuel vehicles when adding additional vehicles to a fleet. District regulations define "alternative fuel" as a heavy-duty vehicle or engine that uses compressed or liquefied natural gas, liquefied petroleum gas,

methanol, electricity, fuel cells, or other advanced technologies that do not rely on diesel fuel. The most commercially available alternative is natural gas.

The rule includes exemption provisions for owners to purchase diesel vehicles if appropriate alternative-fuel vehicles or engines are not available. In addition, the rule provided a limited window of opportunity, the provision sunset on June 30, 2004, for owners to purchase dual-fuel refuse trucks provided that other vehicles were retrofitted with particulate filters. Dual-fuel trucks can operate on both diesel fuel and natural gas.

Implementation of Rule 1193 began on July 1, 2001 for waste collection fleets of 50 or more, and for fleets of 15 or more on July 1, 2002. The District estimates that Rule 1193, as of February 2005, had resulted in the purchase of approximately 1,100 alternative-fuel collection vehicles. By that same date, the District reported receiving exemption requests for 335 diesel vehicles and granting exemptions for the purchase of 241 diesel vehicles.

Of those granted exemptions, 111 were for large, heavy transfer trucks for which no suitable alternative-fuel engine existed, while 130 were for standard curbside collection vehicles and other smaller vehicles. Most of the curbside collection vehicles granted an exemption were for the City of Los Angeles. Los Angeles requested permission to purchase 120 diesel curbside collection vehicles because no suitable alternative-fuel engines meeting the cities bid specifications (11 liter) were available. The District authorized an exemption for 116 diesel vehicles because one manufacturer had offered four alternative-fuel collection vehicles to the City at that power range (SCAQMD 2005).

3. Legal Challenge to the District Fleet Rules

Shortly after the District adopted its fleet rules, the Engine Manufacturers Association and the Western States Petroleum Association sued the District regarding its authority to adopt these rules. On April 28, 2004, the United States Supreme Court ruled that it appears likely that at least certain aspects of the fleet rules adopted by the District were federally preempted and returned the case to the federal district court for further proceedings consistent with its decision. In response to this decision, the District requested that ARB submit the District's rules to EPA for a waiver of preemption pursuant to section 209(b) of the Clean Air Act. On October 1, 2004, ARB requested public comment on the District's request. The ARB staff completed a thorough review of the comments submitted in response to the notice, and consulted with U.S. EPA regarding the legal requirements for obtaining a waiver of a rule adopted by a local government.

Based on ARB's review, staff concluded that these fleet rules, as written and adopted by the District, might not receive a Section 209(b) waiver because these rules have not been adopted by the ARB as state regulations (applicable in the South Coast). For this reason, staff has developed this proposed state rule so that all solid waste collection vehicles will remain subject to purchase requirements similar to those specified by the

District Rule 1193. This process requires a new public record that updates relevant information on the effectiveness and costs of these rules.

Meanwhile the federal district court has continued its proceedings on the District rules. On May 5, 2005, the federal district court ruled that the District's authority is not preempted under the market participant doctrine for the aspects of the District fleet rules that relate to purchasing decisions made by state and local governments. The order, however, noted that it did not address whether other aspects of the District rules may still be subject to preemption. Adoption of this proposal would resolve this uncertainty, assuming U.S. EPA grants the waiver.

On May 26, 2004, the District issued an advisory stating that while the fleet rules remained in force against public entities such as the state, counties, cities and special districts, it would not enforce the rules against private entities and private fleets that contracted to provide waste collection services for public entities such as cities and counties.

4. Proposed Amendments

If adopted by the Board, ARB's existing solid waste collection vehicle rule would be amended to preserve the intent of the District's Rule 1193 as applicable to all owners of solid waste collection vehicles within the district's jurisdiction.

The proposal is to amend ARB's solid waste collection vehicle rule to include a specific purchasing requirement for owners and fleets operating in the District. The purchasing requirement would be based on a performance standard of 0.2 grams per brake horsepower-hour (g/bhp-hr) NOx and 0.01 g/bhp-hr PM, which can be met by a new engine as certified, or a new engine plus a verified emission control system. In developing this proposal, staff has worked to obtain current, objective information on the challenges, cost-effectiveness, and emission benefits from the various technology options.

B. ARB Regulatory Authority

Under California's air pollution control laws, the control of vehicular sources, except as otherwise provided, is the responsibility of ARB. In 1988, the California Legislature enacted the California Clean Air Act (HSC sections 43013 and 43018), which declared that attainment of state ambient air quality standards is necessary to promote and protect public health, particularly the health of children, older people, and those with respiratory diseases. The Legislature directed that these standards be attained by the earliest practicable date.

The Federal Clean Air Act grants California, alone among the states, the authority to adopt more stringent controls of emissions from mobile sources. The California Clean Air Act establishes ARB as the state agency that sets standards for mobile sources.

The California Legislature also granted ARB the authority to identify toxic air contaminants and establish airborne toxic control measures to reduce risk.

C. Current Regulations and Voluntary Programs

Both the Federal government and the State of California have adopted rules that reduce PM and NOx, among other pollutants, from on- and off-road vehicles. The following sections briefly describe the existing federal, state, local and voluntary programs that currently apply to diesel-fueled engines and vehicles operating in California.

1. Federal Regulations

Standards for smoke emissions from on-road heavy-duty diesel vehicles were first set by U.S. EPA in 1970. New engines were subject to PM and NOx exhaust emission standards beginning with model year (MY) 1988 (Table 1). Over the years, more stringent emission standards have paralleled improvements in control technology. Recent amendments to the on-road standards regulate the heavy-duty vehicle and its fuel as a single system, including diesel-fuel sulfur content requirements.

Table 1. Federal Emission Standards for New Heavy-Duty Trucks

Emissions Standards (g/bhp-hr)		
Model Year	Heavy-Duty Truck	
	NOx	PM
1988	10.7	0.6
1990	6.0	--
1991	5.0	0.25
1993	--	0.25
1994	--	0.10
1996	5.0	--
1998	4.0	--
October 2002	2.2 (a)	--
2004	2.2 (a)	--
2007	1.2 (b)	0.01
2010	0.2 (b)	--

a. Nominal NOx value of 2.2 g/bhp-hr is based on emission standards of 2.4 g/bhp-hr for NOx plus non-methane hydrocarbons (NMHC) or 2.5 g/bhp-hr NOx plus NMHC with 0.5 g/bhp-hr NMHC cap, which took effect in October 2002 for those engines subject to U.S. EPA Consent Decrees and the California Settlement Agreements. The Consent Decree-complying engines had to comply with 2004 standards by October 1, 2002.

b. Between 2007 and 2009, U.S. EPA requires 50 percent of heavy-duty diesel engine family certifications to meet the 0.2 g/bhp-hr NOx standard. Averaging is allowed, and it is expected that most engines will conform to the fleet NOx average of approximately 1.2 g/bhp-hr.

a. Current Standards

The current federal (and state) PM engine emission standard for on-road heavy-duty diesel trucks is 0.1 g/bhp-hr. The current NOx emission standard for on-road heavy-duty diesel trucks is 2.4 g/bhp-hr for NOx plus non-methane hydrocarbons (NMHC) or 2.5 g/bhp-hr NOx plus NMHC with 0.5 g/bhp-hr NMHC cap. Only engines subject to U.S. EPA Consent Decrees and the California Settlement Agreements signed in 1998[1] had to comply with this 2004 standard in October 2002; for all the rest, the requirement began with the 2004 MY engines.

Other than the Federal Urban Bus Retrofit/Rebuild Program, no federal regulations exist that mandate reducing emissions from in-use heavy-duty engines.

b. New Engine Standards for 2007 and Beyond

The particulate standard that takes effect with 2007 MY heavy-duty diesel engines is 0.01 g/bhp-hr, which is a 90 percent reduction from the existing standard. That standard is based on the use of high-efficiency exhaust emission control devices or comparably effective advanced technologies. Because these devices are less efficient when used with the current formulation of diesel fuel, refiners are also required to reduce the level of sulfur in highway diesel fuel by 97 percent to 15 parts per million by weight by mid-2006.

The NOx standard in 2010 for new heavy-duty diesel engines, both trucks and buses, is 0.2 g/bhp-hr. However, between 2007 and 2009, U.S. EPA requires that only 50 percent of the heavy-duty diesel engine family certifications to meet this standard; the remaining 50 percent may meet the applicable 2006 MY engine standard. This results in a nominal NOx standard of 1.2 g/bhp-hr from 2007 through 2009. Most engine manufacturers have indicated they will meet this by producing all or most of their engines to a NOx standard of 1.2 g/bhp-hr; others will use averaging to produce engines certified to levels both above and below this NOx standard to comply.

Beginning in 2010, engine manufacturers may no longer average to meet the NOx standard and thus engines will be required to meet the 0.2 g/bhp-hr standard for all engines produced. Some manufacturers may have accumulated credits in prior years, resulting in some engines being certified above this standard, to as high as the family emission limit cap of 0.5 g/bhp-hr NOx.

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[1] Seven of the largest heavy-duty diesel engine manufacturers will be implementing measures to reduce emissions beginning October 1, 2002, to meet the requirements of the Heavy-Duty Diesel Engine Settlement Agreements reached with the ARB. The Heavy-Duty Diesel Engine Settlements were agreements reached in response to lawsuits brought by the United States Environmental Protection Agency and violations alleged by the ARB pertaining to excess in-use emissions caused by the use of defeat devices and unacceptable algorithms. Navistar signed its Settlement Agreement on October 22, 1998. Cummins, Detroit Diesel Corporation, Caterpillar, Volvo, Mack and Renault signed their Settlement Agreements on December 15,1998.

2. California Regulations

California is the only state granted the authority in the Federal Clean Air Act to set standards for mobile engines. While its passenger car standards are more stringent than federal standards, in the area of new heavy-duty diesel engines California has harmonized with federal rules since 1988.

a. New Heavy-Duty Engine Requirements

For new engines, long-term emission reductions are achieved through establishing more stringent new engine standards. Since 1988, California has adopted the same standards for new heavy-duty engines as are adopted by the federal government. The only area of difference is in urban buses, which currently have more stringent California standards. California also has optional reduced-emission standards for heavy-duty vehicles and urban buses (Table 2). In general, vehicles that are eligible for incentive funding, such as the Carl Moyer program, have been certified to these standards.

Table 2. California Optional, Low NOx Emission Standards for New Heavy-Duty Trucks and Urban Buses

Model Year	Optional Standards (g/bhp-hr)	Increment (g/bhp-hr)
2000	2.5-0.5	0.5
October 2002	1.8-0.3 (c)	0.3
2004-2006 (a,b)	1.8-0.3 (c)	0.3

a. For urban buses, emission standards apply only to alternative fueled engines.
b. For urban buses, engine manufacturers may sell diesel hybrid-electric buses certified at 1.8 g/bhp-hr standard to diesel path transit agencies with approved NOx offset plans.
c. Optional emission standards of 1.8 – 0.3 g/bhp-hr are for NOx plus non-methane hydrocarbons (NMHC). Engines certified to the optional NOx standard are excluded from participating in the Averaging, Banking, and Trading (ABT) program.

b. In-Use Heavy-Duty Engine Requirements

California has several regulations designed to ensure that heavy-duty trucks and buses comply with in-use smoke standards. California's Heavy Duty Vehicle Inspection and Periodic Smoke Inspection Programs reduce excessive smoke emissions and tampering with diesel-fueled vehicles over 6,000 pounds gross vehicle weight rating (GVWR) traveling within California. The regulations impose limits on the opacity of smoke from diesel engines when measured in accordance with a snap-acceleration test procedure, and have been in effect since 1991, with amendments adopted in 1997.

In recent years, California has adopted regulations for in-use diesel buses and trucks operated by transit agencies and for in-use diesel solid waste collection vehicles (as discussed above in Section I.A.1.). Regulations have also been adopted for transportation refrigeration units, portable engines, and stationary engines. California

has also developed guidelines establishing criteria for the purchase of new school buses and retrofits of existing school buses called the Lower-Emissions School Bus Program. This is usually accomplished through retiring or retrofitting the existing engines or repowering with a newer cleaner engine.

California has new idling limits for buses and heavy-duty trucks. California's school bus idling requirements became effective July 16, 2003. California limits school bus idling and idling by heavy-duty diesel trucks at or near schools to only when necessary for safety or operational concerns. A driver of a transit bus or other commercial motor vehicle is prohibited from idling more than five minutes at each stop within 100 feet of a school. Idling limits applicable to all other buses and heavy-duty trucks were effective February 1, 2005 and restrict idling, in most cases, to no more than 5 minutes. Examples of some exemptions include buses while passengers are on board and trucks doing work that requires the engine to be idling.

3. Local Regulations

Local Air Pollution Control Districts and Air Quality Management Districts (air districts) have authority to directly regulate stationary sources and some area wide sources. District authority over mobile sources is generally limited to restricting vehicle activity as explained below.

a. General Air District Authority Over Mobile Sources

Air districts participate with local transportation agencies to develop and implement transportation control measures aimed at reducing vehicle activity and emissions. Some air districts have developed model ordinances to reduce idling of trucks and buses, to encourage the purchase of low-emission vehicles for public fleets, and to require public agency contracting that is 'green'. Other air districts have reduced the number of smoking vehicles by mailing letters to the registered owners to request that the vehicles be repaired.

Air districts also have programs that help to fund transportation-related projects that reduce air pollution. Funds are also available to defray the costs of new lower emission technologies for diesel engines. These monies are available to projects, such as cleaner transit buses, trash trucks, school buses, and street sweepers that go beyond established regulatory requirements.

Public outreach is an important component of the air districts' programs to reduce emissions from mobile sources. Public outreach can include forums to present new technologies, programs, and opportunities to reduce emissions. These opportunities might also include encouraging bicycle use and exchanging gasoline lawn mowers for electric lawn mowers, in addition to programs that provide funding for purchases of cleaner engines and vehicles.

b. Specific South Coast Air Quality Management District Authority Over Mobile Sources

The District implements many of the programs identified above. Additionally, to reduce both toxic and smog-forming air pollutants, the Legislature granted the District special authority to adopt fleet rules, as was discussed earlier. Based on this authority, the District adopted seven fleet rules from 2000 to 2001. The rules were developed to gradually shift public agencies and certain private entities to lower emission and alternative-fuel vehicles and apply whenever a fleet operator with 15 or more vehicles purchases or leases a vehicle for replacement or addition to its fleet.

The District defines alternative fuels slightly differently in each of its rules, but generally follows the definition adopted by ARB, in its fleet rule for transit agencies. In Rule 1193 for collection vehicles, alternative fuel is defined to include "compressed or liquefied natural gas, liquefied petroleum gas, methanol, electricity, fuel cells, or other advanced technologies that do not rely on diesel fuel."

There is variation among the District fleet rules due to the different functional demands and accompanying circumstances for each type of fleet vehicle. For light and medium-duty vehicles and commercial airport ground access vehicles, the fleet rules require the acquisition of low-emitting gasoline (ultra low emission vehicle or better) or alternative-fuel vehicles. For transit buses and sweepers, the fleet rules specify the acquisition of alternative fuel vehicles only, based on the assumption that alternative-fueled vehicles have lower emissions than diesel-fueled vehicles. For refuse collection vehicles, the rules provide the choice of acquiring alternative-fuel, pilot ignition, or until July 1, 2004, dual-fuel vehicles. For heavy-duty public fleet vehicles, the rule provides the option of acquiring alternative-fuel, dual-fuel, or dedicated gasoline vehicles. For school buses, many compliance options are available depending on the fleet size, bus type, and availability of funding.

In all cases, purchases of diesel vehicles were effectively prohibited, except for exemptions granted by the district. For several rules, the requirements also vary depending on the availability of incentive funding. Additionally, each fleet rule has alternative compliance provisions for cases in which the requirements are demonstrated to be technically infeasible.

4. Voluntary and Incentive Programs

Voluntary efforts play a key role in helping to achieve air quality goals. Incentives can induce vehicle owners to reduce vehicle emissions prior to compliance deadlines or by reducing emissions beyond regulatory requirements. Owners and operators of transit buses, collection vehicles, school buses, and street sweepers may be eligible for available funding for vehicles that go beyond the established requirements such as those in the proposed ARB fleet rules, e.g., if the adopted optional standard is set at 1.8 g/bhp-hr for NOx and the certified level of an engine was at 1.2 g/bhp-hr NOx, then that was considered buying better than the standard and qualified for funding. By the same

concession, if alternative fuel engines certify at 0.2 NOx in 2007 while the adopted engine standards are effectively 1.2 NOx, then the purchasing of 0.2 NOx engines may qualify for funding.

a. Federal Incentives

On the federal level, U.S. EPA established a Voluntary Diesel Retrofit Program in 2000 to address pollution from diesel construction equipment and heavy-duty on-highway vehicles. This program allows fleet operators to choose appropriate, U.S. EPA-verified technologies that will reduce the emissions of the vehicles and engines in their fleets and identify potential funding sources to assist air quality planners and fleet operators as they create and implement retrofit programs. The program assists air quality planners in determining the number of State Implementation Plan credits produced by their retrofit projects. The U.S. EPA has also established a program to fund school bus retrofits and replacements from penalty revenues.

b. State Incentives

In 1998, the Governor and Legislature appropriated $25 million to implement the Carl Moyer Memorial Air Quality Standards Program (Carl Moyer Program.) Administered by ARB and the local air districts, the program provides grants to local air districts to fund the extra capital cost of cleaner-than-required diesel-powered heavy-duty vehicles and equipment. During the first five years, the Carl Moyer Program received budget appropriations totaling $153 million.

In 2000, the Legislature approved new funds to reduce emissions from school buses. The ARB, in coordination with the California Energy Commission and the local air pollution control districts, established guidelines for the Lower-Emissions School Bus program. The goal of this incentive program is to reduce the exposure of school children to both cancer-causing and smog-forming compounds. This program utilizes two strategies to attain these goals: pre-1987 model year school bus replacement and in-use controls for later model year diesel-fueled school buses. Over fiscal years 2000/2001 and 2001/2002, program funding was $66 million total.

Voters approved Proposition 40, the California Clean Water, Clean Air, Safe Neighborhood Parks, and Coastal Protection Act of 2002, which granted additional funding to reduce diesel emissions. The measure provides about $50 million over two years to ARB, 20 percent of which is to be spent for the acquisition of "clean, safe, school buses for use in California's public schools." The remainder is allocated to the Carl Moyer Program.

In 2004, the Governor and the Legislature approved Assembly Bill (AB) 923 that provides up to $140 million a year of long-term incentive funding. The bill also modified the requirements governing the funds. Program modifications include:

- Expanding pollutants from NOx-only to include particulate matter (PM) and reactive organic gases (ROG).
- Adjusting Smog Check, tire, and Department of Motor Vehicle (DMV) fees to provide an ongoing source of funding through 2015.
- Including fleet modernization, light-duty vehicle projects, and an expanded agricultural assistance program as projects eligible for incentive funds.

c. Local Funding

The revenue that air districts distribute to cities, counties, public agencies, and businesses to fund projects that reduce air pollution comes from DMV fees and the incentive programs previously discussed. State law authorizes districts to impose a registration surcharge of $4 dollar per vehicle upon adoption of a resolution that provides for both the fee and the program to reduce air pollution from motor vehicles and for related planning monitoring, enforcement and technical studies. The DMV collects the fees at the request of the district.

AB 923 allows some local districts to vote to approve an additional $2 dollar per vehicle fee in addition to the $4 dollar per vehicle DMV fee. These funds can be used for Carl Moyer Program projects, Lower-Emission School Bus Program purchases, accelerated vehicle scrap, and some agricultural projects.

The SCAQMD has imposed the $4 dollar per vehicle fee and the additional $2 dollar per vehicle fee on residents of the air district. In addition, SCAQMD has the authority to impose an additional $1 dollar per vehicle until January 1, 2010, and has done so.

The SCAQMD has imposed the $4 dollar per vehicle fee (as provided under AB 2766) and adopted the additional $2 dollar per vehicle fee (as provided in AB 923) for the south coast air district. In the South Coast, the $4 dollar per vehicle fee is distributed 30 percent to the district's general fund, 40 percent to cities and counties, and 30 percent to the Mobile Source Reduction Review Committee (MSRC) to contribute a funding match towards qualifying projects. MSRC has funded $42 million dollars for school buses, transit buses, street sweepers, and refuse trucks since the 1995-1996 fiscal year. The cities and counties portion of the DMV fees has funded some infrastructure needs for alternative-fuel school buses.

The SCAQMD anticipates $22 million dollars annually from the $2 dollar increase in DMV fees in the South Coast district. Over the next 18 months (to the end of calendar year 2006), the district has designated $14 million dollars for Clean On-Road School Buses, $4 million dollars for accelerated vehicle scrap, $11 million for Carl Moyer projects, and $4 million for agricultural sources. The SCAQMD has distributed approximately $28 million dollars of Carl Moyer funding to transit buses, refuse trucks, and street sweepers. The Carl Moyer Program has not been a significant source of funding for school buses due to the very low mileage of those vehicles contributing to a higher cost effectiveness. Funding for alternative school buses, cleaner diesel school

buses, and diesel school bus particulate trap retrofits have come from the Lower-Emissions School Bus Replacement Program and the SCAQMD Governing Board school bus initiatives.

South Coast Rule 2202 - Air Quality Investment Program (AQIP) allows employers with 250 or more employees to participate in an air quality investment program in order to meet their emission reduction target. An employer may elect to participate in the program by investing annually $60 per employee or triennially $125 per employee into an AQMD administered restricted fund. Since 2000, over $1.6 million dollars from AQIP has funded alternative fueled street sweepers and refuse trucks.

II. PUBLIC OUTREACH

The ARB uses a variety of mechanisms to involve the public in its rulemaking efforts. In addition to listening to the opinions of all stakeholders, ARB staff gain valuable information through working with stakeholders regarding costs, feasibility, and availability of technologies used to comply with the proposal.

A. Environmental Justice

On December 13, 2001, the Board approved Environmental Justice Policies and Actions,[2] which formally established a framework for incorporating environmental justice into the ARB's programs, consistent with the directives of State law and policy (ARB 2001). "Environmental justice" is defined as the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies. These policies apply to all communities in California, but environmental justice issues have been raised more in the context of low-income and minority communities because of past land use policies and the cumulative impact of a concentration of emitting facilities in some neighborhoods.

To achieve this ambitious goal, ARB established a Community Health Program and emphasized community health issues in our existing programs. To provide people with the basic tools and information needed to understand and participate in air pollution policy planning, permitting, and regulatory decision-making processes, ARB has published "The Public Participation Guide to Air Quality Decision Making in California."[3]

In addition, at its April 28, 2005, public meeting, the Board adopted the "Air Quality and Land Use Handbook: A Community Health Perspective." This document was developed to provide technical information to local land use and transportation agencies for considering impacts of local sources of air pollution in the land use decision-making process.

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[2] Complete information for these programs can be found at http://www.arb.ca.gov/ch/ej.htm.
[3] Complete information on this program can be found at http://www.arb.ca.gov/ch/public_participation.htm

The Environmental Justice Policies are intended to promote the fair treatment of all Californians and cover the full spectrum of ARB activities. Underlying these Policies is a recognition that we need to engage community members in a meaningful way as we carry out our activities. People should have the best possible information about the air they breathe and what is being done to reduce unhealthful air pollution in their communities. The ARB recognizes its obligation to work closely with all stakeholders; communities, environmental and public health organizations, industry, business owners, other agencies, and all other interested parties to successfully implement these Policies. Our outreach efforts, described below, facilitate this objective.

This amendment, if adopted, will provide small air-quality benefits by reducing NOx emissions from solid waste collection vehicles that operate in neighborhoods in the District. NOx emissions contribute to respiratory impacts in children, fine particulate matter, and the formation of ozone, a criteria pollutant, as discussed in Section III.A.

This rule is designed to reduce emissions from collection vehicles that operate in residential neighborhoods and commercial areas in the South Coast air district. All persons come in contact with collection vehicles as they transit our neighborhoods to collect refuse. In some neighborhoods and commercial districts, there may be up to three trips to pick up different types of refuse, household garbage, green waste, and recyclables on waste collection day. By lowering the emissions from collection vehicles, the exposure to toxic air contaminants and ozone smog is reduced. This proposal benefits these individuals and also supports the ARB's Environmental Justice goals.

B. Outreach Efforts

Consistent with ARB's environmental justice policy for strengthening our outreach efforts in all communities, staff utilized many avenues to engage stakeholders in the rulemaking effort.

1. South Coast Fleet Rules

In October 2004, ARB posted on its website a request for public comment concerning the District's fleet rules. We requested comment on whether ARB should submit the District's fleet rules to U.S. EPA for a waiver of preemption, pursuant to section 209(b) of the Clean Air Act.

The ARB received thousands of comments, including over 4,800 electronic submittals. After a thorough review of the comments and consultation with U.S EPA, staff made a decision to pursue a new rulemaking process for four fleet rules (the street sweeper rule was later dropped with the District's concurrence), with the generation of a new public record that would update relevant information on the effectiveness and costs of these rules.

Staff generated a webpage dedicated to the rulemaking effort. On this webpage, ARB provided notice of the rulemaking process with relevant background and contact

information. Then staff generated a list serve from all those who had provided electronic comments. Along with those on ARB's mobile sources listserve, over 5,700 emails were sent to inform stakeholders of the rulemaking activity.

2. South Coast Collection Vehicle Proposal

As part of outreach efforts for the waste hauler rule proposal, ARB staff conducted one workgroup meeting on March 3, 2005, and one workshop on April 6, 2005; both of which were held in El Monte. The purpose of the workgroup meeting was to introduce the rulemaking to a group of stakeholders who had been meeting as part of SCAQMD's Natural Gas-powered Refuse Vehicle Users Group, along with members of ARB's workgroup for implementation of its statewide collection vehicle rule. Thirty-six people signed in for the meeting, representing natural gas advocacy groups and providers, refuse removal companies, after treatment technology providers, vehicle refurbishers, and consultants to each of these sectors. The SCAQMD provided information on the status of Rule 1193 and the state of natural gas engine technology, and ARB staff provided an overview of our adopted collection vehicle rule along with an introduction to the new rulemaking.

For the April 6, 2005, workshop, attendees included many of the same individuals and companies, plus representatives from environmental organizations, municipalities, waste management companies and service providers, associations, engine manufacturers, oil companies, and other parties interested in residential waste removal. These individuals participated both by providing data, reviewing proposed regulations and by participating in a question-and-answer session during the workshop.

Staff met with a number of stakeholders' groups throughout the rulemaking process. Representatives of the California Refuse Removal Council (CRRC) encouraged their members to cooperate in ARB's data gathering efforts. Waste Management, the state's largest waste hauling company, submitted written comments and made staff members available for numerous telephone and face-to-face interviews. The ARB's staff did face-to-face and telephone interviews and e-mail exchanges with 15 private waste collection firms and 12 municipalities that operated their own collection fleets. Some of the private firms, such as Waste Management, operate multiple collection fleets under various names within the District, and staff tried to interview a number of these fleets. In some cases, staff did multiple interviews with representatives from private and municipal waste hauling groups. The ARB's staff made many site visits to regulated entities, met with stakeholders, and conducted surveys to obtain pertinent information on the challenges and viable options for reducing the fleet vehicle emissions.

On several occasions, over 5,700 emails were sent to provide stakeholders with notification of the workshop, draft regulatory concepts, and proposed draft regulatory language. In addition, hardcopies of the workshop notice and draft regulatory concepts were mailed to 832 addresses, and additional emails were also sent to targeted groups, including all individuals who had participated in the pervious rulemaking for solid waste collection vehicles.

To generate additional public participation and to enhance the information flow between ARB and interested persons, staff made the workshop notices, draft regulatory concepts, draft regulatory language, and workshop presentations available on the ARB webpage. The webpage also contains the names, telephone numbers and e-mail addresses of ARB staff involved in the rule. Notices of the rulemaking activity and workshop were also posted on the District's webpage.

III. NEED FOR EMISSION REDUCTIONS

Many regions of California have serious to severe problems with air quality. In particular, the South Coast Air Basin is designated as a serious nonattainment area for PM_{10} and is a severe nonattainment area for the eight hour ozone standard. The Coachella Valley, which is within the jurisdiction of SCAQMD, is classified as a serious nonattainment area for PM_{10} and a moderate nonattainment area for ozone.

A. Ozone

Ground-level ozone is created by the photochemical reaction between NOx and reactive organic gases (ROG). Breathing ozone can trigger a variety of health problems including chest pain, coughing, throat irritation, shortness of breath, and congestion. It can worsen bronchitis, emphysema, and asthma. Ozone can also reduce lung function and inflame the linings of the lungs. Repeated exposure may permanently scar lung tissue. The elderly, children, and people with compromised respiratory systems are among those persons who may be most affected by exposure to ozone.

Ground-level ozone also damages vegetation and ecosystems. It leads to reduced agricultural crop and commercial forest yields, reduced growth and survivability of tree seedlings, and increased susceptibility to diseases, pests, and other stresses such as harsh weather. Ground-level ozone also damages the foliage of trees and other plants, affecting the landscape of cities, parks and forests, and recreational areas.

NOx is considered an important outdoor pollutant not only because it is an essential precursor in the formation of ground-level ozone, but also because it contributes to the formation of atmospheric acids and secondary particles. In addition, nitrogen dioxide is a reactive gas capable of damaging the cells lining the respiratory tract. The ARB staff is currently reviewing the NO2 standard for possible revision in 2005.

B. Particulate Matter (PM)

PM emissions result primarily from incomplete combustion of fuel in the cylinder and lubrication oil that has entered the cylinder incidentally. Secondarily produced diesel PM is formed as a result of atmospheric reactions with diesel NOx emissions. The majority of diesel PM, approximately 98 percent, is smaller than ten microns in diameter. Diesel PM is a mixture of materials containing over 450 different

components, including vapors and fine particles coated with organic substances. More than 40 chemicals in diesel exhaust are considered TACs by the State of California.

Diesel PM has been linked to a wide range of serious health problems. Particles that are deposited deep in the lungs can result in lung cancer, increased hospital admissions; increased respiratory symptoms and disease; decreased lung function, particularly in children and individuals with asthma; alterations in lung tissue and respiratory tract defense mechanisms; and premature death. Increased PM exposure causes increased cardiopulmonary mortality risk as demonstrated in a validity and causality analysis of 57 epidemiological studies. (Dab, et al. 2001). Significant positive associations exist between lung cancer incidence and the number of days per year that respirable particulates (PM_{10}) exceeded several thresholds (Beeson, et al. 1998). Long-term ambient concentrations of PM_{10} are associated with increased risks of all natural-cause mortality in males, mortality with any mention of nonmalignant respiratory causes in both sexes, and lung cancer mortality in males (Abbey, et al., 1999; McDonnell, et al., 2000).

IV. NEED FOR MODIFICATIONS

Owners of solid waste collection vehicles in the District are subject to two rules: ARB's in-use emission reduction rule for solid waste collection vehicles and the District's alternative-fuel purchase requirements for solid waste collection vehicles. These rules are complementary and compliance with the District's rule assists the owner in complying with ARB's rule in that an alternative-fuel vehicle is considered to be a complying vehicle under ARB's rule. Both rules apply to public agencies and private companies.

As previously discussed, however, the legality of the District's fleet rules, including Rule 1193 for waste collection vehicles, was thrown into doubt when the U.S. Supreme Court ruled on April 28, 2004 that the District's fleet rules might be preempted by federal authority, thus necessitating a waiver. The Supreme Court returned the case to the District Court in California for further action. Discussions with U.S. EPA indicated that only the state-adopted rules could be considered for a waiver of federal preemption. Thus ARB began a new rulemaking process on three of the District's fleet rules, including the waste collection vehicle rule.

On May 6, 2005, the U.S. District Court, Central District of California, issued a tentative ruling that the fleet rules are not preempted when they apply to state and local governments. The court, however, specifically said it was not addressing the issues of the fleet rules as they might apply to the federal government, private entities, and used or leased vehicles. As refuse removal in California is performed by local governments, private companies contracting with local governments, and private companies dealing directly with consumers, the court's rulings leave open a situation whereby some operators would be required to comply with the District rule's purchase requirements and others would not. This would create an uneven compliance environment, leaving

owners who did not have to comply with a competitive advantage over those that did have to comply. By developing a state rule that can receive a waiver of federal preemption, all solid waste collection vehicles would be subject to the same requirements.

A. Air Quality In The South Coast District:

Despite significant progress made in reducing harmful air emissions over the past 20 years, the District continues to experience extremely serious air quality problems, primarily from motor vehicle sources. Thus, reductions of emissions from waste collection vehicles would contribute to an overall reduction of motor vehicle emissions in the District.

B. Comparison of Rule 1193 to ARB's Solid Waste Collection Vehicle Rule

As part of continuing efforts to reduce air pollution in the District and throughout the state, ARB on September 25, 2003 adopted a measure to reduce diesel PM emissions from on-road heavy-duty residential and commercial solid waste collection vehicles. The state measure differs from the District rule in several ways:

While the District rule applies to new vehicle purchases or leases, ARB's rule requires PM reduction from existing in-use trucks that collect solid waste. The ARB rule applies to owners operating one or more collection vehicles and includes roll-off vehicles but not transfer trucks. The District's rule applies to fleets of 15 or more and includes transfer trucks. Although transfer trucks are included in the District's rule, owners have been granted exemptions that allow them to purchase diesel transfer trucks because natural gas engines are not available that meet the specifications for these trucks. The ARB's rule gives the owner a menu of choices for the application of best available control technology by specified implementation dates, whereas Rule 1193 forces the purchase of alternative-fuel vehicles. To provide flexibility to owners, the ARB rule has extensions available if no diesel emission control technology is available that allow owners additional time to purchase new vehicles for replacement. Owners can also delay implementation on some of their vehicles if they reduce emissions from at least 50 percent of all vehicles early, if they participate in an experimental program, or if a particular vehicle is within one year of retirement. The District rule has a variance application process for requesting permission to purchase a diesel engine if a suitable alternative fuel engine is not available for particular applications.

V. INVENTORY OF SOLID WASTE COLLECTION VEHICLES AND EMISSIONS

In 2003, staff conducted a statewide survey of solid waste collection vehicles and engines and developed an inventory model for these vehicles. For this rulemaking proposal, staff updated its inventory for engines and emissions specific to the South Coast.

A. Engine Inventory

The ARB staff estimated the total number of affected vehicles and companies in the District based on a combination of information, including ARB's Diesel Retrofit Implementation and Evaluation Database (DRIED) and supplemental data provided by the District. Using a list generated from these data, staff sent a letter to approximately 128 entities identified as being possibly affected by the rulemaking activity. Staff requested that owners send us records concerning the trucks and engines in their fleets as required in title 13, CCR, Section 2021.2 (f), along with additional information on contract and rate status (Appendix C).

Based on these data, ARB estimates the 2005 population of collection vehicles operating in the District covered by this rule to be approximately 5,000. From 2006 though 2009, staff expects that approximately 1,035 new collection vehicles will be purchased, many as replacements for existing vehicles. Staff estimates that by 2009 the population of vehicles in the District covered by this rule will be approximately 5,370. In 2010, all engines are likely to be certified to 0.2 g/bhp-hr NOx and no significant difference in emissions between available engines is expected. Therefore, purchases of vehicles with post-2009 engines are not considered because the South Coast Fleet Rule would not result in lower emission vehicle purchases from 2010 and thereafter.

Additional details on the composition of the fleet of collection vehicles in the District are provided in Appendix B.

B. Emission Inventory

Staff calculated the baseline collection vehicle emissions inventory for the District for calendar years 2000, 2005, 2010, and 2020 (Table 3). Staff ran the statewide emissions model developed as part of ARB's current collection vehicle rule and scaled down the results by a factor of 39 percent to estimate emissions in the District alone (Appendix B). The baseline inventory assumes that fleet owners are applying BACT to their existing vehicles as required by ARB's current collection vehicle rule, and the inventory also accounts for U.S. EPA 2007 and 2010 new heavy-duty diesel engine standards and 2006 low sulfur diesel fuel regulations.

Table 3. SCAQMD Collection Vehicle Emissions Inventory (tons/day)

Pollutant	2000	2005	2010	2020
NOx	11.6	10.5	7.3	3.5
PM	0.48	0.35	0.11	0.05
HC	1.64	1.04	0.15	0.12

VI. SUMMARY OF PROPOSED CONTROL MEASURE

The proposed amendments to ARB's collection vehicle rule consist of a performance standard for purchase of new engines by owners of collection vehicles based within the District. The scope of the proposal is the same as ARB's existing Solid Waste Collection Vehicle rule, in that it applies to vehicles that collect solid waste for a fee, does not apply to transfer trucks, and does apply to all vehicles, even those in fleets of fewer than 15 trucks. Staff's proposal would require owners to choose a low emission engine meeting a specific performance standard, when purchasing or leasing collection vehicles, provided that compliant technology is commercially available.

A. Options for Compliance

Staff envisions two basic options that owners may choose from to comply with the requirements as outlined in section B below. First, an owner may purchase a vehicle with a new, compliant California-certified engine that meets the proposed performance standard. The proposal makes no distinction as to the type of fuel the engine uses. Alternatively, an owner may apply a verified diesel emission control system to a California-certified engine such that the resultant emissions meet the proposed performance standard. Whether a given verified diesel emission control system would bring an engine into compliance would depend on the details of that system's ARB verification and whether it meets the emission performance requirements.

B. Purchase Requirements

The rule as proposed would require purchase of collection vehicles with engines that meet specified emissions levels, thus the proposal sets a performance standard.

- 2005 and 2006 MY engines: Owners would be required to purchase vehicles with engines that meet the optional low emission certification standards of 1.8 g/bhp-hr for nitrogen oxides (NOx) plus non-methane hydrocarbons (NMHC) and 0.03 g/bhp-hr for particulate matter (PM) as specified in title 13, CCR, section 1956.8(a)(2)(A). For reference, the basic emission standard for these years is 2.4 or 2.5 g/bhp-hr NOx plus NMHC and 0.1 g/bhp-hr PM.

- 2007 and subsequent model year engines: Owners would be required to purchase vehicles with engines that meet the 2007 and subsequent standards specified in title 13, CCR, section 1956.8 (a)(2)(A), provided the declared NOx Family Emission Limit (FEL) of the engine does not exceed 0.2 g/bhp-hr and the declared PM FEL does not exceed 0.01 g/bhp-hr. For reference, most 2007-09 engines are expected to certify to a FEL of 1.2 g/bhp-hr NOx. In 2010 and beyond most engines will certify to a 0.2 g/bhp-hr FEL for NOx. Beginning in 2007, most engines will certify to a FEL of 0.01 g/bhp-hr PM.

While it may at first seem redundant to include requirements for 2007 and beyond that harmonize with the already adopted 2007 standards, unlike those standards, staff's

proposal makes no allowances for emissions averaging, banking, and trading (ABT) programs. Therefore, the engines (or engine plus retrofit combinations) used to comply with the proposed requirements must actually meet the specified standards and may have lower emissions than other similar engines that use the averaging provisions.

C. Exemptions

Staff's proposal allows an exemption from the purchase requirements under two basic conditions: (1) compliant technology is not commercially available or (2) it cannot be used by an owner. Staff proposes that an owner would have to apply in writing to ARB's Executive Officer for the exemption at least 90 days prior to committing to the purchase of a non-compliant vehicle or engine. While the proposal specifies 90 days for the exemption application, staff notes that it would be prudent for an owner to apply even earlier to avoid delays in purchasing if the Executive Officer has not yet made a ruling on the application.

Under the first condition, the Executive Officer may grant an exemption if the owner demonstrates that no compliant engine and chassis configuration or verified diesel emission control strategy is commercially available. Staff proposes that demonstrating this would require the owner to list the bid specifications for the vehicle to be purchased and submit a list of all manufacturers that the owner solicited with these specifications and all responses the owner received. The owner would also be required to list the manufacturer, model, rated horsepower, rated torque, and fuel type of the non-compliant engines the owner proposes to purchase.

The second condition under which the Executive Officer would consider an exemption is if compliant technology is commercially available but could not be used by an owner. In this case, the owner must describe in detail why the commercially available technology cannot be used, whether it is an alternative-fueled engine, a verified diesel emission control system, or some other product. As under the first condition, the owner must list information on the non-compliant engines it proposes to purchase. As an example, staff envisions reasons that may include the owner's company being too small to have its own fueling station and no public fueling station being available.

VII. ENGINE AVAILABILITY & TECHNOLOGICAL FEASIBILITY

This section discusses the availability and feasibility of engines for collection vehicles during the time periods that would be impacted by current and proposed regulations. The information has been obtained from engine manufacturers and other published sources. We have omitted information that engine manufacturers have indicated is confidential. Further information can be found in the Technical Support Document.

Conventional diesel engines use compression-ignition to generate power, whereas engines that operate on an alternative fuel, such as compressed natural gas (CNG), liquefied natural gas (LNG), and liquid petroleum gas (LPG), are typically spark-ignited.

In the heavy-duty engine market, CNG and LNG are the most commonly used alternative fuels.

A. Current Engine Availability

Based on a review of certification records and discussions with manufacturers, there are currently no certified diesel engines that meet the proposed 2005-2006 requirements of 1.8 g/bhp-hr NOx plus NMHC and 0.03 g/bhp-hr PM. Engine manufacturers have, however, certified a number of compliant engine families that operate on alternative fuels and which are applicable to collection vehicle usage (Table 4). The engines range from 250 to 320 horsepower and 660 to 1000 foot-pounds torque. The Cummins C Gas Plus and Deere 6081H engines have been in use for a few years, while the L Gas Plus is only now beginning to become commercially available. Mack also has a natural gas engine certified this year, but it is not commercially available. There are no large displacement, high-powered heavy heavy-duty natural gas engines certified, thus eliminating natural gas from use in the heaviest classes of collection vehicles, roll-off vehicles, and transfer trucks. South Coast data shows roll-off vehicles making up approximately 11% of the District fleet while transfer trucks make up approximately 5% of the fleet.

Table 4. MY 2005 Certified Alternative-Fuel Engines for Collection Vehicles

Engine Manufacturer /Displacement	Series	Fuel Type	NOx+NMHC Certification (g/bhp-hr)	PM Certification (g/bhp-hr)
Cummins 8.3L	C Gas Plus	CNG/LNG	1.7	0.01
Cummins 8.9L	L Gas Plus	CNG/LNG	1.2	0.01
Deere 8.1L	6081H	CNG/LNG	1.2	0.01

B. 2007 to 2009 Engine Availability

In 2007 the engine exhaust emission standards for heavy-duty engines drops to 0.2 g/bhp-hr for NOx and 0.01 g/bhp-hr for PM. Recognizing the challenge facing engine manufacturers in meeting this requirement, U.S. EPA rule allows an optional NOx standard phase-in of 50 percent of sales of the 2007 standard and 50 percent of sales of engines meeting the 2004 to 2006 standard for three years (2007 through 2009). This results in a nominal standard for 2007 through 2009 of 1.2 g/bhp-hr for NOx. The PM standard, however, is 0.01 g/bhp-hr from 2007 on.

Most diesel engine manufacturers have indicated that they will use a two-step approach to meeting the NOx standard. They plan to meet the 1.2 g/bhp-hr NOx standard for most 2007 – 2009 MY engines, although some engines will undoubtedly be certified higher or lower. According to U.S. EPA's second highway diesel progress report (U.S. EPA 2004) and based on ARB staff's evaluation, manufacturers are on track to meet

the requirements in 2007. Alternative-fuel engine manufacturers, on the other hand, are planning to meet the 0.2 g/bhp-hr standard beginning in 2007. While most manufacturers have released details about their 2007 engines, some have not. Thus the information that follows includes general information where specifics are unavailable for publication. Staff's evaluation includes both publicly available and confidential information.

a. Diesel-fueled Engines

All major manufactures have announced that they will be using exhaust gas recirculation (EGR) to meet the 2007 NOx emission standard and diesel particulate filters to meet the particulate standard. EGR causes a portion of the exhaust gases to circulate through a heat exchanger to cool the exhaust before reintroducing the gases into the engine intake manifold. EGR has been used in some engines since 2003, but engine manufacturers have further refined the systems to allow lower NOx emissions.

Caterpillar, Cummins, and DDC plan to offer a full line of medium- and heavy-duty diesel engines; International focuses on the school bus and collection vehicle engine markets; and Mack/Volvo focuses on engines for collection vehicles.

Dual fuel systems for collection vehicles are no longer available in the U.S., as Clean Air Power, the sole manufacturer of these systems, has concentrated its efforts in Europe. Increased interest in its product may, however, prompt Clean Air Power to develop and certify in California a 2007 product for collection vehicles.

Diesel hybrid-electric systems are another technology that reduces both emissions and fuel use and that will be available in 2007. While not classified by ARB as an alternative-fuel technology, diesel hybrid-electric technology achieves lower emissions and better fuel economy than equivalently sized diesel buses or trucks. Emissions testing studies at ARB and other facilities indicate a fuel consumption reduction of 25 percent and NOx emission reduction of about 50 percent for diesel-fueled hybrid-electric buses (HEBs) compared to conventional diesel transit buses.

The past few years have seen a shift from research and development to production and use of HEBs. In 1998, New York City Transit began a demonstration program with four diesel-fueled HEBs. The success of the program has resulted in New York City Transit ordering an additional 325 diesel-fueled HEBs, which it will receive through 2005 (BAE Systems, 2004). In January 2002, fewer than 100 HEBs were in active service. To date, orders have been placed for approximately 650 additional HEBs throughout the United States. In addition to the New York City Transit order, large orders have been placed by King County Metro in Seattle, Washington (213 diesel HEBs) (General Motors, 2004), and Long Beach Transit in California (27 gasoline hybrid buses) (ISE, 2003). ISE has stated that it intends to have a diesel HEB available in California in 2007.

b. Alternative-fuel Engines

Manufacturers of natural gas engines are likely to be able to meet the upcoming 2007 standard without the use of after treatment. Two engine manufacturers, Cummins, through its joint partnership with Westport Innovations, Cummins Westport Inc., and John Deere will be offering alternative fuel products to meet the 2007 emissions standards. Although we have only preliminary data, it appears that all manufacturers of alternative-fuel engines or systems will certify to the 0.2 g/bhp-hr NOx and 0.01 g/bhp-hr PM standards.

Compared to diesel offerings, however, customers will not have a wide a range of offering to choose from when searching for engines. ISE currently offers a California-certified gasoline hybrid electric bus and is developing hybrid electric systems with compressed natural gas, diesel, and hydrogen fuels, also for urban buses. While ISE focuses on the urban bus market, it is considering expanding into other vocations that use heavy heavy-duty engines, such as waste collection vehicles.

John Deere currently only certifies urban bus and medium heavy-duty natural gas engines (Appendix A), but is developing a heavy heavy-duty engine that would be suitable for use in waste collection vehicles. John Deere intends to produce a 250-325 horsepower, 9 L natural gas engine meeting the 0.2 g/bhp-hr NOx level by 2007. This engine could be used in transit buses, school buses, and refuse trucks.

Cummins will be marketing the natural gas engines developed by Cummins Westport Inc. and it intends to offer a full line of products. Although the engines are developed by Cummins Westport Inc., they will be following the "Cummins Value Package Introduction Process," carry the Cummins warranty, and be serviced by Cummins dealers. Cummins is currently providing bids on both diesel and natural gas buses for 2007. Cummins Westport Inc. has partnered with U.S. DOE's NREL to develop a lower emission version of the L Gas Plus (8.9 L) engine for use in medium-duty trucks, refuse trucks, and urban buses. This engine is scheduled to be commercially available in early-2007. The SCAQMD is also currently sponsoring a project with Cummins to commercialize the C Gas Plus engine (8.2 L) to 0.2 g/bhp-hr NOx by 2007.

In 2004, Ford and General Motors stated that they would no longer be producing their smaller CNG engines used in cutaway vehicles. As a result, BAT Technologies, Clean Energy, and Teleflex/GFI Control Systems have jointly proposed a contract with SCAQMD and the state of New York to "develop and certify in California a retrofit system that converts 2005 and subsequent model year gasoline-powered Ford Crown Victoria and E-450 cutaway vehicles to dedicated CNG operation" (South Coast Air Quality Management District, 2004). It is anticipated that once retrofitted, the engines will meet SULEV emission levels. This technology is scheduled to be certified by mid-year 2005.

A heavy-duty pilot ignition (HDPI) engine is a compression-ignition engine that operates on natural gas but uses diesel as a pilot ignition source. Diesel accounts for about six

percent of the fuel consumed. The ARB has defined an HDPI engine in its fleet rule for transit agencies as an engine that uses diesel fuel at a ratio of no more than one part diesel fuel to ten parts total fuel on an energy equivalent basis. Furthermore, the engine cannot idle or operate solely on diesel fuel at any time. An engine that meets this definition and is certified to the lower optional PM standard (0.01 g/bhp-hr) would be classified as an alternative-fuel engine.

In October 2004, Westport Research announced that it has been awarded $1.5 million (USD) by the U.S. DOE's NREL in a cost-sharing subcontract to develop and deploy the next generation of its HDPI technology in heavy-duty natural gas trucks (Cummins ISXG, 14.9 L) in California. NREL funding is provided through sponsorship from the U.S. DOE FreedomCAR and Clean Cities programs. Westport Research intends to certify this engine to 1.2 g/bhp-hr NOx by the end of 2005. Westport Research will also begin testing of the ISXG engine to reach a 0.2 g/bhp-hr NOx emission levels by 2008.

The trucks being deployed in California will be powered by Cummins ISX engines using liquefied natural gas (LNG) fuel systems and are targeted to meet U.S. EPA 2007 emission standards (DieselNet, 2004).

C. Long Term Engine Availability (2010 and beyond)

In 2004 U.S. EPA published its second review outlining the status and progress of engine and vehicle technology toward meeting the federal 2007 standards for heavy-duty diesel vehicles (U.S. EPA 2004). In its report, U.S. EPA concluded that manufacturers will meet the 2007 and 2010 standards in a two step process and that "engine manufacturers' 2007 compliance plans are a building block for the technology package they plan to use to meet the 0.20 g/bhp-hr NOx standard in 2010." Thus, it is likely that selective catalytic reduction (SCR) and NOx adsorbers for NOx reduction, along with further improvements in engine technology, such as Clean Diesel Combustion, will play a large role for diesel technology in 2010 and beyond.

An U.S. EPA research team, with industry partners, is developing a low NOx diesel engine system called Clean Diesel Combustion (CDC). CDC technology utilizes management of the in-cylinder combustion process as the primary control for NOx reduction. In laboratory testing, the CDC system has demonstrated very low NOx emissions without the use of NOx after-treatment.

CDC technology relies upon in-cylinder NOx control, where NOx emissions are reduced in the engine combustion chamber. In-cylinder NOx control is achieved through advances in technology in the engine's fuel system, boost control, EGR and PM aftertreatment systems. CDC technology may be scaled to both light-duty and heavy-duty applications. The key features of CDC technology include the following:

- A hydraulically-intensified fuel system to lower PM emissions while improving engine efficiency,

- A boost system which increases engine power and the efficiency of the combustion process, thus reducing emissions and increasing fuel economy,
- Cooled low pressure exhaust gas re-circulation which lowers peak combustion temperatures, reducing the formation of NOx, and
- After treatment to reduce remaining PM, unburned hydrocarbons, and carbon monoxide in the exhaust.

Several engine and vehicle manufacturers are working to advance this technology with U.S. EPA research team. These industry partners include both automotive manufacturers and heavy-duty diesel engine manufacturers. Detailed test results have been publicly disclosed for small-bore "automotive" sized engines.

Two after treatment technologies that will most likely play a large role in meeting the 2010 NOx standard are selective catalytic reduction (SCR) and the NOx adsorber.

SCR catalysts that use ammonia as a NOx reductant have been used for control of NOx emissions from stationary sources for a number of years. Urea may also used as the source of ammonia for SCR catalysts, and such systems are commonly referred to as urea SCR systems. In recent years, considerable effort has been invested in developing urea SCR systems that could be applied to heavy-duty diesel vehicles with low sulfur diesel fuel. Urea SCR systems were introduced in 2003 and 2004 in European passenger cars and will be used to comply with the EURO IV heavy-duty diesel emission standards. The actual introduction dates in some countries will be earlier than the EURO IV implementation requirements because of tax incentives in those countries to promote early technology introduction (United States Environmental Protection Agency, 2004).

Transit agencies that received an alternative NOx strategy exemption under title 13, CCR, section 1956.2(c)(8) or (d)(9) were required to conduct a demonstration of an advanced NOx after treatment system that could reduce NOx emissions by 70 percent or more on buses operating in urban bus revenue service. Staff is monitoring the demonstration of an ammonia SCR system on urban buses being conducted by the seven transit agencies that received the exemption.

Three SCR NOx after treatment devices were selected, produced and installed by Extengine for demonstration on three urban buses. Initiated in October 2002, VTA conducted baseline and emissions testing prior to placing the buses into revenue service. Preliminary data submitted in January 2004 are favorable and buses continue operating in revenue service (VTA, undated).

Unlike catalysts, which continuously convert NOx to N_2, NOx adsorbers are materials that store NOx under lean conditions and release and catalytically reduce the stored NOx under rich conditions. NO and NO_2 are acidic oxides and can be trapped on basic oxides. Fuel sulfur can be converted to stable sulfates providing competition with NOx for storage sites, thus poisoning the catalysts. NOx adsorber catalysts have a wide operating temperature window and thermal stability consistent with diesel applications

and are capable of providing NOx conversions in excess of 90 percent over much of the operating range. However, fuel intended for adsorber regeneration is wasted if it reacts with O_2 instead of with NOx. The additional heat generated by excessive combustion may induce thermal desorption of NOx.

D. Alternative Fuel Experiences by End-Users

In March and April of 2005, ARB staff surveyed management personnel of waste collection companies and municipalities that collect solid waste in the District through telephone and on-site interviews (Appendix C). The survey's purpose was to gather information from hauling companies that had been operating under the District's Rule 1193 regarding their experiences with using alternative fuel collection vehicles. Staff also used the phone and on-site contacts to elicit records that we required for developing the engine inventory.

Staff ultimately talked with 27 waste collection companies and municipalities. In some cases, however, a single entity operates more than one waste collection fleet within the District. For instance, Waste Management, Inc. operates 11 separate fleets within the District, many operating under names other than Waste Management. The Los Angeles Department of General Services operates more than 700 collection vehicles out of several terminals, or staging yards, in Los Angeles. Thus, through surveying these 27 companies and municipalities, staff was able to survey more than 50 percent of the companies operating in SCAQMD, including the largest companies, for a total fleet survey representing about 4,300 vehicles or approximately 85 percent of the District's collection vehicles.

Since the District's Rule 1193 has been in effect since July 1, 2001, ARB was able to glean from fleet operators actual experiences they have had in converting to and operating alternative-fuel collection vehicles. Staff collected information on the experiences hauling companies have had to date with alternative-fuels and also elicited opinions on what impact the expanded use of alternative fuels would have on these companies.

The results of the survey indicate a wide variety of opinions and experience with alternative-fuel collection vehicles. However, it is fair to say that there is broad dissatisfaction with the older models of natural gas engines. Engines such as the Mack E7G were described as underpowered and very prone to repeated break downs. Waste Management (WM), the state's largest waste collection company, said the Mack E7G engines in their fleet had an average cost of repair more than twice that of comparable diesel engines. The company listed problems with this engine that included multiple failures of electronic components, injector and turbocharger failures, valves breaking, fuel tank vacuum failure and other problems.

WM described better reliability for the Cummins 8.3C engine. However, it was also stated that this engine also lacks the horsepower and torque to perform on any but WM's lightest routes. The new Cummins 8.9L L-Gas Plus engine may provide both the

power and durability waste haulers seek. However, this engine has not been in use long enough to provide a track record by which to judge it.

Other waste haulers also commented on the lack of power and torque with alternative-fuel vehicles as well as a lack of range, saying that they used them mostly on routes that were mainly level and shorter rather than on and longer routes that included hills. Frequent breakdowns and more expensive repairs were common complaints among haulers using alternative fuel vehicles.

Data on costs and fueling infrastructure of natural gas vehicles can be found in the infrastructure appendix.

E. Diesel Emission Control Systems for Collection Vehicles

Staff's proposal envisions one compliance option to be the retrofit of new diesel collection vehicles with verified diesel emission control systems. The primary function of compliant systems would be to reduce emissions of NOx, but 2005 to 2006 engines would also require diesel PM reductions. The discussion below, therefore, emphasizes NOx reduction technology, and in particular two leading candidates. A more general discussion is presented in the Technical Support Document.

To qualify as a compliant emission control system, a product must be verified under ARB's Diesel Emission Control Strategy Verification Procedure (title 13, CCR, sections 2700-2710). Although the primary purpose of the Procedure is to verify diesel PM reductions, it can also be used to verify NOx reductions. A complete and up-to-date list of verified systems and the engine families for which they have been verified can be found on-line at: http://www.arb.ca.gov/diesel/verifieddevices/verdev.htm.

1. Lean NOx Catalyst

While not currently verified for 2005 and 2006 diesel collection vehicles, the lean NOx catalyst has the potential to help heavy duty diesel engines comply with the proposed requirements for those years. By injecting hydrocarbons (e.g., diesel fuel) upstream of a catalyst in a vehicle's exhaust system the lean NOx catalyst system is able to reduce NOx emissions by approximately 25 percent. It does not reduce PM emissions by itself, but can be combined with other controls such as diesel particulate filters.

At present, there is one lean NOx catalyst system verified for a wide range of on-road 1993 through 2003 diesel engines: the Cleaire Longview. The Longview system includes a particulate filter and has certain exhaust temperature requirements for proper functioning. The duty cycle of some collection vehicles may be such that the exhaust temperature is not sufficient for proper operation of the Longview system. The Longview is verified for 25 percent NOx reduction, which if applied to an engine certified at 2.0 g/bhp-hr NOx would comply with this rule during 2005 to 2006. However, it would not provide sufficient NOx reduction to meet the proposed performance standard for

2007 through 2009 engines and it is uncertain whether they will carry the technology beyond 2003 MY engines.

2. Selective Catalytic Reduction

Selective catalytic reduction (SCR) systems are similar to lean NOx catalyst systems in that a reductant is injected into the exhaust stream to react with NOx in the presence of a catalyst. SCR systems use either ammonia or urea and can achieve a wide range of NOx reductions, as high as 90 percent. As with lean NOx catalyst systems, SCR systems can be used in conjunction with various PM control strategies, including oxidation catalysts and diesel particulate filters.

Because of its potential for large NOx reductions, SCR technology would be a good candidate for a retrofit system that could enable 2007-2009 diesel collection vehicles to meet the proposed requirements. About an 80 percent reduction would be required for a 1.2 g/bhp-hr NOx engine to meet the level of 0.2 g/bhp-hr. Owners of collection vehicles interested in this option would need to ensure a continuous supply of reluctant for the system to function properly.

It is uncertain if any SCR retrofit manufacturers will have verified product available for 2007 through 2009 diesel engines. There is, however, one SCR system verified at present: the Extengine ADEC system. The ADEC is verified to achieve an 80 percent NOx reduction and a 25 percent PM reduction. Although the verification is currently limited to certain off-road engines only, the same basic technology could potentially be effective in on-road applications.

VIII. REGULATORY ALTERNATIVES (No Alternative Recommended)

In order to ensure that a regulatory proposal provides the greatest amount of emission reductions, ARB staff explores several possible options. In this proposal three possible alternatives were evaluated by staff.

A. Do Not Adopt This Regulation

There are approximately 5,000 collection vehicles in the District. Of these, fewer than 1,000 are operated on alternative fuels. The collection vehicles that continue to run on diesel fuel contribute significant amounts of NOx and PM to the District's air. Rejecting this regulation would mean losing a reduction of 0.3 tons per day of NOx or less between now and 2020. The magnitude of the NOx reductions is relatively small; however, the District needs large reductions in NOx to meet the ozone and fine particle standards.

B. Rely On Voluntary Compliance

Rule 1193 went into effect for fleets of 50 or more on July 1, 2001, and for fleets of 15 or more on July 1, 2002. Since those dates, operators of waste collection vehicles have

shown little inclination to move away from diesel fuel and embrace the use of alternative fuels. Some appear to be hanging on to older diesel collection vehicles for as long as possible to avoid purchasing new vehicles which would have to be alternative fuel under the District's fleet rule. Of the 27 companies and municipalities surveyed by ARB, 15 were using alternative fuels and 12 continue to use only diesel. Of the 12 entities using only diesel, virtually all said they prefer to continue using diesel rather than alternative fuels. Among the 15 currently using alternative fuels, seven said they would be reluctant to expand use of alternative fuel vehicles because of engine unreliability, costs, or lack of sufficient infrastructure. Several said incentive funding should be provided to those willing to expand their use of alternative fuel.

Staff reviewed data from 11 small companies and municipalities with fleets of 14 or fewer vehicles in the District (15 or more vehicles being the point where the District's Rule 1193 applied). One small municipal fleet had purchased two alternative-fuel vehicles while the other ten continued using only diesel fuel.

Staff concludes, therefore, that relying on voluntary actions would not result in purchase of the lowest emitting vehicles available.

C. Adopt a NOx level of 0.9 g/bhp-hr for 2007-2009 purchases

At the April 2005 workshop, staff solicited input from stakeholders on what might be an appropriate level for the NOx performance standard for 2007 through 2009 low emission purchases. The draft regulatory language included a range from 0.2 to 0.9 g/bhp-hr that was under consideration.

Most diesels in the 2007 to 2009 timeframe will be certified at the 1.2 g/bhp-hr level. Lean NOx catalyst retrofit technology that is currently verified to give a 25 percent NOx reduction could, in principle, reduce NOx emissions to a 0.9 level. As such, the 0.9 level would make the diesel retrofit compliance option a more concrete possibility than a lower level that required an as-of-yet unverified retrofit technology.

Through the workshop process, staff identified several problems with establishing a 0.9 g/bhp-hr NOx performance standard. One problem with this option is that although lean NOx catalyst technology is verified for many on-road engines today, the manufacturer of this retrofit technology indicated that it is not going to pursue the 2007 through 2009 diesel engine market. These engines will be substantially different from today's diesels due to the addition of filters and sophisticated engine management strategies to control both active regeneration and more aggressive exhaust gas recirculation. They will therefore be less amenable to retrofit than today's engines.

Two additional problems with the 0.9 g/bhp-hr NOx level relate to the size of the expected reductions and cost-effectiveness. A 25 percent reduction from 1.2 g/bhp-hr, itself a small number, would result in relatively small emissions benefits. Based on experience with currently verified NOx retrofit technology and discussions with NOx retrofit manufacturers, staff estimates that there would not be a large difference in cost

between the technologies that would be used to meet the 0.9 and 0.2 g/bhp-hr levels. As a result, the cost-effectiveness of the 0.9 g/bhp-hr option is much worse than that of the latter. Therefore, staff has proposed that the performance standard for purchase of new collection vehicles be set at 0.2 g/bhp-hr NOx.

IX. ECONOMIC IMPACT

The proposed amendments would require owners of solid waste collection vehicles who operate in the District to purchase vehicles that meet the proposed emissions requirements. The proposal would affect purchasing decisions primarily between the years 2006 and 2009, involving an estimated 1,035 collection vehicles.

Staff believes that the proposed regulation would impose significant additional costs to owners of collection vehicles in the District, but that it would not cause significant adverse impacts in California employment, business status, or competitiveness.

A. Legal Requirement

Sections 11346.3 and 11346.5 of the Government Code require state agencies proposing to adopt or amend any administrative regulation to assess the potential for adverse economic impact on California business enterprises and individuals. The assessment shall include consideration of the impact of the proposed regulation on California jobs; on business expansion, elimination, or creation; and on the ability of California businesses to compete in other states.

State agencies are also required to estimate the cost or savings to any state or local agency or school district in accordance with instructions adopted by the Department of Finance. This estimate is to include nondiscretionary costs or savings to local agencies, and the costs or savings in federal funding to the state.

B. Affected Businesses

Businesses that may be affected by the proposed regulation include privately-owned solid waste collection companies that operate in the District; manufacturers of diesel engines, alternative-fuel engines, alternative-fuel vehicle system components, alternative-fuel fueling stations, collection vehicles, and emission control system retrofit devices; providers of alternative and diesel fuels; and distributors and installers of emission control systems. Since no heavy-duty engine or collection vehicle manufacturer, either diesel or alternative fuel, is based in California, most impacts to these businesses, both positive and negative, would occur in other states. Several manufacturers and distributors of emission control systems, however, are based in California and could experience market growth as a result of the proposed regulations, were any to verify a system that could allow for retrofitting a diesel engine to meet the requirements.

Most, but not all, waste collection companies are California businesses, but the majority of collection vehicles are owned by companies based in other states. The largest companies that provide waste collection services in the District are Waste Management, which is headquartered in Houston, Texas; Allied Waste Corporation, headquartered in Scottsdale, Arizona; and Republic Industries, Inc. which is headquartered in Fort Lauderdale, Florida. All three are publicly-traded companies.

C. Estimated Costs to Public and Private Collection Vehicle Owners

The proposed regulation would impose costs on both private and public owners of solid waste collection vehicles in the District. It would require owners to purchase vehicles that meet the proposed emission performance standards for NOx and PM when they add vehicles or replace vehicles in their fleets. Staff expects that the proposed requirements would impose additional costs on owners because they would most likely require the purchase of alternative-fueled vehicles or retrofits for new diesel engines. Both options would be more costly than buying a conventional diesel vehicle alone.

Staff estimated the potential cost to owners by examining the most likely compliance option, which would be the purchase of alternative-fueled vehicles. Factors included in this cost estimate include the capital cost of trucks, operations and maintenance costs (including fuel), and the capital cost of installing fueling stations for alternative fuels. Staff also considered a retrofit compliance option, SCR technology as an example. Specific cost estimates, assumptions, and the economics methodology used are detailed in Appendix D.

Staff estimates that the total additional cost from complying with the proposal would range from $31.6 million to $82.7 million over 15 years (2006 through 2020) (Table 5). The high cost estimate assumes the purchase of alternative-fuel (LNG) trucks, and includes differential costs for the vehicle, operations and maintenance, and new fueling stations. Of the $82.7 million, about $56 million (or about two thirds) comes from additional capital costs, while the remaining $27 million comes from additional operations and maintenance costs.

Although there is currently no verified diesel emission control system that would allow owners to meet all of the requirements, staff also considered the potential cost of SCR retrofit systems for comparison (Table 5). This low-cost estimate assumes that all new vehicles purchased are diesels that are retrofitted with an SCR system. The total incremental cost is about $32 million, which is dominated by capital costs. Operations and maintenance costs are primarily from the required use of a supplemental reactant, either urea or ammonia, which would be required for SCR systems. The assumptions behind the costs in Table 3 are found in Appendix D.

Table 5. Estimated Cost of Compliance with Proposal

Compliance Option	Item	Incremental Cost (2005 $)
Alternative fuel (LNG collection vehicles)	Capital [a]	$ 55.6 million
	Operation and Maintenance [b]	$ 27.1 million
	Total Incremental Cost	**$ 82.7 million**
Diesel retrofit (SCR systems)	Capital [c]	$ 30.5 million
	Operation and Maintenance [d]	$ 1.1 million
	Total Incremental Cost	**$ 31.6 million**

a. Includes the incremental cost of purchasing 1,035 LNG collection vehicles between 2006 and 2009 and 10 LNG refueling stations.
b. Includes the incremental cost of LNG fuel and additional maintenance and repair costs.
c. Includes the cost of 1,035 SCR retrofit systems and another 1,035 replacement units 10 years later.
d. The incremental cost the cost of supplying urea.

D. Potential Impact on Other Businesses

If adopted, the proposed purchasing requirements could have a positive impact on manufacturers and distributors of alternative-fuel engines, alternative-fuel vehicle components, alternative fuels and fueling stations, and diesel emission control systems. The proposal would expand the market for these manufacturers, in particular over the 2006-2009 timeframe. Diesel-related businesses, such as diesel engine manufacturers and diesel fuel suppliers may experience reduced demand in proportion to the increased demand for alternative-fuel related products. To the extent that diesel emission control systems are used, the diesel-related businesses would not be impacted negatively.

E. Potential Impact on Business Competitiveness

The proposed amendments apply equally to all owners of solid waste collection vehicles that operate within the District regardless of where their companies are based. They have the impact of removing the doubt associated with the District's Rule 1193 over whether private companies that contract for collection services are included within the scope of the rule. Each of California's top three publicly-traded waste collection companies also operate in the District, thus this rule would affect each equally and not give one a competitive advantage over the other. Larger companies in general, however, may be more able to absorb the additional costs than smaller companies. While it can be argued that the advantages of scale exist regardless of the regulatory climate, they may be more pronounced under this proposal because companies that typically purchase used collection vehicles would most likely no longer be able to do so.

There may also be an impact on the competitiveness of California companies relative to out-of-state companies. Large companies that operate in various states would only have increased operating costs for the portion of their fleet in the District. For companies that operate in the District exclusively, their entire fleet would be affected and thus their expenses would be proportionally higher. The same situation could arise relative to companies that operate in multiple air districts within California as well.

Concerning the other businesses addressed previously in "Section B. Affected Businesses", staff does not expect the proposed regulation to impact the ability of those based in California to compete with businesses in other states. All such businesses would be providing goods and services to customers (collection vehicle companies) that were subject to regulations that had no relationship with a business' location.

F. Potential Impact on Employment

Staff expects that the proposed regulations would result in the expanded use of alternative fuels, related technologies, and diesel emission control systems. To meet increased demand for these products, there would likely be job creation. At the same time, employment may decrease somewhat in diesel-related businesses if owners by and large select the alternative fuel route.

G. Potential Impact on Business Creation, Elimination or Expansion

The proposed amendments are expected to have no impact on business creation or elimination. However, limited business expansion may result from increased demand for alternative-fuel related products and diesel emission control systems.

H. Potential Cost to Local and State Agencies

Both public agencies and private companies that own collection vehicles in the District would be required to follow purchasing requirements if the proposal were adopted. Because the purchase rate tends to be higher with publicly owned fleets, however, staff expects that a disproportional amount of the costs would be incurred by public agencies.

Public agencies own about 29 percent of the estimated total 5,000 collection vehicles in the District. The City of Los Angeles alone, which has half of all publicly-owned collection vehicles, purchases about 100 new collection vehicles each year. That is a large fraction of the 260 new vehicles staff estimated would be purchased each year in the District between 2006 and 2009. For the purposes of determining the costs to public agencies with collection vehicle fleets, staff considered public agency purchase rates between 30 and 50 percent of the District total. The results for the alternative fuel compliance option are shown in Table 6 below.

Table 6. Estimated Cost to Public Fleets

Alternative Fuel Compliance Option	Item	Incremental Cost (2005 $)
30% of all SCAQMD purchases	Capital [a]	$ 16.7 million
	Operation and Maintenance [b]	$ 8.2 million
	Total Incremental Cost	**$ 24.9 million**
50% of all SCAQMD purchases	Capital [c]	$ 27.8 million
	Operation and Maintenance [b]	$ 13.7 million
	Total Incremental Cost	**$ 41.5 million**

a. Includes the incremental cost of 310 LNG collection vehicles between 2006 and 2009 and 3 LNG fueling stations.
b. Federal excise tax not included in diesel and LNG fuel costs.
c. Includes the incremental cost of 517 LNG collection vehicles between 2006 and 2009 and 5 LNG fueling stations.

If public fleets were to purchase new collection vehicles at a rate proportional to their size (about 30 percent of District collection vehicles), staff estimates that the cost of compliance under the alternative fuel option through 2020 would be about $25 million. Because public agencies will likely purchase new vehicles at a greater rate, the second estimate in Table 6 above may be more accurate. Purchasing 50 percent of all new collection vehicles in the District, public agencies would incur an estimated additional cost of $42 million.

I. Cost to the Average Household Receiving Waste Collection Service

Municipalities or collection vehicle owners directly, may pass on to ratepayers the cost to implement the proposed regulations. Staff estimated the annual expected increased cost of solid waste collection services per household by dividing the total dollar costs that businesses and individuals may incur from the proposed regulation over its lifetime, about $83 million, by the number of estimated households in SCAQMD.

Statewide, there are an estimated 12.3 million households (ARB 2003). The fraction of households in SCAQMD can be estimated based on the fraction of California's population in Los Angeles, Orange, Riverside, and San Bernardino Counties. Data from the California Department of Finance show that fraction was about 46 percent in 2004 (DOF 2004). Staff therefore estimates that there are about 5.7 million households in SCAQMD. The total cost per household, over the 2006 to 2020 timeframe, would therefore be approximately $15, or $1.00 annually. This estimated cost per household includes residential and commercial solid waste and recycling services. By comparison, ARB's existing collection vehicle rule, which focuses on cleanup of vehicles currently in operation, increases per household costs $12, or $0.70 annually (ARB 2003).

X. ENVIRONMENTAL IMPACTS AND COST EFFECTIVENESS

The proposed regulation would result in reductions in emissions of NOx from collection vehicles that are purchased in the 2006 through 2009 model years, and reductions in emissions of PM from 2006 model year vehicles. The estimated reductions are small relative to baseline emissions and would be costly to achieve, but nevertheless would provide reductions needed to meet the ozone and fine particle air quality standards. While staff's proposal would not require that these reductions be achieved via the purchase of alternative-fuel vehicles, that is the most likely path to compliance. Staff does not expect significant toxic emissions from these vehicles in light of the effective oxidation catalyst technology that they currently use.

A. Benefits Within the South Coast Air Quality Management District

If adopted, the proposed regulations would result in reduced emissions of NOx of approximately 0.3 tpd each year to 2020 (Table 7). The percent reduction from the baseline ranges from four to nine percent over those years.

Table 7. Collection Vehicle NOx Emissions and Reductions - SCAQMD

NOx	2000	2005	2010	2015	2020
Baseline (tpd)	11.6	10.5	7.3	5.5	3.5
Proposal (tpd)	11.6	10.5	7.0	5.2	3.2
% reduction	0	0	4	5	9

The cumulative NOx reduction through the year 2020 amounts to about 1,590 tons, which is about 4.5 percent of the total NOx emissions from SCAQMD collection vehicles from 2006 to 2020 (Table 7). NOx reductions peak at about 0.3 tons per day following the purchase of the last group of vehicles in 2009. Staff notes that this reduction is quite small compared to the decline in baseline NOx emissions attributed to turnover (7 TPD between and 2020.) Therefore, even a small reduction in new vehicle purchasing (possibly done to avoid or delay purchasing alternative fuel vehicles) could reduce or eliminate these benefits.

Emissions of PM would only be reduced from the collection vehicles purchased in 2006 since all 2007 and subsequent heavy-duty on-road engines, whether diesel or alternative fuel, will meet the same 0.01 g/bhp-hr standard. In addition, reductions in PM emissions from 2006 engines could only be counted for 2006 through 2009 as ARB's existing in-use collection vehicle rule requires that BACT to reduce PM emissions be applied to 2006 model-year engines in the 2009-2010 timeframe. Therefore, staff expects no significant PM reductions relative to district-wide baseline levels.

The situation is similar for non-methane hydrocarbons (NMHC) and carbon monoxide (CO). The proposed requirements set no specific limits for these pollutants. Any changes in their emissions would be incidental and dependent on the particular

technologies chosen by owners. Emissions of both NMHC and CO are expected to be extremely low for 2007 and subsequent diesels, and so like PM, benefits could perhaps be achieved for 2006 vehicles only. Again, staff expects no significant NMHC or CO reductions relative to district-wide baseline levels.

B. Cost-Effectiveness of Proposal

The cost-effectiveness of the proposal is expressed as the total cost of implementation divided by the cumulative emissions of NOx reduced. For the alternative fuel compliance option, the total cost is about $83 million. Dividing by the total NOx reduction of 1,590 tons, cost-effectiveness is about $52,000 per ton. For the diesel retrofit compliance option, assuming verified retrofit technologies become available which is quite uncertain at this time, the total cost is about $32 million, giving a cost-effectiveness of $20,000 per ton. To place the costs in context, most recently adopted mobile source regulations for NOx or HC have a cost effectiveness of $10,000 per ton or less.

C. Potential Negative Impacts

1. Toxics from Diesel and Alternative Fuel Engines

Historically diesel engines were perceived as having higher PM and higher toxic emissions than similar natural gas engines. Natural gas engines were typically thought of as "low emission", as emitting less PM and NOx, than their diesel counterparts (Ahlvik et al 2000; Clark et al 1995; Clark et al 1999; Ayala et al 2002). However, with the advent of after treatment technologies such as diesel oxidation catalysts and diesel particulate filters, and the fact that vehicle exhaust is a complex composition of many compounds, not just PM and NOx, the assumption that natural gas engines are inherently less polluting than diesel equipped with after treatment was called into question.

To address this issue, ARB led a multi-agency research effort to compare emissions from diesel and natural gas engines and transit buses. The study evaluated natural gas (NG) and diesel bus engines with and without exhaust aftertreatment. Summarized in Table 13 is a comparison of emissions based on this study. For NOx, natural gas engines are cleaner until 2010 (assuming a 0.2 g/bhp-hr NOx engine is certified in 2007). Beginning in 2002, diesel bus engines were equipped with a particulate filter, and natural gas engines utilized an oxidation catalyst. As a result, PM emissions are equivalent. Since both the oxidation catalyst and the diesel particulate filter oxidize most toxic compounds, natural gas bus engines since 2002 have roughly equivalent toxic emissions as diesel engines.

Table 8. Emission Comparison - Diesel Truck vs Natural Gas Truck

Model Year Truck	Truck Emission Standards (g/bhp-hr)		Natural Gas, Compared to Diesel, Is Typically:		
	NOx	PM	NOx	PM	Other Toxics
Mid-1990s to 2002 (diesel w/o filter and NG w/o catalyst)	4	0.1	50% cleaner	3 times cleaner	Varies
Today (2003 - 2006) (diesel w/ filter and NG w/o catalyst	~2.2[1]	0.1	25% cleaner	8 times cleaner	Same
2007 (diesel w/ filter and NG w/ catalyst	1.2	0.01	Same*	Same	Same
2010 (diesel w/ filter + absorber and NG w/ 3-way catalyst	0.2	0.01	Same	Same	Same

* A few natural gas engines may comply with the 2010 NOx standard by 2007, in which case they would be ~80% cleaner.

2. Ammonia Slip from Selective Catalytic Reduction

Selective catalytic reduction systems that may be used as retrofits or as part of new engine technology to meet the proposed requirements have the potential for ammonia emissions. A selective catalytic reduction system injects ammonia or urea into the exhaust gas stream to react with NOx in the presence of a catalyst. Such systems, if not carefully designed or calibrated, could potentially release excess ammonia into the atmosphere. In general, the possibility of ammonia slip increases with the desired NOx reduction, as more ammonia must be used to reduce more NOx. However, given the relatively modest percentage reductions expected (80 percent reduction to reduce a 1.2

g/bhp-hr engine to 0.2 g/bhp-hr), highly aggressive SCR systems will likely not be necessary.

Furthermore, careful calibration and use of a clean-up oxidation catalyst can virtually eliminate ammonia slip. To ensure that ammonia emissions do not become a problem, the diesel emission control system verification procedure requires that ammonia slip not exceed 25 parts per million on average. Although there are no SCR systems currently verified for on-road use, there is one verified for off-road use. Several companies have expressed interest in verifying SCR systems for on-road use in the near future.

XI. ISSUES

Over the course of development of this proposal, staff has met many times with various stakeholders and received written and verbal comments. Although staff has considered each comment, not all issues could be resolved. The following is a discussion of major outstanding issues.

A. Proposal is a De Facto Alternative-Fuel Standard

For the 2005 model year, the only new engines certified to the proposed 1.8 g/bhp-hr NOx emission performance standard are alternative fuel engines. Staff projects the same situation for the 2006 model year. No retrofit devices are certified to sufficiently reduce NOx emissions from current diesel engines to meet the proposed performance standard. It is technically possible that manufacturers of currently verified NOx retrofit devices (lean NOx catalyst and SCR) could extend their verifications to these newer engines, but it is not known at this time if they will do so.

For the 2007 through 2009 model years, testimony at workshops indicates that at least two manufacturers of natural gas engines will certify to the proposed 0.2 g/bhp-hr NOx performance standard. No diesel engines are expected to certify to this standard. It is possible a manufacturer of SCR retrofit technology may verify its technology to allow a conventional diesel engine to meet the performance standard, but this remains uncertain at this time.

Beginning in 2010, staff expects both diesel and natural gas engines to certify to the 0.2 g/bhp-hr NOx standard applicable to all heavy duty engines sold in that year.

Thus, between now and 2010 the most likely path of compliance is purchase of natural gas engines. From 2010 on, both natural gas and diesel engines are expected to be available. Based on surveys of waste collection vehicle generators, most would purchase diesel engines once available.

Proponents of natural gas engines state that the proposed rule will provide the incentive for engine manufacturers to continue to develop and certify natural gas engines, allowing the fledgling market to grow. They also believe there is risk that the diesel engine manufacturers will fail to develop the technology to allow the diesel engine to

comply with the national 2010 standards, and this will force a rollback. They point out that natural gas engines will comply with the standard in 2007, three years earlier, and that this is the technology that we can be sure will provide low emissions for the future. Staff agrees that several natural gas engines will likely meet the 0.2 g. standard in 2007.

Engine manufacturers and many fleet operators have stated that the proposed rule will require purchase of natural gas engines for four years, at which time the diesel engines they favor will be compliant. For those not already committed to alternative fuel engines, this could create substantial costs in facilities, training, parts, and fueling infrastructure for a technology they do not plan to continue purchasing beyond 2009. They note that the emission benefits are small, not particularly cost effective and the rule will require considerable process and uncertainty regarding requests for exemptions that they expect will be needed for some vehicle purchases (as has been the case with the current District rule).

Staff believes that the above positions and concerns, although sometimes in stark contrast with each other, have merit. However, staff has not been able to identify an approach that achieves emission reductions similar to the District rule that also addresses the concerns of all the stakeholders. Thus the proposed rule will likely require the purchase of alternative fuel collection vehicles by operators who do not wish to purchase them, for the four years from 2006 to 2009.

B. Issues Related to Federal Clean Air Act Waiver of Preemption

Some workshop commenters challenged California's authority to adopt and enforce fleet regulations in SCAQMD based on federal statutory preemption. Federal Clean Air Act (CAA) section 209(a) preempts states and localities from adopting or enforcing any standard relating to the control of emissions from new motor vehicles or new motor vehicle engines. Notwithstanding this general preemption of state authority for new engines and new vehicles, CAA section 209(b) expressly authorizes U.S. EPA's Administrator to waive the preemption for California.

One challenge is based on the view that ARB will not be able to obtain a waiver of preemption for state standards under CAA section 209(b) because the Board's regulations are subject to the requirements of CAA section 202(a)(3)(C). Section 202(a)(3)(C) requires that in adopting standards, U.S. EPA's Administrator is to provide specified periods of lead-time and stability to classes or categories of new heavy-duty vehicles or engines. As the text of the provision itself dictates, the provision is not applicable to California:

> Any *standard promulgated or revised under this paragraph* and applicable to classes or categories of heavy-duty vehicles or engines shall apply for a period of no less than 3 model years beginning no earlier than the model year commencing 4 years after such revised standard is promulgated. [Italics added for emphasis.]

The text states that "standards promulgated or revised under this paragraph," that is, under CAA section 202(a), must provide the specified lead-time and stability. In the person of the Administrator, U.S. EPA prescribes standards under 202(a). Clearly the provisions apply to U.S. EPA.

California, however, does not promulgate its standards under the grant of authority in section 202(a). California promulgates vehicular emission standards under grants of authority in state law[4] and under the waiver of federal preemption of state standards contained in CAA section 209(b). Since section 202(a)(3)(C) is only applicable to standards promulgated under section 202(a) and since California does not promulgate its standards under 202(a), the provision does not apply to California. And, if the provision does not apply, its specified lead-time and stability requirements do not apply to California.

The inapplicability of CAA section 202(a)(3)(C) to the standards that California promulgates is also consistent with the legislative history of the CAA and the waiver of federal preemption. The legislative history of the waiver provision has emphasized that California is to have "the broadest possible discretion in selecting the best means to protect the health of its citizens." H.R.REP No. 95-294, at 302-02, quoted in Motor and Equipment Manufacturers Association, Inc. v. Environmental Protection Agency.[5] Other courts have also frequently noted that Congress consciously chose to permit California to blaze its own trail.[6]

A second challenge is based on the view that U.S. EPA will need to grant waivers of preemption under CAA section 209(b) prior to the enforcement of any aspect of the proposals. ARB already has waivers of preemption for all of the types of emissions and categories of new engines and new vehicles to which the proposed regulations would apply. For this reason, any new waiver would be needed only for those aspects of the regulations for which California has never before been granted a waiver of preemption. For any aspect of the regulations for which waivers have already been granted, ARB's practice has been to request confirmation that the regulations are within the scope of the previous waivers and to pursue enforcement against new engines and vehicles already covered by the waiver of preemption. For those aspects of the proposal that apply to in-use engines and vehicles, no waiver of preemption is needed since the preemption applies only to new vehicles and new vehicle engines.

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[4] California Health & Safety Code Division 26.

[5] 627 F.2d 1095, at 1110 (D.C.Cir. 1979).

[6] Ford Motor Co. v. EPA, 606 F.2d 1293, at 1297 (D.C.Cir. 1979); Engine Manufacturers Association v. U.S. EPA, 88 F.3d 1075, at 1080 (D.C.Cir. 1996), Motor and Equipment Manufacturers Association, Inc. v. Nichols, 142 F.3d 449, at 463 (D.C.Cir. 1998).

It is also noteworthy that, notwithstanding the legal arguments, there is no substantive argument that lead-time or stability is needed. The lead time and stability requirement was added to the Clean Air Act to assure that when new, more stringent emission standards are adopted, adequate time will be provided to allow the development and validation of new technologies, and to prevent the standards from being changed too frequently. The performance standards proposed by staff differ in that they do not require the development and validation of new technologies. Instead, the rule would require the fleet operator to purchase the cleanest of available engines. If no engine meeting the performance standard is available, a higher emitting engine can be purchased. In this context, there is no need for lead time or stability since engine manufacturers are not required by the rule to produce cleaner engines.

C. Waiver Process Will Delay Rule Implementation and Reduce Benefits Achieved

When the U.S. Supreme Court ruled that a purchase requirement is in fact an emission standard under the federal Clean Air Act, implementation of the District rule required a waiver of federal preemption. The ARB determined that only the state can request a waiver of federal preemption, and that the rule subject to the request must be adopted by the state. This is the principle reason for this proposal being brought before ARB for consideration.

Stakeholders have pointed out that it can take several years following board adoption before a waiver is received from U.S. EPA. This does not usually create a problem because most requests for a waiver involve a regulation that includes lead time to develop new knowledge and will be implemented in three to four years. In the case of this proposed rule, the benefits of the rule accrue only from now until the end of 2009. If the waiver process takes several years, much of the benefit of the rule will be lost.

The ARB staff believes the rule qualifies as "within the scope" of a previous waiver. In such instances, ARB can implement the rule immediately. However, the Engine Manufacturers Association disagrees with the staff's position, and may challenge our waiver request. Discussions with U.S. EPA also have not resulted in a definitive picture of how it will approach ARB's waiver request. Thus, there is uncertainty regarding when the rule, if adopted, can be implemented, and any substantial delay will reduce the emission reductions achieved.

XII. STAFF RECOMMENDATION

The proposed modifications, as described herein, are consistent with the authority of ARB to control emissions from mobile sources. Adoption of this proposal would achieve the emission reductions from collection vehicles envisioned in SCAQMD Rule 1193. Upon approval staff will request a waiver of federal preemption from EPA, which is required to enforce this regulation.

XIII. REFERENCES

1. Abbey, David E., Nishino, Naomi, McDonnell, William F., Burchette, Raoul J., Knutsen, Synnove F., Beeson, W. Lawrence, Yang, Jie X. 1999. Long-term Inhalable Particles and Other Air Pollutants Related to Mortality in Nonsmokers. Am J Respir Crit Care Med 159:373-382.

2. Ahlvik, P.J.E., Brandberg, A.R.L. 2000. Relative Impact on Environment and Health from the Introduction of Low Emission City Buses in Sweden, SAE Tech. Paper 2000-01-1882.

3. ARB 2000. Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles. October 2000. http://www.arb.ca.gov/diesel/documents/rrpapp.htm.

4. ARB 2003. Staff Report: Initial Statement of Reasons, Supplemental Report, Proposed Diesel Particulate Matter Control Measure for On-Road Heavy-Duty Residential and Commercial Solid Waste Collection Vehicles. August 8, 2003. http://www.arb.ca.gov/regact/dieselswcv/dieselswcv.htm

5. ARB 2005. Review of the California Ambient Air Quality Standard for Ozone, California Environmental Protection Agency, Air Resources Board. http://www.arb.ca.gov/research/aaqs/ozone-rs/ozone-final/ozone-final.htm#Summary

6. Ayala, A., Kado, N.Y., Okamoto, R.A., Holmen, B.A., Kuzmicky, P.A., Kobayashi, R., and Stiglitz, K.E. 2002. Diesel and CNG Heavy-duty Transit Bus Emissions over Multiple Driving Schedules: Regulated Pollutants and Project Overview. Journal of Lubricants and Fuels, SAE Transactions, Vol. 111, pp. 735-747 (Also SAE Tech. Paper 2002-01-1722)

7. Ayala, A., Gebel, M.E., Okamoto, R.A., Rieger, P.L., Kado, N.Y., Cotter, C., and Verma, N. 2003. Oxidation Catalyst Effect on CNG Transit Bus Emissions. SAE Technical Paper 2003-01-1900.

8. Beeson, W. Lawrence, Abbey, David E., Knutsen, Synnove F. 1998. Long-term Concentrations of Ambient Air Pollutants and Incident Lung Cancer in California Adults: Results from the AHSMOG Study. Environmental Health Perspectives 106: 813-822.

9. Clark, N. N., Gadapati, C. J., Kelly, K., White, C. L., Lyons, D. W., Wang, W., Gautam, M., and Bata, R. 1995. Comparative Emissions from Natural Gas and Diesel Buses. SAE Tech. Paper 952746.

10. Clark, N. N., Gautam, M., Rapp, B. L., Lyons, D. W., Graboski, M. S., McCormick, R. L., Alleman, T. L., and Norton, P. 1999. Diesel and CNG Transit Bus Emissions

Characterization By Two Chassis Dynamometer Laboratories: Results and Issues. SAE Tech. Paper 1999-01-1469.

11. Dab, William, Segala, Claire, Dor, Frederic, Festy, Bernard, Lameloise, Phillipe, Le Moullec, Yvon, Le Tertre, Alain, Medina, Sylvia, Quenel, Phillipe, Wallaert, Benoit, Zmirou, Denis. 2001. Air Pollution and Health: Correlation or Causality? The Case of the Relationship between Exposure to Particles and Cardiopulmonary Mortality. Journal of the Air and Waste Management Association 51: 220-235.

12. Department of Finance (DOF). 2004. Tables of July 2004 County Estimates Ranked by Size, Numeric and Percent Change. http://www.dof.ca.gov/HTML/DEMOGRAP/repndat.htm

13. Dunn, M. 2003. State of the Art and Future Developments in Natural Gas Engine Technologies. Proceedings of the 9th Diesel Engine Emissions Reduction Conference, Newport, RI.

14. Erkkila, K., Nylund, N., Ikonen, M., and Laurikko, J. 2004. Evaluating Exhaust Emission Performance of Urban Buses Using Transient Heavy-Duty Chassis Dynamometer. Proceedings of the 10th Diesel Engine Emissions Reduction Conference, San Diego, CA.

15. Gauderman, W.J., E. Avol, F. Gilliland, H. Vora, D. Thomas, K. Berhane, R. McConnell, N. Kuenzli, F. Lurmann, E. Rappaport, H. Margolis, D. Bates, and J. Peters. 2004. The Effect of Air Pollution on Lung Development from 10 to 18 Years of Age. N Engl J Med 351:1057-67.

16. Gibbs, R. 2000. Un-Regulated Emissions from CRT-Equipped Transit Buses. 6th Diesel Engine Emissions Reduction Conference, San Diego, CA.

17. Kado, N.Y., R.A. Okamoto, P.A. Kuzmicky, R. Kobayashi, A. Ayala, M.E. Gebel, P.L. Rieger, C. Maddox, and L. Zafonte. 2004. Emissions of Toxic Pollutants from Compressed Natural Gas (CNG) and Low Sulfur Diesel-Fueled Heavy-Duty Transit Buses Tested Over Multiple Driving Cycles. Environmental Science and Technology, In review.

18. Lanni, T., Frank, B.P., Tang, S., Rosenblatt, D., and Lowell, D. 2003. Performance and Emissions Evaluation of Compressed Natural Gas and Clean Diesel Buses at New York City's Metropolitan Transit Authority. SAE Tech. Paper 2003-01-0300.

19. Lapin, C.A., Gautam, M., Zielinska, B., Wagner, V.O., and McClellan, R.O. 2002. Mutagenicity of emissions from a natural gas fueled truck. Mutation Research.

20. Lev-On, M., LeTavec, C., Uihlen, J., Alleman, T.L., Lawson, D.R., Vertin, K., Thompson, G.J., Gautam, M., Wayne, S., Zielinska, B., and Sagebiel, J. 2002.

Chemical Speciation of Exhaust Emissions from Trucks and Buses Fueled on Ultra-Low Sulfus Diesel and CNG. SAE Tech. Paper 2002-01-0432.

21. McConnell, R., Berhane, K., Gilliland, F., London, S., Vora, H., Avol, E., Gauderman, W.J., Margolis, H.G., Lurmann, F., Thomas, D.C., and Peters, J. M. 1999. Air Pollution and Bronchitic Symptoms in Southern California Children with Asthma. Environ Health Perspect 107:757-760.

22. McDonnell, William F., Nishino-Ishikawa, Naomi, Petersen, Floyd F., Chen, Lie Hong, Abbey, David E. 2000. Relationships of mortality with the fine and coarse fractions of long-term ambient PM_{10} concentrations in nonsmokers. Journal of Exposure Analysis and Environmental Epidemiology 10: 427-436.

23.Office of Environmental Health Hazard Assessment (OEHHA). May 1998. *Health Risk Assessment for Diesel Exhaust (Public and Scientific Review Panel Review Draft).* Office of Environmental Health Hazard Assessment, California Environmental Protection Agency. ftp.arb.ca.gov/carbis/regact/diesltac/partb.pdf.

24. Okamoto, R.A., Kado, N.Y., Kuzmicky, P.A., Ayala, A. and Kobayashi, R. Unregulated Emissions from Compressed Natural Gas (CNG) Transit Buses Configured with and without Oxidation Catalyst. Environmental Science and Technology. In review.

25. Peters, A; Dockery, DW; Muller, JE; Mittleman, MA. 2001. Increased Particulate Air Pollution and the Triggering of Myocardial Infarction. Circulation 103: 2810-2815."

26. Peters, J. M., Avol, E., Berhane, K., Gauderman J. W., Gilliland, F., Jerrett, M., Kunzli, N., London, S., Mcconnell, R., Navidi, B., Rappaport, E., Thomas, D., Lurmann, F., Roberts, P., Alcorn, S., Funk, T., Gong, Henry Jr., Linn, W. S., Cass, G., Margolis, H., 2004. Epidemiologic Investigation to Identify Chronic Effects of Ambient Air Pollutants in Southern California, University of Southern California. Prepared for the California Air Resources Board and the California Environmental Protection Agency, Contract No. 94-331. (www.arb.ca.gov/research/abstract/94-331.htm).

28. SCAQMD. 2000. Economic Assessment, Assumptions, Funding Sources, and Socioeconomic Report, Proposed Rule 1190 Series – Clean On-Road Vehicles, June 8, 2000.

29. SCAQMD. 2005. Implementtion Status of the South Coast Air Quality Management District Clean Fleet Vehicle Rules

30. Slowdoske, W.J. 2003. School Bus Emissions Study. Proceedings of the 9th Diesel Engine Emissions Reduction Conference, Newport, RI.

31. US EPA. 2004. Air Quality Criteria for Particulate Matter Office of Research and Development. EPA/600/P-99/002aF, EPA/600/P-99/002bF.

XIV. AVAILABILITY OF TECHNICAL SUPPORT

An electronic version of the technical support document for the proposal is available at http://www.arb.ca.gov/regact/scswcv05/scswcv05.htm. If you would like a hard copy of these documents please fill out this form and mail or fax it to:

Public Information Office
California Air Resources Board
P.O. Box 2815
Sacramento, CA 95812
Fax: (916) 445-5025

Please send the **TECHNICAL SUPPORT DOCUMENT: PROPOSED REGULATION FOR THE PROPOSED SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT FLEET RULES** to:

Name:_____

Address:_____

_____

_____

APPENDIX A

Proposed Regulation Order

Proposed Regulation Order

Amend the following sections of title 13, California Code of Regulations, to read as set forth in the following pages:

Amend:	
Section 2021.2	Methods for Determining Compliance for an Owner of Solid Waste Collection Vehicles

NOTE: This document is printed in a style to indicate changes to the preexisting regulation. The proposed amendments are shown in underline to indicate additions and ~~strikeout~~ to indicate deletions. The symbol "* * * * *" means that intervening text not being amended is not shown. Subsection headings are shown in italics and should be italicized in Barclays California Code of Regulations.

The text of sections 2020 and 2021, with amendments approved by the Board at its February 24, 2005 hearing but not yet final, is provided for information only. Amendments approved at that hearing to add language are shown in *italic underline*, and amendments deleting language are shown in ~~*italic strikeout*~~.

§ 2020. Purpose and Definitions of Diesel Particulate Matter Control Measures

(a) *Purpose*. Diesel particulate matter was identified in 1998 as a toxic air contaminant. According to California law, an airborne toxic control measure using the best available control technology shall, therefore, be employed to reduce the public's exposure to diesel particulate matter.

(b) *Definitions*. For the purposes of the rules specified in article 4, the following definitions apply:

"Alternative fuel" means natural gas, propane, ethanol, methanol, gasoline (when used in hybrid electric buses only), hydrogen, electricity, fuel cells, or advanced technologies that do not rely on diesel fuel. "Alternative fuel" also means any of these fuels used in combination with each other or in combination with other non-diesel fuels.

"Commercially available" means available for purchase and installation at a reasonable cost.

"Heavy-duty pilot ignition engine" means an engine designed to operate using an alternative fuel, except that diesel fuel is used for pilot ignition at an average ratio of no more than one part diesel fuel to ten parts total fuel on an energy equivalent basis. An engine that can operate or idle solely on diesel fuel at any time does not meet this definition.

"Level" means one of three categories of Air Resources Board-verified diesel emission control strategies: Level 1 means the strategy reduces engine diesel particulate matter emissions by between 25 and 49 percent, Level 2 means the strategy reduces engine diesel particulate matter emissions by between 50 and 84 percent, and Level 3 means the strategy reduces engine diesel particulate matter emissions by 85 percent or greater, or reduces engine emissions to less than or equal to 0.01 grams diesel particulate matter per brake horsepower-hour.

"Municipality" means a city, county, city and county, special district, or a public agency of the United States of America or the State of California, and any department, division, public corporation, or public agency of this State or of the United States, or two or more entities acting jointly, or the duly constituted body of an Indian reservation or rancheria.

"Owner" means the same as in title 13, California Code of Regulations, section 2180.1(a)(21).

~~*"Retirement" or "Retire" means an engine or vehicle will be withdrawn from an active fleet in California. The engine may be sold outside of California, scrapped, or used in a backup vehicle.*~~

"Transit agency" means a public entity responsible for administering and managing transit services. Public transit agencies can directly operate transit service or contract out for all or part of the total transit service provided.

"Terminal" means any place or places where a vehicle is regularly garaged or maintained, or from which it is operated or dispatched, which may include a private business or residence.

"Verified" means that a diesel emission control strategy or system has received approval from the Executive Officer according to the "Verification Procedure for In-Use Strategies to Control Emissions from Diesel Engines" in title 13, California Code of Regulations, commencing with section 2700, and incorporated by reference.

"Warranty Period" means the same as in title 13, California Code of Regulations, section 2707.

NOTE: Authority cited: Sections 39600 and 39601, Health and Safety Code. Reference: Sections 39002, 39003, 39650-39675, 43000, 43013, 43018, 43101, 43102, 43104, 43105 and 43700, Health and Safety Code.

§ 2021. Solid Waste Collection Vehicles

(a) *Scope and Applicability.* Sections 2021 and 2021.1 shall apply to municipalities that have a contract with owners for residential and commercial solid waste collection service. Sections 2021 and 2021.2 shall apply to solid waste collection vehicle owners, both private and government entities. These regulations mandate the reduction of diesel particulate matter emissions from 1960 to 2006 model year engines in on-road diesel-fueled heavy-duty residential and commercial solid waste collection vehicles with a manufacturer's gross vehicle weight rating greater than 14,000 pounds.

(b) *Definitions.* The definitions in Section 2020 shall apply to sections 2021, 2021.1, and 2021.2. In addition, the following definitions apply only to sections 2021, 2021.1, and 2021.2.

"Active fleet" means the total, by terminal, of an owner's collection vehicles, excluding backup vehicles.

"Backup vehicle" means a collection vehicle that is driven fewer than 1000 miles annually.

"Contract" means an agreement between an owner and a municipality to perform residential or commercial solid waste collection services, in which the contractor's compensation for providing services, or a formula for determining compensation, is specified.

"Contractor" means an owner with a contract as defined in this section.

"Residential and commercial solid waste" means all putrescible and nonputrescible solid, and semisolid wastes, including garbage, trash, refuse, rubbish, ashes, yard waste, recyclable materials, industrial wastes, demolition and construction wastes, abandoned vehicles and parts thereof, discarded home and industrial appliances, manure, vegetable or animal solid and semisolid wastes, and other discarded solid and semisolid wastes originating from single-family or multiple family dwellings, stores, offices, and other commercial sources, and construction and demolition projects in residential and commercial zones, not including hazardous, radioactive, or medical waste.

"Retirement" or "Retire" means an engine or vehicle will be withdrawn from an active fleet in California. The engine may be sold outside of California, scrapped, or used in a backup vehicle.

"Roll off vehicle" means any heavy-duty vehicle used for transporting waste containers such as open boxes or compactors that may be removed from the tractor.

"Solid waste collection vehicle or collection vehicle" means an on-road heavy-duty vehicle with a manufacturer's gross vehicle weight rating of greater than 14,000 pounds used for the purpose of collecting residential and commercial solid waste for a fee, including roll off vehicles.

"Total Fleet" means the total of an owner's collection vehicles, excluding backup vehicles.

NOTE: Authority cited: Sections 39600 and 39601, Health and Safety Code. Reference: Sections 39002, 39003, 39650-39675, 43000, 43013, 43018, 43101, 43102, 43104, 43105, and 43700, Health and Safety Code.

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§ 2021.2. Methods for Determining Compliance for an Owner of Solid Waste Collection Vehicles.

* * * * *

(g) *Purchase Requirements for an Owner Who Operates One or More Collection Vehicles in the South Coast Air Quality Management District.*

(1) When purchasing a collection vehicle or collection vehicle engine, or leasing a collection vehicle for an active fleet that operates within the jurisdiction of the South Coast Air Quality Management District, an owner shall comply with best engine selection/technology requirements as follows:

(A) A California-certified engine that meets the applicable criterion specified in subsection (g)(2), or

(B) A California-certified engine with a verified diesel emission control strategy that reduces emissions of NOx and PM to the applicable criterion specified in subsection (g)(2), as determined by the verified performance of the strategy and engine combination.

(2) The best engine selection/technology is defined by the following criteria:

(A) *2005-2006 Model Year Engine:* The collection vehicle shall be equipped with an engine certified to the optional NOx plus NMHC standard of 1.8 g/bhp-hr or lower and to the corresponding PM standard of 0.03 or lower g/bhp-hr as specified in title 13, California Code of Regulations, section 1956.8 (a)(2)(A).

(B) *2007 and subsequent Model Year Engine:* Beginning January 1, 2007, the collection vehicle shall be equipped with an engine certified to the 2007 and subsequent standards specified in title 13, California Code of Regulations, section 1956.8 (a)(2)(A), provided the declared NOx FEL of the engine does not exceed 0.20 g/bhp-hr and the declared PM FEL of the engine does not exceed 0.01 g/bhp-hr or meet these specified requirements using the combination of technologies as specified in subsection (g)(1)(B).

(3) *Exemptions.* The Executive Officer shall grant an exemption from the provisions of subsection (g) to an owner demonstrates to the Executive Officer's reasonable satisfaction that the owner meets one of the conditions specified below. In order to qualify for an exemption, the owner must apply to the Executive Officer in writing at least 120 days prior to committing to the purchase of a non-compliant vehicle or engine.

An owner may apply to the Executive Officer for an exemption to the provisions of section (g)(1) for the conditions specified below. An owner shall apply to the Executive Officer in writing at least 120 days prior to committing to the purchase of a non-compliant vehicle or engine.

(A) *Compliant technology not available.* An owner shall demonstrate that no compliant engine and chassis configuration or verified diesel emission control strategy is commercially available for purchase or lease by providing information including, but not limited to, the bid specifications of the vehicle, the number of vehicles, a list of all manufacturers that have been solicited and all responses. The owner shall in addition list the manufacturer, model, rated horsepower, rated torque, and fuel type of the engines the owner proposes to purchase or lease.

(B) *Compliant technology available but cannot be used.* An owner shall demonstrate why commercially available technology cannot be used and in addition shall provide a list of vehicles proposed to be purchased of leased instead that includes the manufacturer, model, rated horsepower, rated torque, and fuel type of the engines.

(C) *Fuel Not Available.* An owner may apply for an exemption if an owner's only option for compliance is to purchase an alternative-fueled vehicle but the required fuel is not available. The owner shall describe why the fuel is not available with reasons including, but not limited to, the locations of the nearest public fueling station and reasons why the owner cannot build its own fueling station. The owner must list all public stations located at transfer stations and landfills that it can access. The Executive Officer shall not grant an exemption if the Executive Officer determines that fuel is sufficiently available at these transfer stations and landfills.

~~(g)~~(h) *Non-Compliance.* The Executive Officer or his/her designee may bring an action for civil penalties as specified in state law and regulations, including, but not limited to, Health and Safety Code Section 39674, for any violation of this section.

(i) *Severability.* Each provision of this section is severable, and in the event any provision is held invalid, the remainder remains in full force and effect.

NOTE: Authority cited: Sections 39600, 39601, and 39658, Health and Safety Code. Reference: Sections 39002, 39003, 39650 through 39675, 43000, 43013, 43018, 43101, 43102, 43104, 43105 and 43700, Health and Safety Code.

APPENDIX B

ENGINE AND EMISSIONS INVENTORY

I. CHARACTERIZATION OF THE SCAQMD ENGINE INVENTORY

A. Methodology

ARB staff estimated the total number of affected vehicles and companies in the SCAQMD based on a combination of information, including ARB's Diesel Retrofit Implementation and Evaluation Database (DRIED), supplemental data provided by the SCAQMDM, and surveys of companies. Using a list generated from these data, staff sent a letter to approximately 128 entities identified as being possibly affected by the rulemaking activity. Staff requested that owners send us records as required in title 13, CCR, Section 2021.2 (f), along with additional information on contract and rate status.

The recording keeping requirement in Section 2021.2(f) specifies that fleet owners shall maintain a list by vehicle identification number of collection vehicles identifying each vehicle type; engine manufacturer, model year, family, and series; and status as active fleet or back-up vehicle. Correlated to each vehicle, they must also provide information on any diesel emission control strategy, including its serial number, manufacturer, model level, installation date, and if using a Level 1 or 2 verified diesel emission control strategy, the reason supporting this choice. In addition, for all diesel emission control strategies, owners must maintain records of maintenance, and if employing a fuel or fuel additive as a diesel emission control strategy, they must provide the most recent two years worth of records of purchased that demonstrate usage.

For a vehicle designated as a backup, the mileage as of January 1 of each year must be provided, and if an owner is claiming an exemption for an engine near retirement, the retirement date of the vehicle is required. For any vehicles participating in a demonstration or experimental program, the owner must provide test plan records, including the start and end dates of the experiment; device manufacturer name and contact information (representative, address, and phone number); name and type of experimental diesel particulate matter emission strategy; and targeted data to be generated by the experiment.

Lastly, all owners are required to provide a signed statement of compliance prepared beginning January 1, 2005, and renewed each January 1 thereafter until January 1, 2013, certifying that the owner's engines are in compliance as required, including required language specified in the regulation as well as the owner's name, business address, and business telephone number. All aforementioned information must be provided to the ARB upon request.

The ARB request letter resulted in very few responses, so staff followed up on the mailed letter with telephone calls, e-mails and site visits. A second survey requesting additional information on in-use experiences was conducted in conjunction to on-site visits. Thirty-one fleet reports were returned in time to be incorporated into this staff report. Site visits, telephone surveys, and data from

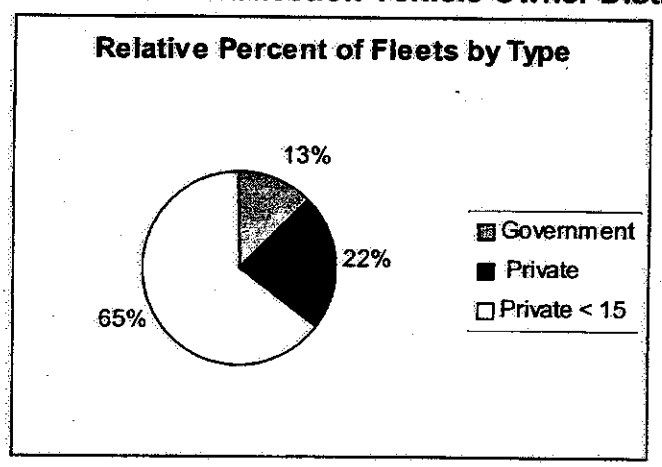
the SCAQMD resulted in 20 additional fleets, for a total of 51 companies. Based on ARB's estimate of the actual number of collection fleets in the SCAQMD, we collected detailed information for about 78 percent of the estimated vehicle total for 2005. However, for some of the summary information, survey results were used in lieu of the fleet return numbers if there was a discrepancy between the fleet information and other information, and/or if the returns appeared to be potentially inaccurate or incorrect. In addition, multiterminal operations having the same owner were only counted as a single entry.

B. Results

Based on all these data, the staff estimates the 2005 population of collection vehicles operating in the SCAQMD covered by this rule to be approximately 5,000. From 2006 though 2009, staff expects that approximately 1,035 new collection vehicle will be purchased. In 2010, all engines, including those engines (or engine plus retrofit combinations) used to comply with BEST requirements must be certified to 0.2 g/bhp-hr NOx and therefore it is not appropriate to include post-2009 engine purchases.

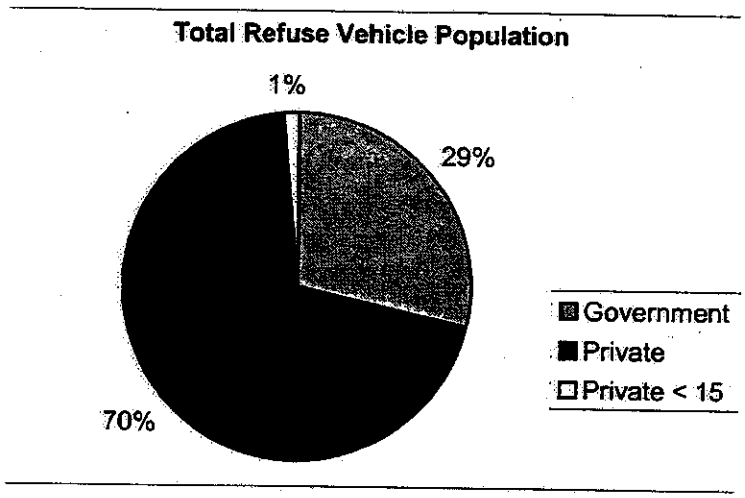
Government, small private (less than 15 vehicles), and large private operators are represented by their relative percent contribution to the total composition of South Coast companies (Figure 1). These estimates are primarily derived from the DRIED database supported by information from the other data sources. DRIED data was used in this case as it represented the most comprehensive listing of companies. Although some companies may no longer exist and/or have been bought out by larger entities, this approach provides the best opportunity to capture the small fleets. We estimate that government entities represent 13 percent of the total fleets estimated as operating in the SCAQMD. Small private (less than 15 vehicles) and large private companies account for 65 and 22 percent of the companies.

Figure 1. Solid Waste Collection Vehicle Owner Distribution



Using the actual fleet information we have from the 51 entities, the number of vehicles housed in small private companies accounts for only about 1 percent of the total. Government held vehicles represent about 29 percent of the total vehicle inventory, with the bulk (70 percent) of the contribution coming from the large private operators (Figure 2). As previously mentioned, it is possible that small private fleets are underrepresented.

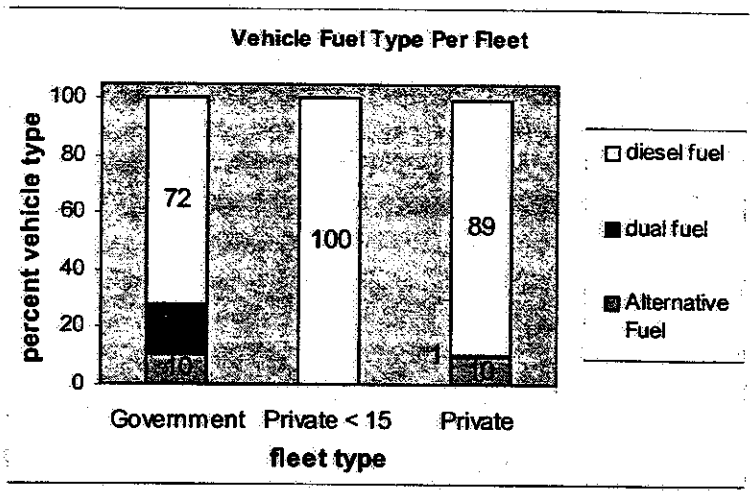
Figure 2. Solid Waste Collection Vehicle Population by Ownership



To estimate the proportion of the operators and vehicles using diesel versus alternative fuels, the ARB used information from all data sources. Because some sources only reported alternative fuel, and not the type of alternative fuel, the data are represented as simply the total number of alternative-fueled vehicles per fleet type. Therefore, alternative-fueled vehicles include LNG and CNG, while dual-fueled vehicles are counted separately.

The percent of government, private and small private operators having alternative-fueled trucks is shown in Figure 3. Alternative-fueled vehicles comprise about 10 percent of the government held vehicles, with another 18 percent of the fleet inventory being dual-fuel vehicles. Large private fleets include about 10 percent alternative-fueled vehicles with only 1 percent coming of their total inventory being dual-fueled vehicles. However, no small private operators, for which we have data, own alternative or dual-fueled vehicles.

Figure 3. Percent of vehicles per fuel type for government, small private and private fleets



When looking at the number of companies, rather than the individual vehicles in those companies, the data indicate that 100 percent of all the companies have diesel vehicles, in other words, there are no fleets that are solely alternative or dual-fueled vehicles.

II. EMISSIONS INVENTORY METHODOLOGY

The EMFAC model used by Air Resources Board (ARB) staff to estimate emissions benefits from the proposed amendments used the same parameters and assumptions as in the supplemental staff report for the original Solid Waste Collection Vehicle rulemaking (ARB 2003). These include emissions factors, the mileage accrual rate, the model year age distribution, and future populations. A review of the emissions model development is included below. For the present analysis, statewide emissions generated by the model were scaled down to reflect the current South Coast Air District population.

A. Review of SWCV Emissions Model Development

At the time the rule was under development, the EMFAC model used by ARB did not specifically address emissions from collection vehicles, and instead included them in the generic category of on-road heavy-duty diesel vehicles. Because the rule dealt only with collection vehicles, a more accurate model had to be developed. Towards that end, ARB staff gathered information on collection vehicle activity and emissions data.

1. Collection Vehicle Activity Data

The following collection vehicle activity data were gathered from different sources and analyzed:

- Accrual rate and cumulative mileage;
- Population and age distribution; and
- Vehicle mile traveled (VMT).

The accrual rate for collection vehicles, estimated to be 15,635 miles per year, is based on the annual mileage data gathered from three solid waste collection companies. Staff assumes that this average annual mileage would apply to collection vehicles of all model years.

A statewide collection vehicle population of 11,778 vehicles in year 2000 was obtained from the Department of Motor Vehicle (DMV) annual vehicle registration database. The age distribution for collection vehicles was also determined from the year 2000 DMV registration data.

Collection vehicle populations for future years were projected using statewide annual solid waste generation data from 1989 to 2000, which were provided by the California Integrated Waste Management Board. The projected future populations were adjusted for fleet attrition using survival rates that reflect the current age distribution of collection vehicles. Another adjustment was made to reflect the SCAQMD Rule 1193, which effectively prevented the purchase of new diesel-powered collection vehicles in the SCAQMD[1].

The collection vehicle daily VMT for a given year was estimated from the collection vehicle population and accrual rate using the following equation:

$$VMT = \Sigma\ (POP_i \times \text{Accrual Rate}_i),\ i = 1 \text{ to } 45$$

The collection vehicle accrual rate, cumulative mileage, and age distribution are shown in Table 1.

[1] The Rule 1193 adjustment for future diesel populations may at first appear to be inappropriate for use in the present analysis. However, the annual vehicle purchase rate that results from all the adjustments is about 5 percent of the total population per year. That purchase rate is reasonable to use, based on communications with California Refuse Removal Council staff.

Table 1. Accrual Rate, Cumulative Mileage, and Population Distribution

Age	Accrual Rate (mi/year)	Cumulative Mileage	Statewide Population*
0	15,635	15,635	306
1	15,635	31,270	586
2	15,635	46,905	361
3	15,635	62,540	287
4	15,635	78,175	728
5	15,635	93,810	707
6	15,635	109,445	592
7	15,635	125,080	632
8	15,635	140,715	355
9	15,635	156,350	977
10	15,635	171,985	686
11	15,635	187,620	987
12	15,635	203,255	503
13	15,635	218,890	455
14	15,635	234,525	460
15	15,635	250,160	431
16	15,635	265,795	522
17	15,635	281,430	186
18	15,635	297,065	344
19	15,635	312,700	290
20	15,635	328,335	297
21	15,635	343,970	420
22	15,635	359,605	212
23	15,635	375,240	147
24	15,635	390,875	80
25	15,635	406,510	56
26	15,635	422,145	42
27	15,635	437,780	36
28	15,635	453,415	32
29	15,635	469,050	15
30	15,635	484,685	12
31	15,635	500,320	12
32	15,635	515,955	5
33	15,635	531,590	4
34	15,635	547,225	3
35	15,635	562,860	1
36	15,635	578,495	3
37	15,635	594,130	3
38	15,635	609,765	3

*Year 2000 population in California.

2. Collection Vehicle Emission Rates

To estimate the emissions inventory for collection vehicles, staff used both the heavy heavy-duty (HHD) truck emission rates and emission rates derived from collection vehicle testing cycle (Table 2). HHD truck emission rates, which were based on test data collected over the Urban Dynamometer Driving Schedule (UDDS), were taken directly from EMFAC2000. In EMFAC2000, all HHD trucks were grouped into different model year (MY) groups based on emission characteristics and emission standards. Vehicles within the same MY group were assumed to have the same emission rates.

Average emission rates for collection vehicles in particular were calculated from test data collected over the New York Garbage Truck Cycle (NYGTC). Test data from six 1992 MY and eight 1994 MY collection vehicles were obtained from the National Renewable Energy Laboratory heavy-duty truck database. Emission rates for other model years were estimated from the rates of 1991 to 1993 and 1994 to 1997 groups using ratios of the emission rates of 1991 to 1993 or 1994 to 1997 HHD truck groups and the rates of other HHD truck groups.

The NYGTC simulates the operation of a collection vehicle on a metropolitan local street; that is, stop-and-go travel at low speed, picking up and emptying trash containers and compacting waste. The NYGTC does not include a collection vehicle's trip from its collection location to its designated dumpsite. Such a trip is typically highway or freeway type of driving and may be similar to the operation of a HHD truck. Operation information from solid waste collection companies shows the typical waste collection trip of a collection vehicle consists of activities on both local streets and driving on highways, although the fractions of the two can vary from location to location.

To reflect this observation, the NYGTC emission rates and EMFAC2000 HHD truck emission rates were combined using fractions of local street versus highway driving. The composite basic emission rate for a given MY group was calculated as follows:

$$BER_X = f\,BER_{NYGTC} + (1-f)\,BER_{HHDD} \qquad (3)$$

Where, BER_X is the composite basic emission rate for MY group x; BER_{NYGTC} and BER_{HHDD} are, respectively, the NYGTC and EMFAC2000 HHD truck emission rates for MY group x; and f is the fraction of trip on local streets. Data furnished by three solid waste collection companies showed that about half of a collection vehicle's travel was spent on local street picking up and compacting waste and the other half spent on highway en route to a dumpsite. In particular, an f value of 0.47 was used.

Table 2. NYGTC and EMFAC2000 HHD Truck Emission Rates (g/mi)

Model Year Group	Avg. NYGTC Emission Rates				EMFAC2000 HHD Truck Emission Rates*							
	HC	CO	NOx	PM	HC		CO		NOx		PM	
					ZM	DR	ZM	DR	ZM	DR	ZM	DR
Pre 1975	47.6	104	158	11.66	1.60	0.017	8.36	0.095	28.5	0.013	1.98	0.016
1975-76	43.2	97.0	150	10.89	1.45	0.017	7.81	0.095	27.2	0.013	1.85	0.016
1977-79	43.2	97.0	150	10.89	1.45	0.017	7.81	0.095	27.2	0.013	1.85	0.016
1980-83	43.2	97.0	150	10.89	1.45	0.017	7.81	0.095	27.2	0.013	1.85	0.016
1984-86	22.0	60.5	112	6.947	0.74	0.017	4.87	0.095	20.2	0.013	1.18	0.016
1987-90	10.1	30.8	92.9	4.945	0.34	0.009	2.48	0.065	16.8	0.015	0.84	0.008
1991-93	8.33	21.6	88.4	3.002	0.28	0.009	1.74	0.056	16.0	0.030	0.51	0.009
1994-97	3.21	13.2	92.1	1.050	0.19	0.016	0.84	0.068	19.1	0.042	0.32	0.010
1998	3.05	9.86	111	0.853	0.18	0.014	0.63	0.049	23.0	0.037	0.26	0.007
1999-02	3.05	9.86	64.5	0.853	0.18	0.009	0.63	0.031	13.4	0.013	0.26	0.003
2003-06	2.37	15.8	32.3	0.853	0.14	0.003	1.01	0.023	6.68	0.007	0.26	0.003
2007-09	1.52	10.1	17.8	0.0853	0.09	0.003	0.65	0.023	3.67	0.007	0.026	0.003
2010+	0.663	4.43	3.23	0.0853	0.039	0.003	0.283	0.023	0.668	0.007	0.026	0.003

* ZM = Zero mile emission rate; DR = Deterioration rate per 10,000 miles.

B. Characterization of Baseline Emissions

The baseline of the present analysis incorporates the application of Best Available Control Technology (BACT) to in-use collection vehicles, which was the subject of the original rulemaking. In particular, staff selected the retrofit implementation scenario "Potential 1" to characterize the baseline (Table 3). This scenario is described in detail in the 2003 staff report. Staff selected Potential 1 out of the three scenarios considered in the original rulemaking because it most closely reflects the situation today (i.e., diesel oxidation catalyst technology has been verified for use with 1988 and newer on-road engines).

Table 3. BACT Implementation Scenario - Potential 1

Group	Engine MY	%BACT	Implementation Date	Technology Option (By Percent Phase-In)			
				Level 1	Level 2	Level 3	Repower
1	1994-2002	10%	12/31/2004	2%		8%	
		25%	12/31/2005	7%		8%	
		50%	12/31/2006	17%		8%	
		100%	12/31/2007	40%		5%	5%
		25%	12/31/2005	15%			
		50%	12/31/2006	25%			
		100%	12/31/2007	45%			5%
1	1988-1990	10%	12/31/2004	10%			
		25%	12/31/2005	15%			
		50%	12/31/2006	25%			
		100%	12/31/2007	45%			5%
2	1960-1987	25%	12/31/2007	2.5%			22.5%
		50%	12/31/2008	2.5%			22.5%
		75%	12/31/2009	2.5%			22.5%
		100%	12/31/2010	2.5%			22.5%
3	2003-2006	50%	12/31/2009	21.5%		28.5%	
		100%	12/31/2010	21.5%		28.5%	
Percent of California's Collection Vehicle Fleet Total:				66%	0%	21%	14%

C. Characterization of the BEST Purchasing Scenario

The proposed amendments to the SWCV rule would affect new vehicle purchasing in the South Coast Air District. If adopted, staff's proposal would require owners of collection vehicles to purchase vehicles that meet Best Engine Selection/Technology (BEST) requirements. There would be no prescribed way to meet BEST requirements. Two potential routes for compliance would be purchasing alternative-fueled vehicles and retrofitting new diesel vehicles with verified diesel emission control systems.

The present analysis deals primarily with future engines that will rely on new technology to meet stringent future emissions standards. Because these engines are not available today, there are no chassis test data available on which to base emissions factors. Therefore, staff used the emission factors as derived in the original analysis for diesel collection vehicles that were consistent with BEST requirements.

Although BEST purchase requirements span 2005 and subsequent years, the scenario used by staff covered only 2006-2009. If adopted in July 2005, the

proposed rule would not affect a significant amount of 2005 MY purchasing, so that year was excluded. From 2010 onward, the proposed BEST requirements align with 2010 on-road heavy-duty engine standards and so no significant benefits would be gained from new purchases in that timeframe. Emissions benefits from cleaner collection vehicles would therefore come from 2006-2009 purchases.

For each year in the 2006-2009 window, staff modeled the new vehicle purchase rate at about 5 percent of the total population. Both the baseline and BEST purchasing scenarios used the same purchase rate. Staff from the California Refuse Removal Council indicated that 5 to 10 percent was reflective of typical purchasing rates, but that the actual future purchasing rate may be difficult to predict in light of the proposed purchase requirements.

C. Emissions Specific to the South Coast Air District

To estimate emissions specific to the South Coast Air District, staff multiplied the model's statewide results by a factor of 0.39. Data from the ARB survey of fleets in the South Coast combined with additional data from the SCAQMD's survey in 2004 show that there are approximately 5,000 collection vehicles in the South Coast Air District. This is about 39 percent of the estimated 2005 statewide population of 12,975 vehicles.

III. COLLECTION VEHICLE EMISSIONS INVENTORY

Using the above data and assumptions, staff calculated a baseline collection vehicle emissions inventory for calendar years 2000, 2005, 2010, and 2020 (Table 4). It includes implementation of BACT according to the Potential 1 scenario described above. The inventory takes into account the U.S. EPA 2007 heavy-duty diesel engine and 2006 low sulfur diesel fuel regulations. The emissions shown correspond to 39 percent of the total statewide emissions from collection vehicles.

Table 4. SCAQMD Collection Vehicle Emissions Inventory (tons/day)

Pollutant	2000	2005	2010	2020
NOx	11.6	10.5	7.3	3.5
PM	0.48	0.35	0.11	0.05

III. REFERENCES

ARB. 2003. Staff Report: Initial Statement of Reasons, Supplemental Report, Proposed Diesel Particulate Matter Control Measure for On-Road Heavy-Duty Residential and Commercial Solid Waste Collection Vehicles. August 8, 2003.

APPENDIX C

SOLID WASTE COLLECTION COMPANY SURVEY

I. Solid Waste Collection Company Survey

Staff interviewed 27 companies and public agencies that collect solid waste in the South Coast Air Quality Management District (SCAQMD). The private companies and municipal fleets surveyed (Table 1) account for approximately 4,300 solid waste collection vehicles or approximately 85 percent of the waste collection vehicles in the South Coast District.

Table 1. Private Companies and Municipalities Surveyed

Private Companies	Municipalities
Athens Services	Burbank
Big Bear Disposal	Culver City
Browning Ferris Industries	Glendale
Burrtec Waste Industries	Long Beach
Cal Met Services	Los Angeles DGS
Calif. Waste Services	Ontario
Commercial Waste Services	Pasadena
Consolidated Disposal Service	Pomona
CR&R (four fleets)	Redlands
Foothill Waste Reclamation	San Bernardino (city)
G&B Rubbish & Rolloff	Santa Monica
Palm Springs Disposal	Torrance
Key Disposal	
Rainbow Disposal	
Waste Management (11 fleets)	

Of the 27 entities interviewed, 15 are currently using alternative-fuel vehicles, including dual-fuel, which run on a combination of diesel and alternative fuel. The other 12 have only vehicles that run on standard CARB diesel or ultra low sulfur diesel. While ARB staff visited as many hauling facilities as possible for face-to-face interviews, some survey forms were completed as the result of telephone calls or returned by e-mail. In some cases, the initial survey results were supplemented by follow-up telephone calls, site visits or e-mails.

Questions 1 through 4 were designed to elicit specific information on the number of collection vehicles in the fleet, the number of diesel and alternative fuel vehicles, how long various fuels had been used, and whether the ability existed to re-fuel trucks in the

field. Questions 5 through 9 dealt with issues of maintenance and maintenance facilities for alternative fuel vehicles and additional staff training that might be needed to deal with maintenance of these vehicles. Question 10 was open-ended, asking for any additional comments the respondent wanted to make in connection with topics mentioned or not mentioned in the survey.

A. Survey Results

Private waste hauling companies and municipalities that do their own waste collection rely mainly on three types of fuels, diesel, compressed natural gas (CNG), and liquefied natural gas (LNG) to power their collection vehicles.

1. Fuel Usage

Diesel is the fuel with which virtually all haulers have the longest experience and greatest comfort level. Conversely, for most individuals in the hauling industry, experience with alternative fuels is relatively new and they have not reached the comfort level for these fuels that they have with diesel. Of those surveyed, 15 listed experience with alternative fuels ranging from six months to 10 years. The majority, however, listed three years or less experience with alternative fuels. Even with the District's Rule 1193 having been in effect for nearly three years, 12 of the fleet operators surveyed said they have only diesel collection vehicles in their fleets. ARB staff calculated approximately 5,000 collection vehicles in the District. Of this number, fewer than 1,000 are operating on alternative fuel or are dual-fuel vehicles with engines operating on a combination of diesel and alternative fuel. More than 4,000 collection vehicles in the District continue running on diesel alone.

2. In-Field Refueling:

Many haulers have told ARB that alternative-fuel vehicles have more limited range on a single fill up when compared to diesel vehicles. Therefore, the survey asked about their ability to fuel vehicles in the field. Fifteen respondents said they could refuel only diesel in the field while two said they could refuel CNG in the field and one said their fleet had the ability to refuel LNG in the field. It is worth noting that refueling diesel in the field can be as simple as bringing a can of diesel fuel to a stranded truck while alternative fuels require more sophisticated refueling equipment.

2. Maintenance Shop Modifications

Fire code and safety regulations for dealing with gaseous fuels add significantly to the expense of creating indoor service facilities where work can be done on alternative fuel vehicles. These facilities are required to have sensors to detect buildup of gas, fire alarm systems, and up-graded air circulation systems. Specialized tools are also required for working on alternative fuel vehicles. Eight respondents said they had modified their shops to handle alternative fuels at costs ranging from $150,000 (Waste Management) to $2 million (Los Angeles Department of General Services). Waste

Management reports modifications to maintenance facilities to handle alternative-fuel vehicles have run from $150,000 to $500,000, depending on the size of the facility and the extent of the modifications. Facilities that do not modify repair shops must work on alternative-fuel vehicles outside in the open air or send them to other repair facilities. The manager of Waste Management's 13-acre, 183-truck San Gabriel facility said he declined to up-grade his maintenance facility because it would have cost approximately $500,000. Three other respondents said they have not upgraded maintenance shops but estimated the costs of doing so from $700,000 to $1.5 million.

3. Fueling Station Costs

Survey respondents reported that the cost for an LNG fueling facility ranged from $600,000 to more than $2 million. Cost estimates for CNG were reported to be from $700,000 to more than $3 million. A more detailed discussion of fueling infrastructure is found in the infrastructure section of the Technical Support Document.

4. Down Time For Alternative-Fuel Vehicles

Of the individuals surveyed, nine said they have found that when there are problems with alternative-fuel vehicles they must be taken out of service for longer periods of time then diesel vehicles before they are repaired and back in service. Down time can run from several days to several weeks. One large hauling firm reported that an early alternative-fuel engine had an average cost of repair more than twice that of comparable diesel engines, and that the average number of repairs per vehicle for LNG units is three times higher than that of a diesel. It reported fewer repair problems with later model alternative fuel engines but that they still lack the horsepower and torque to work all but the lightest collection routes. It expressed hope that the new 8.9L Cummins L-Gas Plus engine would provide not only the required reliability but also the additional power necessary to be used to service an an expanded variety of routes.

5. Cost Of Trucks

Virtually all those interviewed were fairly consistent in their descriptions of the difference between the cost of a standard diesel waste collection vehicle and its alternative fuel counterpart. The consensus was that an alternative-fuel collection vehicle costs about $40,000 to $50,000 more than diesel. The City of Los Angeles provided data for their most recent purchase of collection vehicles showing a cost of $206,508 for LNG vehicles and $156,445 for diesel, a difference of $50,063 more for the LNG vehicles. Both were side-loaders meeting the same specifications. See Appendix D for more detailed information on vehicle costs.

6. Repair Costs

Eight of the survey respondents who have experience with alternative-fuel vehicles said repair costs for those vehicles are significantly higher than for diesel vehicles. Six

haulers said the costs for alternative-fuel and dual-fuel vehicle repairs ran respectively seven percent, 20 percent, 25 percent, 35 percent, 50 percent, and 100 percent more than their diesel counterparts. Many of these haulers also said that repairs are more complex and parts are more expensive for alternative fuel vehicles. One private hauler cited costs such as $656 for a diesel turbo-charger compared to $1,700 for LNG; diesel cylinder head $1,200 compared to $2,500 for LNG, and diesel electronic control module $600 compared to $1,800 for natural gas.

Conversely, however, three of the municipalities surveyed, Burbank, Ontario and Santa Monica, said the costs for maintaining alternative fuel vehicles was about the same as that for diesel trucks, though Ontario said parts are more expensive for alternative fuel vehicles. One municipality that has been using CNG for about eight years reported a preference of CNG to diesel because it brings cleaner air and is a renewable, domestic resource. It reported repair costs for both CNG and diesel trucks to be about the same and that the city would continue using alternative fuel trucks even without a mandate to do so.

7. Alternative-Fuel Vehicle Range

Five of those interviewed said they have found that alternative-fuel trucks, including dual-fuel trucks, travel less distance when filled with fuel than their diesel counterparts. Two respondents also said the alternative-fuel vehicles have less power and torque than diesel vehicles and therefore cannot be used for the range of jobs that diesel trucks perform. However, four of the respondents, all of them speaking for municipal fleets, said they found no problem with the range achieved by alternative-fuel vehicles.

8. Training Staff For Alternative-Fuel Vehicles

Fourteen responders who use alternative-fuel vehicles said staff must receive special training to operate and/or service these vehicles. In some cases haulers write staff training into their new-vehicle or engine purchases. Some haulers said they train their mechanics slowly, over the period when their alternative-fuel engines are still under warranty. Two responders set the cost at $3,000 for training a mechanic to work on alternative-fuel trucks. One responder discussed the need to educate everyone, from city council members on down, in the city's use of alternative-fuel vehicles and the need for continuing education on maintenance and safety issues.

SWCV (Rule 1193) FLEET SURVEY

FLEET BUSINESS NAME:_____

OWNER /MGR/SUPV/SUPT._____Date:_____

CA #_____TERMINAL # _____

QUESTIONS: (Please check or circle the desired answer)

1. Your SWCV fleet size, California_____ SCAQMD Area_____

Fuels Utilized----------

Propane_____
CNG_____
LNG_____
DUAL FUEL_____
CARB DIESEL_____
15 ppm or less---------- ULSD_____

2. What fuel is available for SWCV'S at fleet or contract facilities?

Propane_____
CNG_____
LNG_____
DUAL FUEL_____
CARB DIESEL_____
15 ppm or less ULSD_____

3, How long has SWCV'S used the following fuels?

Propane_____
CNG_____
LNG_____
DUAL FUEL_____
CARB DIESEL_____
15 ppm or less ULSD_____

4. Does fleet have refueling capability in the field for SWCV'S?
(Yes) (No)

Fuels----------

Propane_____
CNG_____
LNG_____
DUAL FUEL_____
CARB DIESEL_____
15 ppm or less ------ ULSD_____

5. Fleet maintenance shop modified to service alternative fueled SWCV'S? (Yes) (No)
(In progress) (Under construction) Please explain:

_____
_____
_____
_____

NOTES:

Fleet Staff: ARB Staff

1
2.
3.
4
5.
6.

Photo's attached (Yes) (No

NOTES:

Fleet Staff: ARB Staff: SCAQMD Staff:

1_____
2._____
3._____
4_____
5._____
6._____

_____ Photo's attached (Yes) (No)

Air Resources Board

9480 Telstar Avenue, Suite 4
El Monte, California 91731 www.arb.ca.gov

February 25, 2005

Mail-Out #MSC 05-06

TO: Owners of Solid Waste Collection Vehicles

SUBJECT: REQUEST FOR RECORDS

The Air Resources Board (ARB) adopted the Diesel Particulate Matter Control Measure for On-road Heavy-duty Diesel-Fueled Residential and Commercial Solid Waste Collection Vehicles in September 2003. As of December 31, 2004, all owners of solid waste collection vehicles are required to maintain specific records regarding their vehicles. The record keeping requirement is found in title 13, California Code of Regulations [CCR], section 2021.2 (f):

> **Record Keeping Requirement**. Beginning December 31, 2004, an owner shall maintain the following records. The owner shall provide the following records to an agent or employee of the Air Resources Board upon request for all collection vehicles in his total fleet subject to compliance with this regulation.

Per this requirement, I am hereby calling in the records specified in section 2021.2 (f)(1) for all vehicles housed in terminals located in the South Coast Air Quality Management District (SCAQMD). You are required to deliver these records, by e-mail, fax, or postal mail, within two weeks of the date of this letter, to the following location:

Dr. Nancy L. C. Steele
California Air Resources Board
9480 Telstar Avenue, Suite 4
El Monte, California 91731

Fax: (626) 575-6699
E-mail: swcv@arb.ca.gov

The information we are gathering will be used to assess the status of implementation of the rule, including the effectiveness of the rule in reducing emissions. In addition to this mandatory information request, we are also including in this letter an optional survey we would like you to fill out to help us determine the status of rate negotiations for the costs of implementing the rule.

We are requesting the records and survey information for vehicles in the SCAQMD at this time but plan to expand this survey throughout the state later this year. Therefore if you have vehicles located outside of the SCAQMD and would like to provide this information for all of your vehicles, please segregate the data into two groups – SCAQMD and other.

Please feel free to contact Ms. Annette Hebert, Chief, at (626) 575-6973 or by email ahebert@arb.ca.gov, or Dr. Nancy Steele, Manager, at (626) 350-6598 or by email nsteele@arb.ca.gov, if you have any questions or need additional information.

Sincerely,

/s/

Robert H. Cross, Chief
Mobile Source Control Division

Attachment

cc: Ms. Annette Hebert, Chief
Heavy-Duty Diesel In-Use Strategies Branch

Dr. Nancy Steele, Manager
Retrofit Implementation Section

APPENDIX D

COST ANALYSIS METHODOLOGY

I. METHODOLOGY

The proposed regulation would impose costs on both privately and publicly-owned solid waste collection vehicle fleets in the South Coast Air District. In order to estimate the potential magnitude of these costs, staff examined the most costly compliance option, which staff anticipates would be the purchase of alternative-fueled vehicles. In particular, costs reflect liquefied natural gas (LNG) vehicle technology, which tends to be preferred over compressed natural gas by collection vehicle owners. For reference, staff also examined a retrofit compliance option. In both cases, amortized capital costs, maintenance and repair costs, and fuel costs through the year 2020 were all brought to their present value and expressed in 2005 dollars.

From 2010 onward, staff anticipates that many unmodified diesel engines will be able to meet BEST criteria, and so the proposed amendments would not impose any special requirements on collection vehicle owners in that timeframe. Therefore, staff only considered new LNG vehicle purchases through the year 2009. Incremental maintenance and fuel costs on these vehicles, however, were accounted for through 2020. Staff also included the cost of constructing enough fueling stations to serve the vehicles purchased through 2009.

A. Capital Costs

The capital cost estimates used by staff in this analysis are shown in Table 1, below. Note that the LNG collection vehicle cost is expressed as an estimated incremental cost above that of a diesel vehicle.

Table 1. Capital Cost Estimates and Economic Parameters

Item	Cost/Value
LNG collection vehicle	$50,000 (incremental)
LNG Fueling Station (100 veh.)	$856,000
Diesel retrofit (SCR)	$20,000
Discount rate	5%
Amortization period	10 years
Capital Recovery Factor (CRF)	0.13

The $50,000 incremental cost for an LNG collection vehicle is a representative number for the difference in cost with a diesel vehicle today. It is based on discussions with various owners that have purchased both LNG collection vehicles and diesel vehicles. It is difficult to predict how this price differential may change in 2007 and subsequent years because both diesel and natural gas engines will undergo significant technological changes to meet stricter emissions standards. Given this uncertainty and the lack of any substantial cost data on future engines, staff elected to use the $50,000 increment for each year's purchases.

Staff used a new vehicle purchase rate of about 5 percent of the district-wide population per year[1]. Summing purchases from 2006 through 2009, the primary years of consideration, staff estimates approximately 1,035 new collection vehicles will be purchased. The $50,000 capital cost increment was applied to each of these purchases.

To accommodate the fueling needs of all the new LNG vehicles, staff included LNG fueling stations into the economic analysis. For each 100 new vehicles purchased, staff accounted for one new LNG fueling station at a cost of $856,000 each. A white paper on natural gas infrastructure written by staff of the SCAQMD lists actual LNG fueling station costs for collection vehicle fleets (SCAQMD 2005). The average cost of ten LNG fueling stations for privately-owned fleets comes out to $856,000 per station. Each station typically has a 15,000 gallon LNG storage tank which could conceivably fuel about 250 collection vehicles each day if vehicles used 50 gallons per day and the tank were refilled every day. However, such frequent refilling with LNG trucked in from other states is unrealistic given today's production levels. Staff therefore estimated 1 new station for every 100 new vehicles assuming a more realistic tank refilling rate of 2 times per week. Because the usage of existing fueling station capacity is not yet at 100 percent, it might be argued that a lower rate of fueling station construction should be assumed. Staff chose to err on the side of being conservative on this point. Therefore, staff's analysis includes the capital cost of 10 new fueling stations.

For the diesel retrofit cost comparison, staff chose to consider selected selective catalytic reduction (SCR) technology, which is one potential retrofit option. The estimated $20,000 capital cost is based on communications with SCR system manufacturers. Staff assumed that after 10 years, each SCR system would have to be replaced with a new one. Although the first round of SCR system capital costs were amortized, the replacement units were treated as lump sum capital costs in the years of purchase. This was done to account for the full capital costs before 2020.

Capital expenditures for the LNG vehicles, fueling stations, and the first round of SCR system purchases were all amortized over a period of ten years from the year of purchase with a 5 percent interest rate. Each year's costs for a given capital expenditure were calculated per the following equation:

$$\text{Annualized Capital Cost} = \text{CRF} * \text{Capital Cost}$$

where the capital recovery factor, CRF, is in turn given by the equation:

$$\text{CRF} = \frac{i(1+i)^N}{(1+i)^N - 1}$$

The CRF is determined by two parameters: N, the period (ten years) and i, the discount rate (5 percent).

[1] For details, see Appendix C: Emission Inventory.

Each year's annualized capital costs were brought back to their present value (2005) by multiplying by the present value factor:

$$\text{PV factor} = \frac{1}{(1+i)^n}$$

where n is the number of years from 2005.

B. Operation and Maintenance Costs

The operation and maintenance cost assumptions used by staff are shown in Table 2, below. As with the capital cost, note that the maintenance and repair cost per vehicle is cast as an incremental cost above that of a diesel vehicle.

Table 2. Operation and Maintenance Cost Estimates and Assumptions

Item	Value
LNG vehicle maintenance and repairs	$2,000/year/vehicle (incremental)
LNG fuel	$1.12/gallon
Diesel fuel	$2.00/gallon
Urea	$2.00/gallon
Annual engine operation	2600 hours
Diesel fuel consumption	2.48 gallons/hour
Annual diesel fuel consumption	6,450 gallons/vehicle
LNG to diesel fuel usage ratio (by vol.)	1.9
Annual LNG fuel consumption	12,300 gallons/vehicle
Annual urea consumption	58 gallons/vehicle

Staff selected a $2,000 per year incremental maintenance and repair cost for alternative fueled vehicles in the present analysis. In practice, there is a broad range of additional maintenance and repair costs, and a given fleet's experience depends on many variables. The trend, however, is that costs for alternative fueled collection vehicles have been significantly greater than for their diesel counterparts. Staff bases this conclusion on a limited amount of published data and numerous personal communications with owners during site visits and telephone calls. Very little actual cost data has been published comparing diesel and alternative fuel collection vehicles due to the sensitive nature of this information to the refuse industry and the fact that these vehicles have not been in service for a long time. Repair costs are often still covered by warranty, for example, and are not recorded. However, some published data or otherwise public data are available.

A refuse industry report issued in June 2003 (updated in 2005) by Environ Strategy Consultants does contain some detailed, specific cost information (Environ Strategy

Consultants, 2005). A fleet in the South Coast Air Basin tracked maintenance and repair costs from ten of its diesel collection vehicles and ten of its new dual-fuel collection vehicles over a period of 16 months from 10/31/01 to 2/26/03. Parts and labor costs averaged about $1035 more for each dual-fuel vehicle. The fleet also reported additional annual preventative maintenance costs which sum to $1005 per vehicle. Adding this number the $1035 figure scaled down to 12 months, the annual additional maintenance and repair cost per vehicle comes to about $1780.

A report produced by the National Renewable Energy Laboratory (NREL) in January 2001 detailed Waste Management's experiences with its dedicated LNG vehicles (Chandler et al, 2001). Researchers compared costs and performance of three diesel and five LNG collection vehicles in Waste Management's fleet over a period of 12 months from November 1998 to October 1999. The total maintenance cost per hour for the diesels averaged $5.95 while that for the LNG vehicles averaged $7.32. Multiplying by the hours of operation for each, the annual additional maintenance cost for the LNG vehicles averaged about $2,850 per vehicle.

The City of Long Beach submitted operating cost information to the SCAQMD as part of a Rule 1193 survey. It compared operating costs from three of its 2000 model year diesel vehicles with three of its 1996 model year CNG vehicles over a three-year period from 2001-2003. The annual parts and labor costs averaged $1,800 per diesel vehicle and $6,600 per CNG vehicle, giving an annual cost increment of $4,800 for each CNG vehicle.

The City of Ontario also submitted data as part of the SCAQMD survey, but had very different results. Ontario compared costs from four of its 2000 model year diesel vehicles with four of its 2003 model year CNG vehicles from January through October 2003. The result was that the labor and parts costs averaged $2,170 per diesel vehicle, which was actually $1,150 in excess of the $1,020 average for the CNG vehicles.

Out of all the published or public data discussed thus far, Ontario's are the only data that are for today's natural gas engine technology. Though the data are limited in scope and duration, they reflect what several owners have indicated qualitatively in personal communications with staff, namely that today's natural gas engines are performing noticeably better than earlier models. While this might suggest using an incremental maintenance and repair cost lower than the $2,000 per year selected by staff, there is yet another variable to consider. The 2007 natural gas engines will employ different technology from today's engines to achieve the 0.2 g/bhp-hr NOx emission level. Because of the uncertainty of the performance of this future technology, staff decided to take a more conservative stance and use the $2,000 per year estimate for each year.

The price per gallon of LNG and diesel fuel used by staff in this analysis are shown in Table 2. The price of LNG excluding taxes is assumed to be $0.90 per gallon based on conversations with LNG fuel suppliers. Staff applied state sales tax (8.25 percent) to this price in addition to federal and state excise taxes of 11.9 and 6 cents per gallon, respectively, giving a total cost of $1.15 per gallon. Because public fleets are exempt

from the federal excise tax and comprise 29 percent of the total fleet, staff weighted the price to arrive at a basin-wide average of $1.12 per gallon. The price of diesel fuel is particularly volatile and difficult to predict with any accuracy. For this analysis, staff examined rack diesel prices for Los Angeles over the past year and found an average price of about $1.46 per gallon. Staff applied state sales tax to this price in addition to federal and state excise taxes of 24.4 and 18 cents per gallon, respectively, and another 6 cents per gallon for transportation costs and profit margin. This gave a total cost of $2.07 per gallon. Weighting the price as for LNG to account for public fleets' federal excise tax exemption, the average basin-wide price comes to $2.00 per gallon.

For both LNG and diesel collection vehicles, staff assumed 2600 hours of engine operation per year based on survey data. Staff used detailed survey data from a fleet of 34 diesel collection vehicles of various types to determine the diesel fuel consumption rate of 2.48 gallons per hour. For the ratio of LNG to diesel fuel consumption, staff relied on two sets of data. Survey data from a fleet of 34 diesel and 125 LNG vehicles all doing approximately the same work showed that the LNG consumption was 2.1 times the diesel consumption on a gallons per hour basis. The NREL report cited earlier found the ratio to be 1.7, LNG to diesel. Staff took the average of these two, namely 1.9, for the present analysis.

Using the figures in Table 2, staff calculated that the annual incremental operation and maintenance cost for an LNG vehicle would be $2,900 per vehicle. Staff accounted for this extra cost through 2020. Each year's costs were brought back to their present value (2005) as described in the capital costs section above.

Staff also estimated the cost of continuously supplying urea to a diesel collection vehicle using an SCR retrofit. In communications with a supplier of urea for SCR systems, staff learned that $2 per gallon delivered is a representative price. The quantity of urea required for a given collection vehicle depends on how much total NOx must be reduced. In a report to the Engine Manufacturers Association, the company TIAX estimated that a 1 g/bhp-hr NOx reduction would require an amount of urea equivalent to 0.9 percent of the amount of diesel fuel consumed (TIAX 2003). Staff therefore estimated an annual urea consumption of approximately 58 gallons per vehicle.

II. RESULTS

The estimated costs through 2020 that are directly attributable to the proposed amendments are summarized below in Table 3. For the alternative fuel compliance option, the total additional costs come to about $83 million. Again, this is the estimated cost of what staff expects to be one of the most costly compliance options, namely purchasing LNG collection vehicles. Of the $83 million, about $56 million (or about two thirds) comes from additional capital costs, while the remaining $27 million comes from additional operation and maintenance costs. The example SCR retrofit option selected for comparison has a total incremental cost of about $32 million, dominated by capital costs.

Table 3. Estimated Cost of Compliance with BEST Requirements

Compliance Option	Item	Incremental Cost (2005 $)
Alternative fuel (LNG collection vehicles)	Capital	$ 55.6 million
	Operation and Maintenance	$ 27.1 million
	Total Incremental Cost	**$ 82.7 million**
Diesel retrofit (SCR systems)	Capital	$ 30.5 million
	Operation and Maintenance	$ 1.1 million
	Total Incremental Cost	**$ 31.6 million**

Tables 4 and 5 below show the year-by-year breakdown of the costs summarized in Table 3.

Table 4. Estimated Annual Costs – Alternative Fuel Compliance Option

Year	LNG Vehicles Purchased	LNG Fueling Stations Purchased	Discounted Incremental Capital Costs	Discounted Incremental O&M Costs	Total Annual Cost
2006	246	0	1,515,336	684,034	2,199,370
2007	256	2.5	3,198,127	1,330,186	4,528,312
2008	254	2.5	4,704,501	1,907,508	6,612,009
2009	279	2.5	6,196,244	2,488,262	8,684,505
2010	0	2.5	6,118,331	2,369,773	8,488,104
2011	0	0	5,826,982	2,256,927	8,083,908
2012	0	0	5,549,506	2,149,454	7,698,960
2013	0	0	5,285,244	2,047,099	7,332,343
2014	0	0	5,033,566	1,949,618	6,983,184
2015	0	0	4,793,872	1,856,779	6,650,651
2016	0	0	3,635,307	1,768,361	5,403,669
2017	0	0	2,384,811	1,684,153	4,068,964
2018	0	0	1,252,972	1,603,956	2,856,927
2019	0	0	139,974	1,527,577	1,667,551
2020	0	0	0	1,454,835	1,454,835
TOTAL	**1035**	**10**	**55,634,773**	**27,078,522**	**82,713,295**

Table 5. Estimated Annual Costs – Diesel Retrofit Compliance Option

Calendar Year	SCR Systems Purchased	Discounted Incremental Capital Costs	Discounted Incremental O&M Costs	Total Annual Cost
2006	246	606,135	27,161	633,296
2007	256	1,178,701	52,819	1,231,520
2008	254	1,690,277	75,743	1,766,020
2009	279	2,204,893	98,803	2,303,696
2010	0	2,099,898	94,098	2,193,996
2011	0	1,999,903	89,617	2,089,520
2012	0	1,904,670	85,350	1,990,019
2013	0	1,813,971	81,285	1,895,256
2014	0	1,727,591	77,415	1,805,006
2015	0	1,645,325	73,728	1,719,054
2016	246	4,068,228	70,217	4,138,446
2017	256	3,619,803	66,874	3,686,677
2018	254	3,074,801	63,689	3,138,490
2019	279	2,821,082	60,656	2,881,738
2020	0	0	57,768	57,768
TOTAL	**2069**	**30,455,279**	**1,075,224**	**31,530,502**

III. REFERENCES

Chandler, K.; Norton, P.; Clark, N. 2001. Waste Management's LNG Truck Fleet: Final Results. Alternative Fuel Truck Evaluation Project. U.S. Department of Energy. January 2001.

Environ Strategy Consultants, Inc. 2003. Natural Gas Vehicle/Engine Users Refuse Industry Report. June 18, 2003, updated February 2005.

SCAQMD 2005. Status Report of Natural Gas Infrastructure Expansion in the South Coast District. April 22, 2005.

SCAQMD. Rule 1193 survey data from the cities of Ontario and Long Beach.

TIAX 2003. SCR-Urea Infrastructure Implementation Study Final Report. Created for the Engine Manufacturers Association, July 30, 2003.

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

AIR RESOURCES BOARD

TECHNICAL SUPPORT DOCUMENT

PROPOSED REGULATION FOR THE PROPOSED SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT FLEET RULES

July 2005

This report has been reviewed by the staff of the California Air Resources Board and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Air Resources Board, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

State of California
California Environmental Protection Agency
AIR RESOURCES BOARD

Technical Support Document for the Proposed Regulations for the South Coast Air Quality Management District Fleet Rules

Table of Contents

I. Summary 2
II. Introduction 3
III. Engine Technology and Availability 3
1. Current Engine Availability 4
a. Diesel-fueled Engines 4
b. Alternative Fuel Engines 5
2. Mid-term Future Engine Availability (2007 – 2009) 5
a. Diesel-fueled Engines 6
b. Alternative-fuel Engines 7
3. Long Term Engine Availability (2010 and beyond) 9
IV. Diesel Emission Control Strategies 11
A. Diesel Oxidation Catalyst 11
B. Passive Diesel Particulate Filters 11
C. Active Diesel Particulate Filters 12
D. Lean NOx Catalyst 12
E. Selective Catalytic Reduction 13
F. NOx Adsorbers 13
G. Crankcase Filters 13
H. Exhaust Gas Recirculation 13
I. Alternative Diesel Fuels 14
J. Fuel Additives 14
K. Future plans 15
V. Goals and Implementation of Alternative Fuels Programs 15
VI. Infrastructure for Alternative Fuels 17
VII. References
Appendices
A Diesel Engine Availability
B Status Report of Natural Gas Infrastructure Expansion in the South Coast District
C Distribution of Alternative Fuel Stations within the South Coast Air Quality Management District

I. Summary

The staff of the Air Resources Board (ARB) has conducted this technical review in support of its proposed regulations for diesel particulate matter (PM) and oxides of nitrogen (NO_x) from fleets of transit buses, school buses, and refuse collection vehicles in the South Coast Air Quality Management District (SCAQMD).

This report describes the availability of heavy duty engines (diesel and alternative fuel) and hybrid technology for transit buses, solid waste collection vehicles, school buses, and other heavy-duty vehicles during the time periods that would be impacted by the proposed regulations. In addition, this report discusses the retrofit strategies currently available and projected to be available to reduce PM, and NO_x, and global warming emissions from the three types of fleets. This discussion addresses the potential limitations of these strategies and identifies those technologies that have been verified by the ARB's Diesel Emission Control Strategy Verification Procedure. This report also provides information on the various public and private partnerships that have emerged to promote the use of alternative fuels by fleets and individual consumers to reduce petroleum consumption in the transportation sector. Finally, this report discusses the availability and accessibility of the necessary infrastructure to provide alternative fuels to the fleets covered by this measure.

II. Introduction

A variety of strategies can be used for controlling emissions from diesel engines, including aftertreatment hardware, such as filters, fuel strategies, engine modifications, and repowering with a newer engine with lower emissions. In addition, new vehicles can be purchased that use alternative fuels, such as compressed natural gas (CNG) and liquified natural gas (LNG), or that rely on the cleanest available diesel engine technology.

III. Engine Technology and Availability

This section discusses the availability of engines for transit buses, solid waste collection vehicles (collection vehicles), school buses, and other heavy-duty vehicles during the time periods that would be impacted by the proposed regulations: 2005-2006 (current), 2007-2009 (mid-term), and 2010 and beyond (long-term). The information has been obtained from engine manufacturers and other published sources. We have omitted information that engine manufacturers have indicated is confidential.

Conventional diesel engines use compression-ignition to generate power, whereas engines that operate on an alternative fuel, such as compressed natural gas (CNG), liquefied natural gas (LNG), and liquid petroleum gas (LPG), are typically spark-ignited. In the heavy-duty engine market, CNG and LNG are the most commonly used alternative fuels. For the purpose of this discussion, we use the definition of alternative-fuel adopted by the Air Resources Board (ARB or the Board) in Title 13, California Code of Regulations (CCR), section 2020: "natural gas, propane, ethanol, methanol, gasoline (when used in hybrid electric buses only), hydrogen, electricity, fuel cells, or advanced technologies that do not rely on diesel fuel." Diesel hybrid-electric, dual fuel and bi-fuel trucks and buses are not considered to be alternative-fueled, although they can have significantly lower emissions than a straight diesel engine.

Alternative-fueled engines are typically certified to lower engine exhaust emissions than same model year diesel-fueled engines, although a diesel engine equipped with exhaust aftertreatment may have emissions comparable to an alternative-fuel engine. The ARB and the United States Environmental Protection Agency (U.S. EPA) adopted optional standards starting in 1995 to provide an opportunity for engine manufacturers to certify their engines to lower optional engine emission standards; the U.S. EPA terms these "Blue Sky Engines." Currently, only natural gas engines have been certified to the optional standards in California. The higher purchase price of alternative-fuel, lower emission engines is often offset by various grants available in California.

1. Current Engine Availability

Manufacturers have been able to meet the current engine exhaust standards without the use of aftertreatment technologies, relying instead on modifications to engine and combustion related components. Engine modifications include such changes as improved electronic controls, improved turbocharger systems, and improved exhaust gas recirculation. Combustion modifications include improved engine timing, improved fuel injection systems, and improved cylinder design.

a. Diesel-fueled Engines

For the 2005 model year (MY), there is broad coverage of diesel engines for all vocations of vehicle, except urban buses, from Cummins, Caterpillar, Detroit Diesel Corp (DDC), Daimler Chrysler, and Volvo (Appendix A). There are 14 medium heavy-duty diesel (MHDD) engine families certified in California,[1] with displacements ranging from 4.25 to 8.9 liters (L) and 150 to 350 horsepower (HP). For heavy heavy-duty diesel (HHDD) engines, ranging from 8.8 to 15 L displacement and 280 to 600 HP, there are about 13 engine families certified.[1] The certified or family emission limit (FEL) NOx + NMHC levels for these engines range from 2.2 to 3.1 grams per brakehorsepower-hour (g/bhp-hr); the certified or FEL PM levels range from 0.04 to 0.1 g/bhp-hr, with two exceptions discussed below.

California has set different emission limits for urban bus engines. For the 2004 to 2006 MY, diesel engines must be certified at 0.5 g/bhp-hr NOx and 0.01 g/bhp-hr PM. There is no urban bus diesel engine certified to these limits. California regulations provide for an exception to this standard for the seven transit agencies that applied for and received an "alternative NOx strategy exemption." Engine manufacturers can certify urban bus diesel engines to the standards for 2003 in the 2004 to 2006 MY for sale to those transit agencies only. There is one diesel urban bus engine family, the Caterpillar C9, that is certified to 2.3 g/bhp-hr NOx + NMHC and 0.004 g/bhp-hr PM. In response to grant programs that require the purchase of a cleaner school bus when a diesel engine is purchased, Caterpillar has certified a C7 engine family to a lower PM level of 0.01 g/bhp-hr, with a NOx + NMHC certification of 2.4 g/bhp-hr.

Based on discussions with engine manufacturers, we expect much the same diesel engine product availability for the 2006 MY for school buses, and collection vehicles. For urban buses, in 2004, California adopted new engine standards for diesel hybrid-electric buses (HEB), applicable to the 2004 to 2006 MY only, of 1.8 g/bhp-hr NOx and 0.01 g/bhp-hr PM. Transit agencies on the

[1] As of February 15, 2005; certifications continue to be processed throughout the calendar year.

diesel path were allowed to apply for permission to purchase these buses, subject to certain requirements. Based on conversations with manufacturers, the staff expects that there will be one or more engine families certified and available for purchase in 2006, thus providing some transit agencies with an additional option for a diesel engine purchase.

b. Alternative Fuel Engines

As in other years, engine manufactures have certified fewer engine families to operate on alternative fuels, with less coverage over the range of engine size and horsepower, than is available for diesel fuels (Appendix A). For MHDD engines, Cummins and John Deere have certified a total of five[1] engine families to operate on natural gas and one certified to operate on LPG. The engines range from 185 to 320 HP and 5.9 to 8.9 L displacement. There are no HHDD natural gas engines certified, thus eliminating natural gas from use in the heavier classes of collection vehicles and transfer trucks. For urban buses, there are two natural gas engine families certified by Cummins, two certified by DDC, and one certified by John Deere.

Alternative-fuel engines are certified to the optional standards, beginning at the highest level of 1.8 g/bhp-hr NOx, and declining in 0.3 increments; the optional PM standards are 0.03, 0.02, and 0.01 g/bhp-hr. If an engine manufacturer certifies an engine family at one of these lower levels, and removes the engine family from use in averaging, banking, and trading, then the user may apply for grant funds to pay for the incremental cost based on the amount of NOx reduced. The 2005 MY engines are certified from 1.8 to 1.0 b/hp-hr NOx and 0.01 g/bhp-hr to a non-detectable level of PM.

The outlook for natural gas engine availability in 2006 is the same as for 2005. John Deere is currently involved in a demonstration project with United States Department of Energy's National Renewable Energy Laboratory (U.S. DOE NREL) and SCAQMD to certify this engine to the 1.2 g/bhp-hr NOx standard. This engine is equipped with an oxidation catalyst and will be available for transit buses, school buses, and refuse trucks. John Deere intends to have this product available by October 2005.

2. Mid-term Future Engine Availability (2007 – 2009)

A particulate emission standard of 0.01 g/bhp-hr for heavy-duty on-road diesel engines will take effect nationally and in California beginning with MY 2007, except for urban bus engines to be sold in California. The 0.01 standard for urban bus engines has been in effect in California for engines produced after October 1, 2002. These standards are based on the use of high-efficiency catalytic exhaust emission control devices or comparably effective advanced technologies.

In 2007 the engine exhaust emission standards for heavy-duty engines drop to 0.2 g/bhp-hr for NOx. However, recognizing the challenge of decreasing the engine exhaust NOx emissions to 0.2 g/bhp-hr, engine manufacturers may phase-in the NOx standard as 50 percent of sales at the new standard in 2007 - 2009. In adopting the phase-in NOx standard, the U.S. EPA acknowledged the challenge that manufacturers face to be able to produce a diesel engine at the 0.2 g/bhp-hr NOx standard by 2007.

In general, manufacturers have indicated that they are taking a two-step approach to meeting the NOx standard, averaging their engines to meet the average of approximately 1.2 g/bhp-hr NOx from 2007 to 2009 and dropping to 0.2 g/bhp-hr NOx for 2010. According to the U.S. EPA's second highway diesel progress report (United States Environmental Protection Agency, 2004) and based on the ARB staff's recent meetings, manufacturers are on track to meet the requirements in 2007.

While most manufacturers have released details about their 2007 engines, some have not. Thus the information that follows includes general information where specifics are unavailable for publication. Staff's evaluation includes both publicly available and confidential information.

a. Diesel-fueled Engines

All major manufactures have announced that they will be using exhaust gas recirculation (EGR) to meet the 2007 NOx emission standard and diesel particulate filters to meet the particulate standard. EGR causes a portion of the exhaust gases to circulate through a heat exchanger to cool the exhaust before reintroducing the gases into the engine intake manifold. EGR has been used in some engines since 2003, but engine manufacturers have further refined the systems to allow lower NOx emissions.

Caterpillar, Cummins, and DDC plan to offer a full line of medium- and heavy-duty diesel engines; International focuses on the school bus and collection vehicle engine markets; and Mack/Volvo focuses on engines for collection vehicles.

Dual fuel systems for collection vehicles are no longer available in the U.S., as Clean Air Power, the sole manufacturer of these systems, has concentrated its efforts in Europe. Increased interest in its product may, however, prompt Clean Air Power to develop and certify in California a 2007 product for collection vehicles.

Diesel hybrid-electric systems are another technology that reduces both emissions and fuel use and that will be available in 2007. While not classified by ARB as an alternative-fuel technology, diesel hybrid-electric technology achieves lower emissions and better fuel economy than equivalently sized diesel buses or

trucks. Emissions testing studies at ARB and other facilities indicate a fuel consumption reduction of 25 percent and NOx emission reduction of about 50 percent for diesel-fueled hybrid-electric buses (HEBs) compared to conventional diesel transit buses.

There is a growing momentum toward advanced, fuel-saving hybrid technology in medium and heavy-duty work trucks. The national Hybrid Truck Users Forum is a joint program between WestStart-CALSTART and the U.S. Army's National Automotive Center to speed the commercialization of hybrid drivelines that could be used in both military and commercial vehicles (ISE, 2004). FedEx Express, a subsidiary of FedEx Corp., is currently operating 18 delivery trucks nationally (FedEx Express, 2005). Eaton Corporation and International Truck and Engine Corporation announced in October 2004 a plan to build more than 20 advanced pre-production hybrid-electric work trucks for national deployment and assessment for use in heavy-duty (19,000-33,000 GVWR) truck operation (WestStart, 2004). DHL Express is using a Solectria diesel hybrid class 7 delivery truck in regular operations (DHL, 2004). International is currently developing diesel hybrids for utility trucks, and refuse trucks that are designed to meet the 1.2 g/bhp-hr NOx level. International does not currently intend to market these systems for use in transit or school buses.

The past few years have seen a shift from research and development to production and use of HEBs. In 1998, New York City Transit began a demonstration program with four diesel-fueled HEBs. The success of the program has resulted in New York City Transit ordering an additional 325 diesel-fueled HEBs, which it will receive through 2005 (BAE Systems, 2004). In January 2002, fewer than 100 HEBs were in active service. To date, orders have been placed for approximately 650 additional HEBs throughout the United States. In addition to the New York City Transit order, large orders have been placed by King County Metro in Seattle, Washington (213 diesel HEBs) (General Motors, 2004), and Long Beach Transit in California (27 gasoline hybrid buses) (ISE, 2003). ISE has stated that it intends to have a diesel HEB available in California in 2007.

b. Alternative-fuel Engines

Manufacturers of natural gas engines are likely to be able to meet the upcoming 2007 standard without the use of aftertreatment. Cummins, through its joint partnership with Westport Innovations, Cummins Westport Inc., and John Deere will be offering alternative fuel products to meet the 2007 emission standards. Although we have only preliminary data, it appears that manufacturers of alternative-fuel engines or systems will certify to the 0.2 g/bhp-hr NOx and 0.01 g/bhp-hr PM standards.

Compared to diesel offerings, however, customers will not have a wide a range of offerings to choose from when searching for engines. ISE Corporation

currently offers a California-certified gasoline hybrid electric bus and is developing hybrid electric systems with compressed natural gas, diesel, and hydrogen fuels, also for urban buses. While ISE focuses on the urban bus market, it is considering expanding into other vocations that use heavy heavy-duty engines, such as waste collection vehicles.

John Deere currently only certifies urban bus and medium heavy-duty natural gas engines (Appendix A), but is developing a heavy heavy-duty engine that would be suitable for use in waste collection vehicles. John Deere intends to produce a 250-325 horsepower, 9 L natural gas engine meeting the 0.2 g/bhp-hr NOx level by 2007. This engine could be used in transit buses, school buses, and refuse trucks.

Cummins will be marketing the natural gas engines developed by Cummins Westport Inc. and it intends to offer a full line of products. Although the engines are developed by Cummins Westport Inc., they will be following the "Cummins Value Package Introduction Process," carry the Cummins warranty, and be serviced by Cummins dealers. Cummins is currently providing bids on both diesel and natural gas buses for 2007. Cummins Westport Inc. has partnered with U.S. DOE's NREL to develop a lower emission version of the L Gas Plus (8.9 L) engine for use in medium-duty trucks, refuse trucks, and urban buses. This engine is scheduled to be commercially available in early-2007. The SCAQMD is also currently sponsoring a project with Cummins to commercialize the C Gas Plus engine (8.2 L) to 0.2 g/bhp-hr NOx by 2007.

In 2004, Ford and General Motors stated that they would no longer be producing their smaller CNG engines used in cutaway vehicles. As a result, BAT Technologies, Clean Energy, and Teleflex/GFI Control Systems have jointly proposed a contract with the SCAQMD and the state of New York to "develop and certify in California a retrofit system that converts 2005 and subsequent model year gasoline-powered Ford Crown Victoria and E-450 cutaway vehicles to dedicated CNG operation" (South Coast Air Quality Management District, 2004). It is anticipated that once retrofitted, the engines will meet SULEV emission levels. This technology is scheduled to be certified by mid-year 2005.

A heavy-duty pilot ignition (HDPI) engine is a compression-ignition engine that operates on natural gas but uses diesel as a pilot ignition source. Diesel accounts for about six percent of the fuel consumed. The ARB has defined an HDPI engine in its fleet rule for transit agencies as an engine that uses diesel fuel at a ratio of no more than one part diesel fuel to ten parts total fuel on an energy equivalent basis. Furthermore, the engine cannot idle or operate solely on diesel fuel at any time. An engine that meets this definition and is certified to the lower optional PM standard (0.01 g/bhp-hr) would be classified as an alternative-fuel engine.

In October 2004, Westport Research announced that it has been awarded $1.5 million (USD) by the U.S. DOE's NREL in a cost-sharing subcontract to develop and deploy the next generation of its HDPI technology in heavy-duty natural gas trucks (Cummins ISXG, 14.9 L) in California. The NREL funding is provided through sponsorship from the U.S. DOE FreedomCAR and Clean Cities programs. Westport Research intends to certify this engine to 1.2 g/bhp-hr NOx by the end of 2005. Westport Research will also begin testing of the ISXG engine to reach a 0.2 g/bhp-hr NOx emission levels by 2008.

The trucks being deployed in California will be powered by Cummins ISX engines using liquefied natural gas (LNG) fuel systems and are targeted to meet the U.S. EPA 2007 emission standards (DieselNet, 2004).

3. Long-Term Engine Availability (2010 and beyond)

Engine technology for 2010 will most likely rely upon selective catalytic reduction (SCR), NOx adsorbers, and further improvements in engine technology to reduce NOx emissions.

A U.S. EPA research team, with industry partners, is developing a low NOx diesel engine system called Clean Diesel Combustion (CDC). The CDC technology utilizes management of the in-cylinder combustion process as the primary control for NOx reduction. In laboratory testing, the CDC system has demonstrated very low NOx emissions without the use of NOx after-treatment.

The CDC technology relies upon in-cylinder NOx control, where NOx emissions are reduced in the engine combustion chamber. In-cylinder NOx control is achieved through advances in technology in the engine's fuel system, boost control, EGR and PM aftertreatment systems. The CDC technology may be scaled to both light-duty and heavy-duty applications. The key features of CDC technology include the following:

- A hydraulically-intensified fuel system to lower PM emissions while improving engine efficiency,
- A boost system which increases engine power and the efficiency of the combustion process, thus reducing emissions and increasing fuel economy,
- Cooled low pressure exhaust gas re-circulation which lowers peak combustion temperatures, reducing the formation of NOx, and
- Aftertreatment to reduce remaining PM, unburned hydrocarbons, and carbon monoxide in the exhaust.

Several engine and vehicle manufacturers are working to advance this technology with the U.S. EPA research team. These industry partners include both automotive manufacturers and heavy-duty diesel engine manufacturers. Detailed test results have been publicly disclosed for small-bore "automotive" sized engines.

Two aftertreatment technologies that will most likely play a large role in meeting the 2010 NOx standard are selective catalytic reduction (SCR) and the NOx adsorber.

The SCR catalysts that use ammonia as a NOx reductant have been used for control of NOx emissions from stationary sources for a number of years. Urea may also used as the source of ammonia for SCR catalysts, and such systems are commonly referred to as urea SCR systems. In recent years, considerable effort has been invested in developing urea SCR systems that could be applied to heavy-duty diesel vehicles with low sulfur diesel fuel. Urea SCR systems were introduced in 2003 and 2004 in European passenger cars and will be used to comply with the EURO IV heavy-duty diesel emission standards. The actual introduction dates in some countries will be earlier than the EURO IV implementation requirements because of tax incentives in those countries to promote early technology introduction (United States Environmental Protection Agency, 2004).

Transit agencies that received an alternative NOx strategy exemption under title 13, CCR, section 1956.2(c)(8) or (d)(9) were required to conduct a demonstration of an advanced NOx aftertreatment system that could reduce NOx emissions by 70 percent or more on buses operating in urban bus revenue service. Staff is monitoring the demonstration of an ammonia SCR system on urban buses being conducted by the seven transit agencies that received the exemption.

Three SCR NOx aftertreatment devices were selected, produced and installed by Extengine for demonstration on three urban buses. Initiated in October 2002, VTA conducted baseline and emissions testing prior to placing the buses into revenue service. Preliminary data submitted in January 2004 are favorable and buses continue operating in revenue service (VTA, undated).

Unlike catalysts, which continuously convert NOx to N_2, NOx adsorbers are materials that store NOx under lean conditions and release and catalytically reduce the stored NOx under rich conditions. NO and NO_2 are acidic oxides and can be trapped on basic oxides. Fuel sulfur can be converted to stable sulfates providing competition with NOx for storage sites, thus poisoning the catalysts. NOx adsorber catalysts have a wide operating temperature window and thermal stability consistent with diesel applications and are capable of providing NOx conversions in excess of 90 percent over much of the operating range. However, fuel intended for adsorber regeneration is wasted if it reacts with O_2 instead of with NOx. The additional heat generated by excessive combustion may induce thermal desorption of NOx.

IV. Diesel Emission Control Strategies

The ARB has developed the Diesel Emission Control Strategy (DECS) Verification Procedure.[2] The purpose of the procedure is to verify strategies that provide reductions in diesel PM emissions. A complete and up-to-date list of verified DECSs and the engine families for which they have been verified can be found on our web site:
http://www.arb.ca.gov/diesel/verdev/currentlyverifiedtech.htm.

There are a number of retrofit technologies that may be applied to reduce emissions from late-model (1994 and subsequent) diesel engines. Some of the more common ones are discussed briefly below.

A. Diesel Oxidation Catalyst

A diesel oxidation catalyst (DOC) is a flow through device that consists of a canister containing a honeycomb-like structure or substrate. The substrate has a large surface area that is coated with an active catalyst layer containing platinum or palladium. DOCs are temperature dependent, but are generally considered to be widely applicable to diesel engines, including two-stroke engines.

A DOC reduces the soluble organic fraction (SOF) of diesel particulates, typically reducing particulate matter by 25 percent. However, DOCs may not achieve a 25 percent reduction consistently, due to differing SOF emissions among engines or modes of operation. One verified DOC-based system includes crankcase filtration to ensure a minimum 25 percent reduction on a variety of engines and operations. DOCs in general can reduce hydrocarbons (HC) and carbon monoxide (CO) by 37 to 71 percent. DOCs do not reduce NO_X emissions

B. Passive Diesel Particulate Filters

Diesel particulate filters (DPFs) essentially trap particulates which are then oxidized at a later time to "regenerate" the filter. Passive filters use the heat in the engine exhaust along with a catalyst to burn off the collected soot. Most passive filters use platinum group metals to convert NO to NO2, which then reacts with the soot. Special attention must be paid when applying passive filters to engines with exhaust gas recirculation (EGR) or other technologies that reduce NOx emissions before they reach the catalyst to ensure that sufficient NO is available for the regeneration process.

Because passive DPFs rely on exhaust heat to trigger regeneration, their applicability is determined by the engine and duty cycle of the vehicle. In

[2] Approved by the Board in May 2002. Sections 2700 through 2710, Title 13, California Code of Regulations.

general, low-sulfur fuel is needed to prevent sulfate formation. In addition to reducing PM by 85 percent or more, the passive filters catalytically reduce HC and CO emissions by 60-90 percent as well. Passive DPFs do not reduce NO_X emissions.

The passive DPFs verified for on-road use include the Donaldson DPM, the Johnson Matthey continuously regenerating technology (CRT) and catalyzed continuously regenerating technology (CCRT) filters, and the Lubrizol Purifilter. The Cleaire Longview, which includes a lean NOx catalyst system, as well as a passive DPF, is also verified for on-road engines. At this time, only the Johnson Matthey CRT and CCRT are verified for use with EGR-equipped engines, although other manufacturers have indicated they plan to extend their verifications to include this category of engines.

C. Active Diesel Particulate Filters

Active diesel particulate filters rely on another source of heat besides the engine exhaust. The additional source of heat is typically a fuel burner, fuel injection, or electrical. Some use off-board regeneration by plugging into the electrical grid, or removing the filter element and placing it into some sort of regeneration station. Active regeneration may be combined with passive regeneration to maximize regeneration opportunity.

As with passive filters, the active systems reduce PM by 85 percent or greater. However, if no catalytic material is used, there is no significant reduction in HC or CO. Because active systems are not dependent on exhaust heat, they are relatively insensitive to duty cycle. If there is no catalytic element, there is no need to be restricted to low-sulfur fuel, and no increase in NO2 emissions. Active systems are potentially more costly than passive systems, due to the need for sophisticated controls.

Currently, one active system has been verified, the ECS Lubrizol Combifilter, for off-road use.

D. Lean NOx Catalyst

A Lean NOx catalyst system uses the injection of hydrocarbons, often diesel fuel, into the exhaust system upstream of a catalyst to reduce NOx emissions. The catalyst can reduce NOx by 25 percent. There is a slight fuel economy penalty involved. A lean NOx catalyst does not reduce PM emissions by itself, but can be combined with other controls such as diesel particulate filters. A lean NO_X catalyst does not reduce CO or HC emissions.

There is one lean NOx catalyst system verified for on-road engines at present, the Cleaire Longview, which includes a passive DPF.

E. Selective Catalytic Reduction (SCR)

An SCR system injects ammonia or urea into the exhaust gas stream to react with NOx in the presence of a catalyst. There is the possibility of ammonia slip into the exhaust, but this can be addressed through careful calibration, and/or the use of a clean up oxidation catalyst following the SCR catalyst. Verification requires that ammonia slip not exceed 25 parts per million on average over a test cycle.

SCR systems have been used commercially for many years with stationary diesel engine and marine applications. SCR can reduce NOx by 55 to 90 percent, and can be used in conjunction with PM control strategies such as DOCs and DPFs.

There is one SCR system verified at present, the Extengine ADEC for select off-road engines. The ADEC achieves a 25 percent PM reduction.

F. NOx Adsorbers

During lean driving conditions, NOX is adsorbed and stored in catalyst washcoat. During rich operation, NOx is desorbed and catalytically reduced. This results in NOx reductions of up to 90 percent. NOx adsorbers require a closed loop control in tight integration with the engine management and other vehicle systems such as, on-board diagnostics. Operation of NOx adsorbers can carry a fuel economy penalty (typically 3 to 5 percent). The thermal durability and resistance to sulfur are potential issues for implementation of this strategy. NOx adsorbers do not reduce PM by themselves, but may potentially be combined with a DPF.

At this time, there are no verified NOx adsorbers for retrofit use.

G. Crankcase Filters

Crankcase filters reduce blow-by contaminants, including PM, that can foul a turbocharger and aftercooler components. They have been used with DOCs to ensure that PM is reduced by 25 percent. Among their other benefits are a cleaner engine compartment, reduced engine oil consumption, and reduced underhood odor/fumes.

Donaldson has a verified DOC/crankcase filter combination.

H. Exhaust Gas Recirculation

Exhaust Gas Recirculation (EGR) reduces NOx through lowering the oxygen concentration in the combustion chamber, as well as, through heat absorption. It

displaces some of the oxygen inducted into the engine as part of its fresh charge air with inert gases. EGR can reduce NOx by 40-50 percent. However, it does bring with it a potential PM emission increase and engine wear issues. These issues can be minimized by combination with a DPF.

At this time, the Johnson Matthey EGRT, which includes a passive DPF, is the only verified retrofit EGR system.

I. Alternative Diesel Fuels

An alternative diesel fuel is a fuel that does not require engine or fuel system modifications for a standard diesel engine to operate. ADFs include water/diesel emulsions, biodiesel, and gas to liquid (GTL) fuels.

Water/diesel emulsions involve a mixture of diesel fuel with water and emulsifying and stabilizing additives. Depending on the product, the water content may vary from 8 to 35 percent. Water/diesel emulsions can reduce PM emissions by 50 percent or greater and NOx emissions by 15 percent. The addition of water decreases combustion temperatures and lowers NOx emissions, while PM is reduced through improved atomization and mixing of air and fuel. Due to replacement of fuel volume by water, the engine may not reach its rated power, and there will be a fuel economy penalty. At this time, Lubrizol's PuriNOx fuel (also marketed as ProFormix) is the only emulsion that has been verified.

Biodiesel is produced from vegetable and tree oils, animal fats, or used cooking oils and fats. It is commonly used in blends with standard diesel fuel. While use of biodiesel can reduce PM by up to 25 percent, it does increase NOx emissions, which must be addressed before it could be verified as an emissions control strategy. However, several cities and other groups use biodiesel blends voluntarily, and other retrofit manufacturers are looking into verifying their systems for compatibility with those blends.

GTL fuels are produced from natural gas, coal feedstocks and biomass. They are most commonly used in blends with standard diesel fuel. GTL Fuels can reduce PM by 20 to 25 percent. Issues include a decrease in lubricity and poor cold flow properties. No GTL fuels have been verified as Diesel Emissions Control Strategies.

J. Fuel Additives

Fuel additives are designed to be added to fuel or fuel systems or other engine-related systems such that it is present in-cylinder during combustion. There are different mechanisms by which fuel additives can work. In particular, fuel-borne catalysts facilitate regeneration in diesel filters.

An assessment of multimedia effects is required before any fuel additive can be verified as a diesel emission control additive. Additionally, registration with the U.S. EPA is required. These conditions have been set in place to ensure that the fuel additive will not cause other problems as it is emitted into the environment.

No fuel additives have been verified at this time.

K. Future plans

Conversations with manufacturers of retrofit controls have revealed that there are plans to expand NOx control technologies available. In particular, Extengine has taken action to extend its existing SCR verification, and Johnson Matthey has indicated that it would pursue verification of its SCRT, a combination of their CRT filter and selective catalytic reduction.

Most manufacturers have expressed a preference to devote resources to items for which a rule or funding program is already in place, as that assures them of a market for their products. Thus, staff has a reasonable expectation that as new fleet rules are adopted, verification activity would increase for the market segments covered by those rules.

V. Goals and Implementation of Alternative Fuels Programs

In 2003, pursuant to AB 2076, the California Energy Commission (CEC) and ARB jointly adopted the following goals for the reduction in petroleum dependence:

- Reduced demand for on-road gasoline and diesel fuel of 15 percent below the 2003 levels by the year 2020, and to maintain this level of demand for the foreseeable future and
- Increased use of non-petroleum fuels to 20 percent of on-road fuel consumption by 2020 and to 30 percent by 2030.

These goals were developed in response to concerns about the increasing dependence on imports of refined petroleum products, rising greenhouse gas emissions, and the adverse health effects associated with exposure to air pollution. A significant reduction in petroleum demand can be achieved by substituting non- petroleum fuels, such as natural gas for gasoline and diesel. (California Air Resources Board and California Energy Commission, 2003).

The United States Department of Energy Clean Cities program has promoted the use of natural gas-fueled public fleets. The mission of the Clean Cities program is to advance the economic, environmental, and energy security of the United States by supporting local decisions to adopt practices that contribute to reduced petroleum consumption in the transportation sector. The objectives of the Clean Cities program are:

- to facilitate the deployment of alternative fuel vehicles,
- to support the installation of an alternative fuel refueling infrastructure throughout the nation,
- to increase the use of fuel blends (diesel/biodiesel, ethanol/gasoline, and compressed natural gas/hydrogen),
- to accelerate sales of hybrid electric vehicles,
- to promote informed consumer choice on fuel economy, and
- to encourage the use of idle reduction technologies for heavy-duty trucks and other vehicles.

The Clean Cities program has carried out this mission through a network of more than 80 volunteer, community-based coalitions, which have developed public/private partnerships. Since 1993, Clean Cities coalitions have steadily increased the number of alternative fuel vehicles on the United States highways, with gains averaging around 15 percent in recent years (United States Department of Energy, 2005).

California is the nation's leading user of natural gas vehicles. The Clean Cities Program has been responsible for encouraging the successful development and implementation of a number of alternative fuel fleets in California. These have included waste management vehicles in San Diego County powered on LNG and CNG ; CNG-fueled school buses in San Diego County; CNG-fueled transit buses in Lodi, Los Angeles, and Davis; and CNG-fueled shuttle buses at Hearst Castle. Table 1 contains detailed information about a selection of CNG and LNG-fueled fleets in California (United States Department of Energy, 2005).

Table 1

Information Regarding CNG and LNG-Fueled Fleets in California

Organization	Applications	Fuel Type	Number of Vehicles
Waste Management, Inc. (various parts of California)	Heavy-Duty Delivery Vehicles, Refuse Haulers	CNG, LNG	360
City of Lodi, CA	Transit Buses	CNG	19
Los Angeles Metropolitan Transit Authority	Transit Buses	CNG	1570
Unitrans (City of Davis)	Transit Buses, Support Operations, Vans	CNG, Hydrogen	19
San Marcos Unified School District (San Diego)	School Buses	CNG	55
State of California Department of Parks and Recreation (Hearst Castle)	Trams and Internal Transit	CNG	16

VI. Infrastructure for Alternative Fuels

The SCAQMD reports an increase in alternative fuel fueling sites in the District over the past five years. The SCAQMD draft document entitled Status Report of Natural Gas Infrastructure Expansion in the South Coast District, 2005 (Appendix B) says "From a pre-year 2000 station inventory of approximately 25 stations that mostly dispensed CNG and had very limited public access; there are now over 100 CNG or LNG stations that have or will (soon) have full public access." The web site Clean Car Maps, which tracks alternative fuel fueling sites, reports 66 CNG and 10 LNG fueling stations that are open to the public in Southern California (Clean Car Maps, 2005).

As shown in Figures 1 through 5 of Appendix C, there are sufficient fueling stations distributed at appropriate distances to meet the current demand for

alternate fueled vehicles in the SCAQMD. However, the increase in alternative fuel vehicles in the SCAQMD that would be expected to occur as a result of implementation of these proposed fleet rules means that additional fueling facilities would need to be constructed. While doing calculations on the potential costs of the waste collection vehicle rule, the ARB staff estimated that each increase of approximately 100 alternative fuel vehicles would create the need for one fueling station.

A. Compressed Natural Gas

The cost of fueling facilities varies depending on the number of vehicles to be filled each day and the speed with which they must be filled. Sempra Utilities estimates the cost of a CNG filling station with the ability to fill 100 solid waste collection vehicles overnight at $700,000. A similar facility for 50 trucks would be $445,000 (Sempra Utilities, 2005).

In a cost analysis done for transit bus fleets, Clean Energy, a supplier of alternative fuels and fueling facilities, estimated the cost of a CNG filling station for 25-50 buses at $700,000 to $800,000. For fleets of 50 to 100 buses, the cost was estimated to be $1.3 million to $1.5 million. Large fleets of more than 100 buses would require fueling facilities costing $2.5 to $3 million (Clean Energy, 2005).

B. Liquefied Natural Gas

In costs for LNG fueling facilities, Clean Energy estimated $600,000 for a facility capable of fueling 12 buses per hour in a fleet of 100 buses. For fleets of 200 buses, Clean Energy estimated $1.5 million to $2 million for a LNG fueling facility (Clean Energy, 2005). Waste Management, California's largest waste hauling company, estimates an average cost of approximately $600,000 each for construction of LNG fueling stations at eight of its terminals in the state (Stoddard, 2005). The City of Los Angeles Department of General Services estimates the cost of construction and equipment for an LNG fueling station to service 120 waste collection vehicles at $3.5 million (Tran, et al., 2005).

In many cases, these costs are defrayed by government incentives. Of $40.6 million in expenditures for alternative fueling sites to serve waste hauler fleets in the SCAQMD, the District reports supplying $10.9 million in incentive funds (Appendix B).

Clean Energy will build fueling facilities or build and operate the facilities under an arrangement where the end user pays for the facility through an amortized fee built into the cost of the fuel purchased (Clean Energy, 2005).

Another issue with LNG is delivery cost. The fuel is trucked in from Arizona to the SCAQMD at a cost of approximately $1000; from Texas at $2,500 per load

and from Wyoming at $3,000 per load. Several Waste Management staff mentioned that recent problems at LNG processing facilities had delayed the trucking of fuel into California and caused supply disruptions (Curtis, et al., 2005).

The SCAQMD requires public access when it provides incentive funding to defray the cost of a fueling station. However, the term "public access" generally refers to access for other fleets and not necessarily members of the general public. To allow general public access could open the municipality or private company to liability issues and also hinder the use of fueling facilities at times when they are most needed. Fleet operators generally make pre-arrangements concerning times of use and fees to be paid for use of another operator's fueling station (Saito, 2005).

VII. References

BAE Systems. June 2004. Orion VII Hybrid Transit Bus, Product Overview.

California Air Resources Board and California Energy Commission. August, 2003. Reducing California's Petroleum Dependence. http://www.energy.ca.gov/reports/2003-08-14_600-03-005.PDF.

Clean Car Maps. April 14, 2005. An Internet Web Page Listing Alternative Fuel Fueling Sites. http://www.cleancarmaps.com/home/

Clean Energy. April 12, 2005. Information conveyed by telephone and email to the staff of ARB from Dave Aasheim and James N. Harger, staff of Clean Energy.

Curtis, Thomas, Frank Dopp, and Darrell Kato. March 2005. ARB survey interviews with three management-level staff of Waste Management.

DHL. June 21, 2004. Press Release. "DHL Places Two Alternative Fueled Vehicles Into the Field".

DieselNet. October, 2004. "Westport Secures NREL Funding for HPDI Truck Program." http://www.dieselnet.com.

FedEx Express. April 22, 2005. Press Release. "FedEx Announces Plans to Add Up to 75 'Clean Air' Hybrid Trucks to Fleet."

General Motors. May 27, 2004. Press Release. "GM Delivers Nation's Largest Hybrid Bus Fleet to King County."

ISE Corporation. 2003 Annual Report.

ISE Corporation. July 19, 2004. Press Release. "ISE Corporation Announces New Army Contract for Hybrid Truck."

Saito, Dean. April 13, 2005. Telephone conversation with Dean Saito of South Coast Air Quality Management District and the staff of the Air Resources Board.

Sempra Utilities. April 8, 2005. E-mail response from Stan Sinclair of Sempra Utilities responding to ARB questions concerning costs of setting up CNG filling stations for fleets of 50 and 100 waste collection vehicles.

Stoddard, Kent. March 22, 2005. E-mail from Waste Management responding to the questions concerning costs of LNG filling stations for waste collection vehicles.

South Coast Air Quality Management District Board. December 3, 2004. Board Meeting, Agenda Number 4.

Tran, Kim et al., City of Los Angeles Department of General Services. Undated. Case Study: City of Los Angeles Dual-Fuel Refuse Collection Vehicles and LNG Refueling Infrastructure.

United States Department of Energy. 2005. www.eere.energy.gov/cleancities An Internet web page listing Clean Cities alternative-fueled fleets.

United States Environmental Protection Agency. March 2004. Highway Diesel Progress Review Report 2.

VTA, Undated. California Transit Agencies Advanced NOx Reduction Demonstration Program.

WestStart. 2004. Announcements During the Hybrid Truck Users Forum Held in Kalamazoo, Michigan, October 14-15, 2004.

APPENDICES

Appendix A

Diesel Engine Availability

The following table (Table A-1) list the 2005 model year California certified heavy-duty diesel engines (as of March 2005).

2005 MY Diesel Fuel Heavy Duty Engines

MFR[1]	SERVICE CLASS	DISP (L)	NMHC+NOx STD	MODELS(HP)
CAT	MHD	7.2	2.5	C7 (275-300hp)
CAT	MHD	7.2	2.5	C7 (207-350hp)
CAT	UB	8.8	2.5	C9 (285-330hp)
CAT	MHD	8.8	2.5	C9 (335-440hp)
CAT	MHD	11.1	2.5	C11 (315-385hp)
CAT	MHD	12.5	2.5	C13 (395-525)
CAT	MHD	15	2.5	C15 (435-625hp)
CUMM	HHD	10.8	2.5	ISM (400-500hp)
CUMM	MHD	5.9	2.5	ISB (260hp)
CUMM	MHD	5.9	2.5	ISB (185-230hp)
CUMM	MHD	5.9	2.4[2]	ISE (300hp)
CUMM	MDV[3]	5.9	2.5	ISB (325hp)
CUMM	MHD	5.9	2.5	ISB (245-275hp)
CUMM	MHD	8.3	3.1[2]	ISC (326hp)
CUMM	HHD	10.8	2.4[2]	ISM (340-500hp)
CUMM	HHD	10.8	2.4[2]	ISM (291-380hp)
CUMM	HHD	14.9	2.5	ISX (425-600hp)
CUMM	HHD	14.9	2.4[2]	ISX (400-450hp)
CUMM	MHD	8.8	3.3[2]	ISL (310-380hp)
CUMM	MHD	8.3	2.8[2]	ISC (255-326hp)
CUMM	MHD	8.3	2.9[2]	ISC (240-260hp)
DCAG	HHD	12.8	2.5	OM460LA (350-450hp)
DCAG	MHD	7.2	2.5	OM926LA (250-300hp)
DCAG	MHD	4.25	2.5	OM904LA (150-170hp)
DCAG	MHD	6.37	2.5	OM906LA (190-260hp)
DDC	HHD	12.7	2.5	Series 60 (380-455hp)
DDC	HHD	14.0	2.5	Series 60 (455-515hp)
GEP	MDV	6.5	2.5	L65 (205hp)

GM	MDV	6.6	2.5	LLY (300-310hp)
GM	MDV	6.6	2.5	LLY (310hp)
GM	MDV	6.6	2.5	LLY (210-300hp)
HINO	HHD	7.7	2.5	J08E-TB (260hp)
HINO	LHD	4.7	2.5	J05D-TA (175hp)
HINO	MHD	7.7	2.5	J08E-TA (220-230hp)
INT	LHD	6.0	2.5	A (235-325hp)
INT	LHD	4.5	2.5	A (200hp)
INT	LHD	6.0	2.5	A (175-230hp)
INT	MHD	6.0	2.5	A (235-325hp)
INT	MHD	7.6	2.5	D (210-300hp)
INT	MHD	9.3	2.5	D (285-340hp)
ISUZU	LHD	5.2	2.5	4HK1TC (190hp)
ISUZU	MHD	7.8	2.5	6HK1X (200-230hp)
MACK	HHD	11.9	2.4[2]	AC (310-480hp)
MACK	HHD	11.9	2.8[2]	AI (375-360hp), AMI (370hp)
MACK	HHD	11.9	2.7[2]	AMI (370hp)
MACK	HHD	11.9	2.5	AI (300-400hp), AMI (300-335hp)
MACK	HHD	11.9	2.4	E7G (325-425hp)
MACK	HHD	11.9	2.3[2]	AC (427hp)
MFTB	LHD	4.9	2.5	4M50 (147-175hp)
MFTB	MHD	7.5	2.5	6M60 (243-274hp)
Volvo	HHD	12.1	2.5	VE D120 (385-485hp)

[1]Abbreviations used - CAT: Caterpillar; CUMM: Cummins, INC.; DCAG: Daimler Chrysler AG; DDC: Detroit Diesel Corporation; GEP: General Engine Products; GM: General Motors; HINO: Hino Motors Limited; INT: International Truck and Engine Corp.; ISUZU: Isuzu Motors Limited; MACK: Mack Truck; MFTB: Mitsubishi Fuso and Bus Corp.
[2]NOx+NMHC FEL (Family Emission Limits)
[3]Medium-duty Vehicle

The following table (Table A-2) lists the 2005 model year California certified heavy duty alternative fueled engines (as of March 2005). Alternative-fuel engines are currently available for most of the same applications as heavy-duty diesel applications

2004 MY Alternative Fuel Heavy Duty Engines

MFR[1]	SERVICE CLASS	FUEL	DISP (L)	NMHC +NOx STD	MODELS(HP)
BIPT	HDO	LPG	8.1	1.5	GM 8.1 (325 hp)
CUMM	MHD	CNG	5.9	1.8	BG (195-230hp),
CUMM	BUS	CNG	8.3	1.8[2]	CG (250-280hp)
CUMM	MHD	LPG	5.9	2.2[2]	BLPG (185-195hp)
CUMM	MHD	CNG	8.3	1.8	CG (250-280hp)
CUMM	MHD	CNG	8.9	1.5[3]	LG (320hp)
CUMM	MHD	CNG	8.8	1.4[2]	LG (320hp)
DDC	BUS	CNG	8.5	1.2[2]	CNG (275hp), LPG (275hp)
DDC	BUS	CNG	8.5	1.2[3]	CNG (275hp), LPG (275hp)
DEER	MHD	CNG	8.1	1.5[3]	6081H (250hp)
DEER	BUS	CNG	8.1	1.8[3]	6081H (250-280hp)

[1]Abbreviations used - BIPT: Bi-Phase Technologies, LLC; CUMM: Cummins, INC.; DDC: Detroit Diesel Corporation; DEER: John Deere and Company
[2]NOx+NMHC FEL (Family Emission Limits)
[3]NOx+NMHC Optional Standard
are operating in revenue service (VTA 2004).

Appendix B

Status Report of Natural Gas Infrastructure Expansion in the South Coast District (Draft)

DRAFT

STATUS REPORT OF NATURAL GAS INFRASTRUCTURE
EXPANSION IN THE SOUTH COAST DISTRICT
April 22, 2005

Background

The AQMP relies on the expedited implementation of advanced technologies and clean–burning fuels in Southern California to achieve air quality standards. In addition, the AQMP has identified the use of alternative clean fuels in mobile sources as a primary attainment strategy. To that end, the 1190 rules, which require implementation of alternative fuel heavy-duty vehicles in public and selected private fleets in the Basin promote government fleets (with more than fifteen vehicles) to purchase low-emission or alternative fuel vehicles when adding or replacing vehicles to their fleet. These important Rules have set the stage for widespread penetration of clean fuel, low emission technologies.

Fleets that were impacted by Rules 1192, 1193, 1194, 1195 and 1196 required additional fueling infrastructure, with public access, in place as soon as possible to effect a smooth transition to an alternative fuel fleet. New infrastructure would also diminish the obstacle of the lack of fueling locations throughout the greater Los Angeles basin. In order to meet public and private fleet fueling needs, existing infrastructure needed to be upgraded and new natural gas fueling infrastructure needed to be developed in areas where these fleets operate. These new natural gas fueling stations needed to be built in areas that would accommodate taxis, shared ride operators, hotel/parking shuttles and municipal fleets.

By constructing more natural gas fueling facilities, benefits from these projects accrue to all cities and area residents. Such new construction provides a coordinated effort and plan for growth of the overall fueling infrastructure and helps reduce costs associated with duplication of effort. There are economies of scale captured as a result of the many infrastructures planned and installed, possibly reducing the cost of infrastructure and making alternative refueling stations more affordable. While having no direct impact on air emission reductions, new natural gas fueling stations help facilitate the introduction of low emission, natural gas fueled vehicles (NGVs) initially in private and public fleets in the area. Such increased penetration of NGVs will provide direct emissions reductions of NOx, VOC, CO, PM, and toxic air contaminants throughout the Basin.

Incentive Program Funding

Key to the implementation of alternative fuel heavy-duty vehicles and equipment is the establishment of fueling infrastructure. Public funding has been made available under various programs for the establishment of alternative fuel fueling infrastructure. These funding programs include the Clean Fuels Fund, the AES

Settlement Fund, funding through the Mobile Source Air Pollution Reduction Review Committee (MSRC) and AB 2766, and the Carl Moyer Program. To date, over $30 million has been spent by the AQMD alone for such infrastructure programs. These different funding programs tend to solicit cost-share proposals from private and public fleet owners and fuel vendors intending to install alternative fuel dispensing facilities with an emphasis on providing publicly accessible fueling for heavy-duty vehicles. The goal of these programs is to provide cost-share funds to assist both public and private fleet owners and fuel vendors to establish publicly accessible natural gas fuel dispensing facility projects within the South Coast Air Basin (SCAB).

The AQMD has actively been involved in promoting the use of alternative fuels by providing cost-sharing assistance for the establishment of alternative fuel infrastructure. These funds are normally designed to offset the capital investment required to establish these facilities. Funding of this nature also helps reduce the risk assumed by the fuel provider relative to the future recovery of their capital investment, thereby allowing the fuel provider to make a business case for a strategically significant location and allow the alternative fuel to be priced more competitively compared to conventional fuels due to the smaller amount of amortized capital costs. In addition, they help implement and increase widespread penetration of low emission, alternative fuel, and heavy-duty vehicles in public, commercial and private fleets. Furthermore, these projects provided applicants and other alternative fuel vehicle participants experience and knowledge of alternative fuel storage and dispensing systems.

In recognition of the contribution of heavy-duty vehicles to the emissions inventory, and the difficulty in implementing low emission technologies, approximately $30 million has been spent by the AQMD on projects totaling over $94 million over the past five years to provide incentives for alternative fuel infrastructure. The incentive program has provided cost-share funds to assist public agencies and fleet owners to establish alternative fuel dispensing facility projects in the SCAB. This incentive program and the subsequent additional infrastructure have directly supported the implementation of the Fleet Rules.

Participants in these funding programs were required to install either CNG or LNG fuel infrastructure and documentation which clearly showed a commitment that the proposed fuel infrastructure would dispense a significant amount of fuel on an annual basis, averaged over a 5 year period to heavy duty vehicles. In addition, the participants were required to provide documentation signed by other vehicle owners that would be using the fuel to demonstrate that throughput requirements would be met.

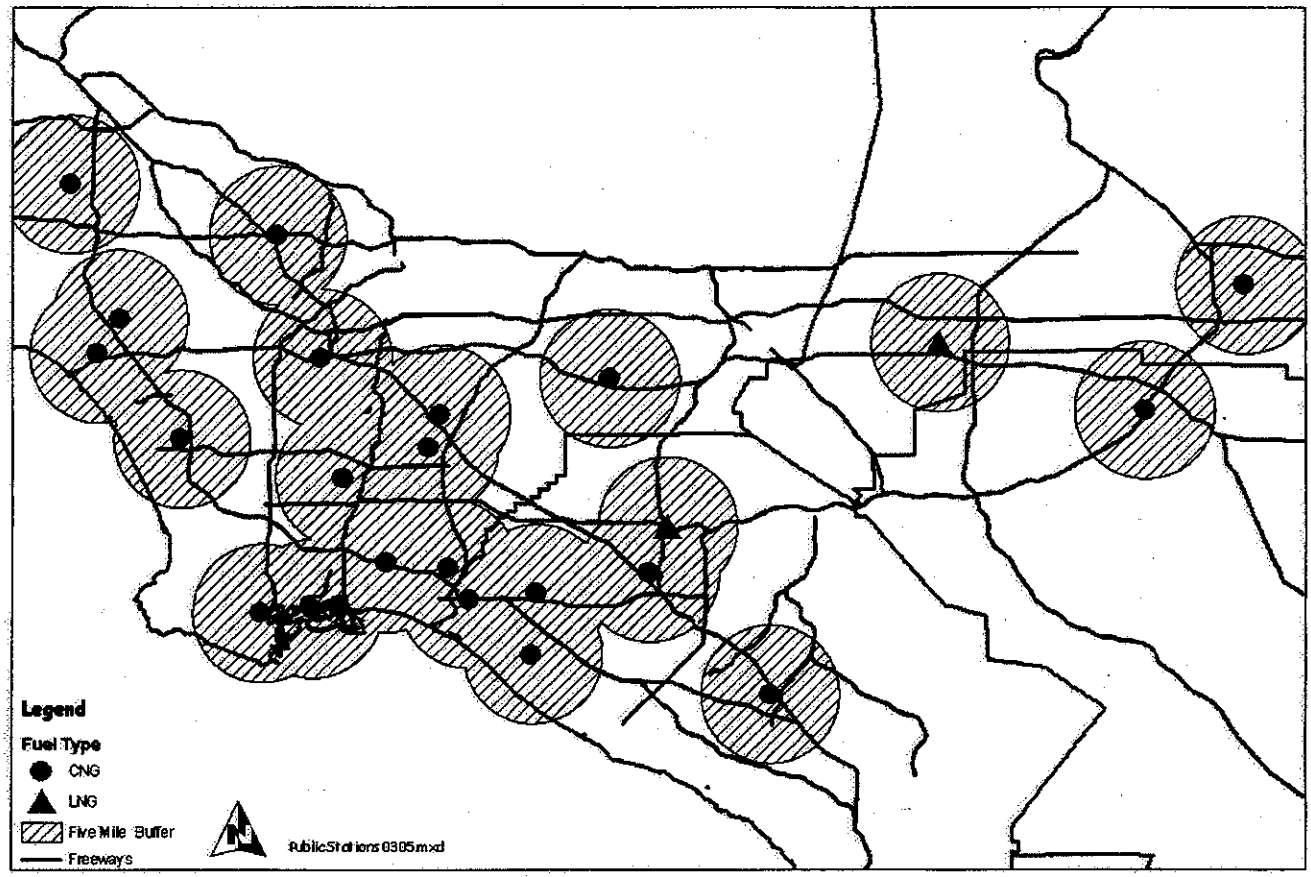
Participants in these funding programs are normally project owner/developer's that own and operate the intended natural gas fueling stations and may include public agencies or private entities. Participants also included fleet owners, state and local governments, as well as automobile manufacturers, alternative fuel

suppliers, storage and equipment component manufacturers whose intention is to own and operate the intended natural gas fueling station. Projects that were strategically located or assisted fleet owners or public agencies subject to the Fleet Rules to establish alternative fuel dispensing facilities in California were eligible. Projects that partnered with school districts or fleet owners subject to the Fleet Rules were given a priority and granted additional consideration. Grant funds could only be requested for costs associated with the physical fueling facility including, but not limited to, storage, dispensing, and/or electronic point-of-sale (EPOS) equipment at designated fueling facilities. Funding for EPOS equipment had to have universal capability (i.e., it must accept Voyager, Visa, MasterCard and other proprietary cards where applicable) where cross fueling was not an issue and where the general public may fuel where it is practical.

Comparison in Infrastructure Between Years 2000 and 2005

At the time the last Economic Assessment was published in June of 2000 by the AQMD in preparation for the Fleet Rules, there were few compressed natural gas (CNG) fueling stations located in southern California and only two liquefied natural gas (LNG) station that was accessible to public or private fleet vehicles. Figure 1 shows the pre- year 2000 station inventory in the greater metropolitan areas of southern California consisting of approximately 25 stations that mostly dispensed CNG and had very limited public access. It is apparent from the concentric circles drawn around each of the stations, representing 5 mile radii, that there wasn't much in the way of penetration of alternative fuel fueling infrastructure. It also shows that, in order for the Fleet Rules to succeed, additional fueling infrastructure was required.

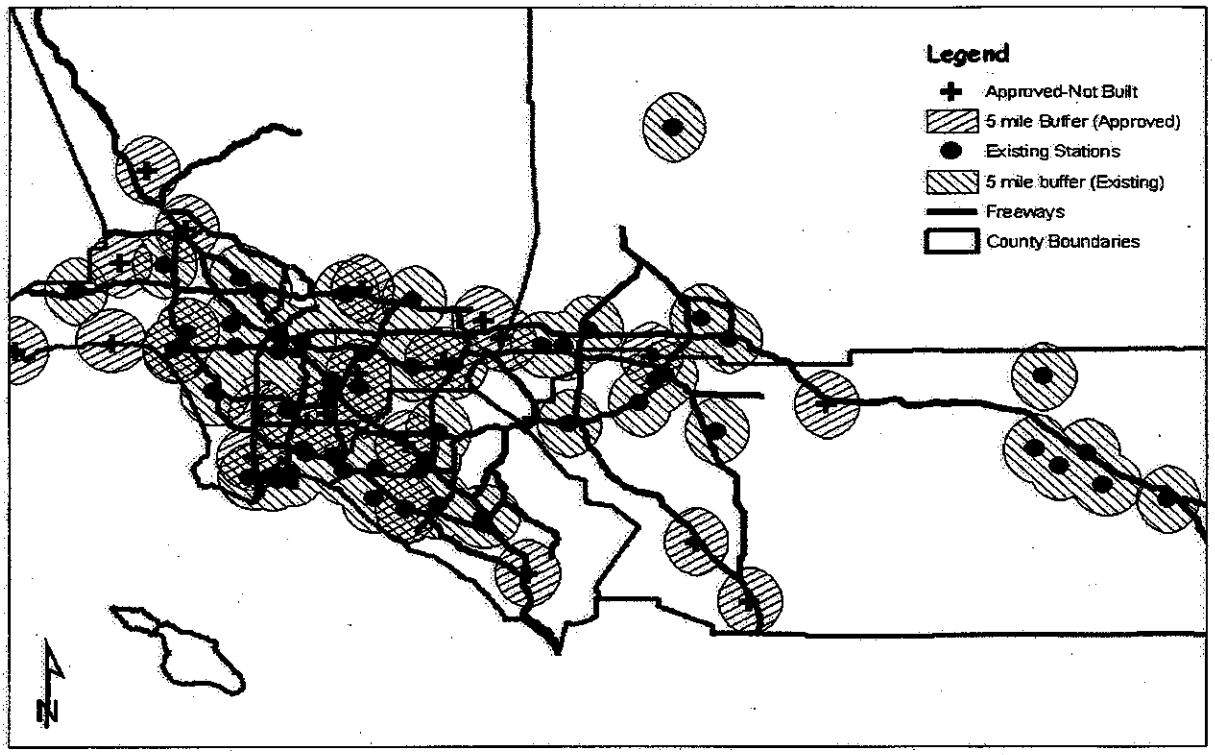
Figure 1 – Pre Year 2000 Alternative Fuel Infrastructure



The incentive funding programs offered by the AQMD have had a significant impact in the number of conveniently located publicly accessible fueling stations that are now in operation within the SCAB. From a pre- year 2000 station inventory of approximately 25 stations that mostly dispensed CNG and had very limited public access, there are now over 100 CNG or LNG stations that have or will have full public access. This type of access includes the ability to use popular credit cards, including Visa and MasterCard, as well as cards issued by different natural gas providers, allowing for convenient fueling throughout the SCAB.

Figure 2 is a map of the southern California metropolitan area and includes the four different counties as well as the major freeways that run through them. The map clearly shows the significant increase in the number of stations that are either fully operational or in the planning and permitting stage.

Figure 2 – Current Year 2005 Alternative Fuel Infrastructure



The map also includes a striped 5 mile "buffer" zone around each station, existing or planned, that was created as a planning tool to determine where possible "gaps" in the location of convenient fueling stations might exist. The gap analysis, or demographic optimization study, depicts all existing clean fuel facilities in the South Coast Air Basin and determines their proximity to new and proposed clean fuel fleets. The analysis program provided tremendous insight as to those areas that did not have adequate penetration of alternative fuel fueling infrastructure. The analysis program helped fleet operators to analyze their needs in relation to the existing or planned infrastructure and helped facilitate the decision to build or share a clean fuel fueling station by determining if using a nearby fueling station was more cost effective than building their own station. In other cases, operators found it more cost effective to build their own station and recruit other fleets in the vicinity to use their station. The filling of these different gaps in and around the major metropolitan areas and along the main corridors throughout the SCAB became a priority and applicants to the various funding programs that located stations in these gaps were given additional consideration during the scoring of competitive solicitations.

Project Funding

Appendix A contains a listing of all partially or fully funded projects through the AQMD incentive programs. All told, over $30 million in funding has been provided for projects totaling over $130 million in total costs. These projects include alternative fuel infrastructure for CNG, LNG and L/CNG fueling stations at public and private organizations and businesses as well as production of LNG from pipeline quality or landfill gas, development of advanced CNG equipment, and equipment upgrades for existing infrastructure. Funding from the MSRC for the different projects has not been included in the Appendix or any of the following tables even though the majority of projects did apply to both programs.

The funded stations vary greatly from one another with respect to their location, the type of fuel being dispensed, the type of (fleet) vehicles that are being fueled, the fuel throughput and in the cost associated with the construction. Depending on the overall intent of the station owners, i.e. if the station is to fuel a captive fleet or if it is more generally situated to capture privately owned vehicles, the overall business opportunity and financial return that the station owner requires may also be very different. There are several categories that the funded stations fall into. They are:

1. CNG Stations
2. LNG Stations
3. Refuse Haulers
4. Transit Fleets
5. Schools and Private School Bus Service Providers

Tables appearing in the following sections list the infrastructure-related projects that have been awarded funding by the AQMD's Governing Board. The categories appearing in each of the tables include the company or agency that was awarded funding, the name of the project, the total overall cost of the project and the amount of the award from the AQMD. In the last column there appears the annual fueling throughput, expressed in 1,000's of gasoline equivalent gallons, for the station as originally proposed or agreed to by contract by the company or agency requesting funds.

CNG Stations

Generally speaking, stations falling into the CNG category may have a dedicated fleet but are required to provide some form of public access and have either card readers or have in place fuel provider agreements with fleets that desire to use the facilities. Projects listed all have access to the general public unless otherwise noted. Of the CNG stations, fully 76 different stations have utilized funding from the AQMD. These funds were used from simply upgrading stations with new dispensers and credit card readers to the construction of new fueling

infrastructure. Funding was provided to agencies, cities, fuel vendors, equipment vendors and schools. Table 1 - CNG STATIONS lists the projects where over $8 million in funding was provided under the AQMD incentive programs for projects totaling over $22 million. Some of the projects listed in this and other tables were recently approved for funding by the Governing Board and are still in the planning or permitting stage. All projects have been completed unless otherwise noted.

Table 1 - CNG STATIONS

Company	Project Title	Project Total	AQMD Award	Annual Fuel Throughput (000's GGE)
City Of Banning	Construct Natural Gas Fueling Station	$725,000	$140,000	85
City Of Burbank	Construct CNG Refueling System	$942,436	$230,000	300
City Of La Verne[1]	Construct New CNG Fueling Station	$425,000	$120,000	15.3
City Of Monterey Park	Construct CNG Refueling System	$84,300	$59,000	1
City Of Placentia[1]	Construct CNG Refueling System	$635,000	$200,000	59
City Of Sierra Madre[1]	Construct CNG Fueling Station	$368,000	$73,776	3
City Of Whittier	Upgrade CNG Fueling Station	$325,000	$150,000	75
Clean Energy	Construct one CNG Fueling Station	$546,535	$144,400	200
Clean Energy[2]	Construct 5 CNG Stations in Pomona, Mission Viejo, Santa Monica, Riverside & Canoga Park	$3,098,550	$924,000	1,450
Clean Energy	Construct Four Natural Gas Refueling Stations	$2,440,400	$800,000	800
Clean Energy	Construct Natural Gas Refueling Station	$904,585	$88,800	200
Clean Energy	Upgrade 17 Existing CNG Fueling Stations	$1,445,112	$892,615	N/A
Foothill Transit[2]	Construct CNG Station with Public Access	$760,000	$188,710	
Fuelmaker Corporation	Develop/Demonstrate Advanced CNG Home Refueling Appliance	$1,225,000	$750,000	N/A
Fuelmaker Corporation	Phase II Support to Develop/Demonstrate Advanced CNG Home Refueling Appliance	$1,341,000	$550,000	N/A
Gas Equipment Systems[2]	Construct Four CNG Fueling Stations	$1,860,000	$570,000	197
Orange County Sanitation District[2]	Upgrade CNG Fueling Station	$80,000	$24,000	302
Pinnacle CNG Company	Maintenance and Management of CNG Fueling Station	$239,000	$239,000	N/A
Pinnacle CNG Systems, LLC	Construct CNG Fueling Station	$615,200	$615,200	95
R. F. Dickson Co.	Construct CNG Fueling Facility	$730,000	$180,000	400

R.F. Dickson Co.[2]	Upgrade Existing CNG Fueling Station in Bellflower	$703,828	$211,148	N/A
Southern California Gas Company	Upgrade 10 Existing CNG Fueling Stations	$641,280	$448,900	N/A
Thermo Power Corp	Low-Cost Natural Gas Compressor & Natural Gas Vehicle Refueling Station	$1,016,000	$250,000	N/A
UCLA Fleet & Transit Services	Upgrade Existing Public Access Station	$32,000	$15,921	46
Valley Power Products	CNG-Fueled Airport Service Equipment @ LAX	$863,960	$348,803	N/A
Yellow Cab Company	Construct New CNG Fueling Station	$450,000	$150,000	150
		$22,497,186	**$8,364,273**	**4,378**

1 Limited public access
2 Not yet completed or in planning stage

LNG Stations

Stations that were funded under the LNG category have captive fleets but also have made a concerted effort to provide fuel to outside agencies and businesses. Even though they have LNG fueling systems, they have made significant extra investment and installed equipment necessary to provide CNG from the LNG system. This category would not include hauling or transit fleets. Table 2 - LNG STATIONS lists the projects where approximately $1.5 million in funding was provided under the AQMD incentive programs for projects totaling almost $6 million.

Table 2 – LNG STATIONS

Company	Project Title	Project Total	AQMD Award	Annual Fuel Throughput (000's GGE)
City Of Long Beach[2]	Construct L/CNG Production Facility	$3,500,000	$500,000	300
City Of San Bernardino[1]	Construct L/CNG Refueling Station	$1,250,000	$143,208	48
Downs Commercial Fueling, Inc.[2]	Construct CNG Refueling System	$850,000	$453,137	300
Sysco Food Services Of Los Angeles	Construct LNG Fueling System	$1,002,476	$450,000	900
		$6,602,476	**$1,546,345**	**1,548**

1 Limited public access
2 Not yet completed or in planning stage

Refuse Haulers

The refuse haulers that have been funded include both contract and government operated refuse services. The refuse company had the option of determining what type of fueling technology as well as the type of vendor product that satisfied their needs. Types of fueling infrastructure funded include LNG, CNG and L/CNG stations. In some cases, the station operator installed L/CNG fueling

technology after the LNG station was constructed. Table 3 -REFUSE HAULERS lists the projects where approximately $11 million in funding was provided under the AQMD incentive programs for projects totaling approximately $40 million.

Table 3 – REFUSE HAULERS

Company	Project Title	Project Total	AQMD Award	Annual Fuel Throughput (000's GGE)
Burrtec, Inc. [1, 2]	Construct LNG Fueling System	$627,141	$188,000	198
City Of Los Angeles, Dept. Of Public Works[1]	Construct LNG Fueling Station	$3,200,000	$200,000	480
Consolidated Disposal Service[2]	Construct LNG Fueling System	$740,127	$222,038	820
CR&R Inc. [2]	Construct 2 L/CNG Fueling Stations	$1,164,948	$582,474	380
Dept. Of Water & Power / City of Los Angeles[1]	Construct 2 LNG Fueling Stations	$24,000,000	$6,000,000	N/A
Riverside County Waste Management	Construct LNG Fueling Station	$1,140,000	$200,000	68
Riverside County Waste Management	Construct LNG Fueling Station	$1,282,400	$148,350	N/A
Riverside County Waste Management	Supplemental Funding for LNG Fueling Station	$1,188,350	$165,000	N/A
Sanitation Districts Of Los Angeles County	Construct LNG Refueling Systems	$1,120,000	$818,750	350
Sanitation Districts Of Los Angeles County[2]	Construct CNG Fueling Station at JWPCP in Carson	$850,000	$250,000	150
Taormina Industries	Construct L/CNG Fueling Station	$1,059,850	$413,000	300
USA Waste Of California, Inc. [1]	Construct L/CNG Fueling Station	$850,000	$400,000	1,400
Valley Power Products Inc[1]	CNG-Fueled Airport Service Equipment @ LAX	$863,960	$348,803	N/A
Valley Vista Services	Construct CNG Fueling Station	$840,844	$200,000	300
Waste Management Of San Gabriel[1]	Construct L/CNG Fueling Station	$850,000	$400,000	1,360
Waste Management Recycling And Disposal Services[1]	Construct L/CNG Fueling Station	$850,000	$400,000	680
		$40,627,620	**$10,936,415**	**6,486**

1 Limited public access
2 Not yet completed or in planning stage

Transit Fleets

Of the four transit fleets that requested incentive funding from the AQMD, three use CNG in their buses, but two of them opted to install L/CNG fueling systems instead of a straight CNG system. The cost of installing an L/CNG fueling system is often believed to be less than the cost of a CNG system. Table 4 - TRANSIT FLEETS lists the projects where approximately $4 million in funding was provided under the AQMD incentive programs for projects totaling almost $18 million.

Table 4 – TRANSIT FLEETS

Company	Project Title	Project Total	AQMD Award	Annual Fuel Throughput (000's GGE)
Santa Monica Big Blue Bus[1]	Purchase/Install L/CNG Refueling Systems	$6,501,930	$500,000	8,500
Foothill Transit[1]	Purchase/Install CNG Refueling System	$3,800,000	$700,000	600
OmniTrans[1]	Purchase/Install two New L/CNG Fueling Systems	$5,810,360	$1,650,000	4,000
Orange County Transportation Authority[1, 2]	LNG Equipment Upgrade and New Alternative Fueling Infrastructure	$2,000,000	$1,000,000	N/A
		$18,112,290	**$3,850,000**	**13,100**

1 Limited public access
2 Not yet completed or in planning stage

Schools

Overall, 86 different alternative fueling infrastructure projects were funded under the school category. Funding was provided under the Lower-Emission School Bus Replacement Program as well as the Clean Fuels Fund and the AES Settlement Fund. Table 5 - SCHOOLS lists the projects where approximately $5 million in funding was provided under the AQMD incentive programs for projects totaling almost $7 million. A significant difference exists in the amount of funding provided between some of the school districts. For those districts that have fewer than 20 buses a time fill system was normally specified while those having greater than 20 buses opt for a fast fill system. Time fill systems generally cost much less than a fast fill system.

Table 5 – SCHOOLS AND PRIVATE SCHOOL BUS SERVICE PROVIDERS

Company	Project Title	Project Total	AQMD Award
Capistrano USD[1]	Install CNG Fueling Facility	$ 111,200	$ 111,200
Coachella Valley USD[1]	CARB Emissions Reduction Credit Bank Program	$ 257,950	$ 257,950
Colton Joint USD[1]	CARB Emissions Reduction Credit Bank Program	$ 302,600	$ 302,600
First Student, Inc.[2]	New Public Access CNG Fueling Station at Gardena Bus Yard	$ 842,000	$ 250,000
Fuelmaker Corporation[1]	Upgrade CNG Fueling Stations at Various School Districts and Municipalities	$ 180,000	$ 90,000
Fullerton Joint USD[1]	New CNG Refueling System in Fullerton	$ 274,632	$ 137,300
Jurupa USD[1]	New CNG Refueling System for 34 Buses	$ 1,075,244	$ 390,244
Lake Elsinore USD[1]	New CNG Fueling Station at Maintenance Yard	$ 190,000	$ 75,000
Whittier Union High School[1]	Upgrade Existing Public Access Station	$ 32,000	$ 15,921
		$3,265,626	**$1,630,215**

1 Limited public access
2 Not yet completed or in planning stage

Lower-Emission School Bus Replacement Program

School	Program	Project Total	AQMD Award
Alhambra USD	PA 2005-01	$13,380	$13,380
Alta Loma USD	FY 2000-	$10,730	$10,730
Alta Loma USD	FY 2003-04	$13,316	$13,316
Alta Loma USD	PA 2005-01	$11,815	$11,815
Arcadia USD	FY 2001-	$38,096	$38,096
Arcadia USD	FY 2002-03	$11,500	$11,500
Arcadia USD	FY 2003-04	$11,880	$11,880
Arcadia USD	PA 2005-01	$47,522	$47,522
Azusa USD	FY 2003-04	$13,380	$13,380
Azusa USD	PA 2005-01	$26,761	$26,761
Banning USD	FY 2000-01	$12,589	$12,589
Banning USD	FY 2001-02	$60,954	$60,954
Banning USD	FY 2003-04	$11,815	$11,815
Beaumont USD	FY 2002-03	$11,500	$11,500
Bellflower USD	FY 2002-03	$92,000	$92,000
Bellflower USD	FY 2003-04	$47,520	$47,520
Bellflower USD	PA 2005-01	$11,880	$11,880
Bonita USD	FY 2002-03	$11,500	$11,500
Bonita USD	FY 2003-04	$13,380	$13,380
Bonita USD	PA 2005-01	$40,141	$40,141
Buena Park USD	FY 2002-03	$46,000	$46,000
Buena Park USD	PA 2005-01	$59,079	$59,079
Chaffey Joint USD	FY 2000-01	$22,143	$22,143
Chino Valley USD	FY 2000-01	$15,569	$15,569
Chino Valley USD	FY 2001-02	$35,958	$35,958
Chino Valley USD	FY 2002-03	$34,500	$34,500
Chino Valley USD	FY 2003-04	$11,815	$11,815
Colton Joint USD	FY 2000-01	$86,926	$86,926
Colton Joint USD	FY 2001-02	$25,866	$25,866
Colton Joint USD	PA 2005-01	$39,947	$39,947
Covina-Valley USD	FY 2002-03	$11,500	$11,500
Covina-Valley USD	FY 2003-04	$13,380	$13,380
Desert Sands USD	FY 2000-01	$64,384	$64,384
Fullerton Joint USD	FY 2000-01	$75,532	$75,532
Fullerton Joint USD	FY 2002-03	$11,500	$11,500
Fullerton Joint USD	FY 2003-04	$11,815	$11,815
Fullerton Joint USD	PA 2005-01	$35,447	$35,447
Garden Grove USD	FY 2000-01	$85,846	$85,846
Garden Grove USD	FY 2001-02	$116,292	$116,292
Garden Grove USD	FY 2002-03	$11,500	$11,500

Garden Grove USD	FY 2003-04	$13,316	$13,316
Garden Grove USD	PA 2005-01	$23,631	$23,631
Hacienda-La Puente USD	PA 2005-01	$71,283	$71,283
Hemet USD	FY 2002-03	$11,500	$11,500
Hemet USD	FY 2003-04	$11,815	$11,815
Hemet USD	PA 2005-01	$11,815	$11,815
Huntington Beach City School District	FY 2002-03	$11,500	$11,500
Huntington Beach City School District	FY 2003-04	$13,316	$13,316
Huntington Beach City School District	PA 2005-01	$13,315	$13,315
Lake Elsinore USD	PA 2005-01	$35,447	$35,447
Los Alamitos USD	PA 2005-01	$39,947	$39,947
Los Angeles USD	FY 2000-01	$396,729	$396,729
Los Angeles USD	FY 2001-02	$186,408	$186,408
Los Angeles USD	FY 2002-03	$126,500	$126,500
Menifee USD	FY 2002-03	$11,500	$11,500
Menifee USD	FY 2003-04	$13,316	$13,316
Menifee USD	PA 2005-01	$11,815	$11,815
Monrovia USD	FY 2000-01	$53,924	$53,924
Montebello USD	FY 2000-01	$95,526	$95,526
Moreno Valley USD	FY 2000-01	$37,766	$37,766
Moreno Valley USD	FY 2002-03	$11,500	$11,500
Moreno Valley USD	FY 2003-04	$11,815	$11,815
Moreno Valley USD	PA 2005-01	$23,631	$23,631
Mountain View USD	FY 2000-01	$75,545	$75,545
Newport-Mesa USD	PA 2005-01	$39,947	$39,947
Ontario-Montclair School District	FY 2000-01	$16,498	$16,498
Orange USD	PA 2005-01	$13,315	$13,315
Placentia-Yorba Linda USD	FY 2000-01	$43,052	$43,052
Pupil Transportation Cooperative	FY 2000-01	$75,617	$75,617
Pupil Transportation Cooperative	PA 2005-01	$66,902	$66,902
Redlands USD	FY 2002-03	$11,500	$11,500
Redlands USD	FY 2003-04	$11,815	$11,815
Redlands USD	PA 2005-01	$23,631	$23,631
Santa Monica-Malibu USD	FY 2000-01	$11,353	$11,353
Torrance USD	FY 2000-01	$13,196	$13,196
Upland USD	PA 2005-01	$11,815	$11,815
Walnut Valley USD	FY 2000-01	$11,379	$11,379
Walnut Valley USD	FY 2002-03	$11,500	$11,500
Walnut Valley USD	PA 2005-01	$13,380	$13,380
		$3,014,419	**$3,014,419**
	GRAND TOTAL	**6,915,044.64**	**$4,844,634**

CNG vs. Diesel Fuel Retail Pricing

The prices contained within this report are meant to represent retail, at-the-pump sales prices for natural gas and diesel. Prices for natural gas were collected from the Southern California Gas Company and a local commercial vendor of natural gas, where taxes are not included.

Diesel fuel averaged $2.132 per gallon nationwide during the week of November 15, 2004. This represented an increase of 42.1¢ per gallon from June 2004. During the week of November 15, diesel prices ranged from a low of $2.056 in the Gulf Coast region to a high of $2.274 on the West Coast. Between June and November, 2004, prices for diesel increased in every region of the country. The diesel prices here are retail prices and include federal, state, and local taxes. These prices were obtained from the Energy Information Administration.

Average natural gas (CNG) retail pump prices for the West Coast during the week of November 15, 2004 were $1.80 per GGE.

Price Trends

	June 14, 2004	November 15, 2004
	Change in Price	
Diesel Price Trends $0.276	$1.998	$2.274
CNG Price Trends $0.28	$1.54	$1.82
SoCalGas Price ($0.27)	$1.57	$1.40

APPENDIX A – ALL FUNDED PROJECTS

Company	City	Project Title	Project Total	AQMD Award
Burrtec, Inc.	Santa Clarita	New LNG Fueling System	$627,141	$188,000
Capistrano USD	San Juan Capistrano	New CNG Fueling Facility	$111,200	$111,200
City Of Banning	Banning	New CNG Fueling Station	$725,000	$140,000
City Of Burbank	Burbank	New CNG Refueling System	$942,436	$230,000
City Of La Verne	La Verne City Hall	New CNG Fueling Station	$425,000	$120,000
City Of Long Beach	Long Beach	New LNG Production Facility	$3,500,000	$500,000
City Of Los Angeles, Dept. Of Public Works	Los Angeles	Construct & Operate New LNG Fueling Station	$3,200,000	$200,000
City Of Monterey Park	Monterey Park	New CNG Refueling System City Yard	$84,300	$59,000
City Of Placentia	Placentia	New CNG Refueling System in the City Yard	$635,000	$200,000
City Of San Bernardino	San Bernardino	Development of LNG-L/CNG Refueling Station	$1,250,000	$143,208
City Of Santa Monica (Big Blue Bus)	Santa Monica	Install Two L/CNG Refueling Systems	$6,501,930	$500,000
City Of Sierra Madre	Sierra Madre	Install New Public Access CNG Fueling Station	$368,000	$73,776
City Of Whittier	Whittier	New CNG Fueling Station at City Yard	$325,000	$150,000
Clean Energy	Downey, Long Beach, Thousand Palms, Baldwin Park	Construct & Operate 1 LNG & 4 CNG Fueling Stations	$546,400	$144,400
Clean Energy	Pomona, Mission Viejo, Santa Monica, Riverside & Canoga Park	New CNG Stations in Pomona, Mission Viejo, Santa Monica, Riverside & Canoga Park	$3,098,550	$924,000
Clean Energy	Pasadena, Burbank, Garden Grove, Los Angeles	Construction/Upgrade of Four Natural Gas Refueling Stations	$2,440,400	$800,000
Clean Energy	Palm Desert	Purchase/Installation of NG Refueling Station	$904,585	$88,800
Clean Energy	17 different cities	Upgrade Existing CNG Fueling Stations	$1,445,112	$892,615
Coachella Valley USD	Coachella Valley	CARB Emissions Reduction Credit Bank Program		$257,950
Colton Joint USD	Colton	CARB Emissions Reduction Credit Bank Program	$302,600	$302,600
Consolidated Disposal Service	Long Beach	New LNG Fueling System	$740,127	$222,038
CR&R Inc.	San Juan Capistrano	New LNG-L/CNG Refueling	$1,164,948	$582,474

	& Stanton	Stations		
Dept. Of Water & Power	Los Angeles	Construction of LNG Fueling Facilities for Refuse Haulers	$24,000,000	$6,000,000
Downs Commercial Fueling, Inc.	Temecula	New CNG Refueling System	$850,000	$250,000
Downs Commercial Fueling, Inc.	Temecula	New L/CNG Fueling System		$203,137
First Student, Inc.	Gardena at Bus Yard	New CNG Fueling Station	$842,000	$250,000
Foothill Transit	Pomona	New CNG Refueling System	$3,800,000	$500,000
Foothill Transit	Pomona	New CNG Fueling Facility		$200,000
Foothill Transit	Pomona	New CNG Station with Public Access	$760,000	$188,710
Fuelmaker Corporation	N/A	Develop/Demonstrate Advanced CNG Home Refueling Appliance	$1,225,000	$750,000
Fuelmaker Corporation	N/A	Phase II Support to Develop/Demonstrate Advanced CNG Home Refueling Appliance	$1,341,000	$550,000
Fuelmaker Corporation	N/A	Upgrade CNG Fueling Stations at Various School Districts and Municipalities	$180,000	$90,000
Fullerton Joint USD	Fullerton	New CNG Refueling System	$274,632	$137,300
Gas Equipment Systems	Malibu, Zuma Beach, City of San Fernando & City of Beaumont	New CNG Fueling Stations	$1,860,000	$570,000
Jurupa USD	Jurupa	New CNG Refueling System	$310,000	$125,000
Jurupa USD	Jurupa	Supplemental Funding for CNG Fueling Station	$609,826	$109,826
Jurupa USD	Jurupa	CNG School Bus Replacements and CNG Infrastructure	$155,418	$155,418
Lake Elsinore USD	Lake Elsinore	New CNG Fueling Station	$190,000	$75,000
OmniTrans	San Bernardino & Montclair	New L/CNG Fueling System	$5,810,360	$750,000
OmniTrans	San Bernardino & Montclair	New 2 L/CNG Fueling Facilities		$400,000
OmniTrans	San Bernardino & Montclair	New L/CNG Refueling Station in City of Montclair		$250,000
OmniTrans	San Bernardino & Montclair	New L/CNG Refueling Station in San Bernardino		$250,000
Orange County Sanitation District	Fountain Valley Facility	New Dispenser/Payment System	$80,000	$24,000
Orange County Transportation Authority	Santa Ana	Cost-Sharing Equipment to Upgrade Transit LNG Tanks & Expand New Alternative Fueling Infrastructure	$2,000,000	$1,000,000

PG&E	Sacramento	Cost-Share Small-Scale Natural Gas Liquefaction Plant	$7,400,000	$200,000
Pinnacle CNG Company	Diamond Bar	Maintenance and Management of CNG Fueling Station at AQMD Headquarters	$239,000	$239,000
Pinnacle CNG Company	Diamond Bar	Construction of Fast-Fill CNG Fueling Station at AQMD Headquarters	$615,200	$615,200
R. F. Dickson Company	Bellflower	Cost-share Installation of CNG Fueling Facility	$730,000	$180,000
R.F. Dickson Co.	Bellflower	Upgrade Existing CNG Fueling Station in Bellflower	$703,828	$211,148
Riverside County Waste Management	Aqua Mansa	New LNG Fueling Station	$1,140,000	$200,000
Riverside County Waste Management	Aqua Mansa	New LNG Fueling Station at Agua Mansa Road	$1,282,400	$148,350
Riverside County Waste Management	Aqua Mansa	Supplemental Funding for LNG Fueling Station	$1,188,350	$165,000
Sanitation Districts Of Los Angeles County	La Puente	New LNG Refueling Systems at Puente Hills Landfill	$1,120,000	$258,750
Sanitation Districts Of Los Angeles County	La Puente	New LNG-L/CNG Fueling Station at Puente Hills Landfill		$560,000
Sanitation Districts Of Los Angeles County	Carson	New Fast-Fill Public Access CNG Fueling Station at JWPCP	$850,000	$250,000
Southern California Gas Company	10 different cities	Upgrade Existing CNG Fueling Stations	$641,280	$448,900
SunLine Services Group	Thousand Palms	New LNG Production Facility	9,800,000	$549,054
Sysco Food Services, Inc.	Walnut	Construct & Operate L/CNG Fueling Station	$1,002,476	$200,000
Sysco Food Services, Inc.	Walnut	New LNG Fueling System	$1,002,476	$250,000
Taormina Industries	Anaheim	New CNG refueling System	$1,021,850	$200,000
Taormina Industries	Anaheim	New LNG-L/CNG Refueling Station	$1,059,850	$203,682
Taormina Industries	Anaheim	New LNG-L/CNG Refueling Station at Taormina		$9,318
Thermo Power Corp	N/A	Low-Cost Natural Gas Compressor & Natural Gas Vehicle Refueling Station	$1,016,000	$250,000
UCLA Fleet & Transit Services	Westwood	Upgrade Existing Public Access Station	$32,000	$15,921
USA Waste Of California		New LNG-L/CNG Fueling System	$850,000	$400,000

Valley Power Products Inc	Los Angeles	CNG-Fueled Airport Service Equipment @ LAX	$863,960	$348,803
Valley Vista Services	City of Industry	New CNG Fueling System at Waste Transfer Facility	$840,844	$200,000
Waste Management Of San Gabriel	Baldwin Park	Purchase/Install LNG-L/CNG Fueling System	$850,000	$400,000
Waste Management Recycling And Disposal Svcs	Los Angeles	Development of LNG-L/CNG Fueling Station at Bradley Landfill	$850,000	$400,000
Whittier USD	Whittier	Upgrade Existing Public Access Station	$32,000	$15,921
Yellow Cab Company	Anaheim	New CNG Fueling Station	$450,000	$150,000
			$130,984,060	$30,785,673

*Some or all of these projects funding were de-obligated

Appendix C

Distribution of Alternative Fuel Stations within the South Air Quality Management District

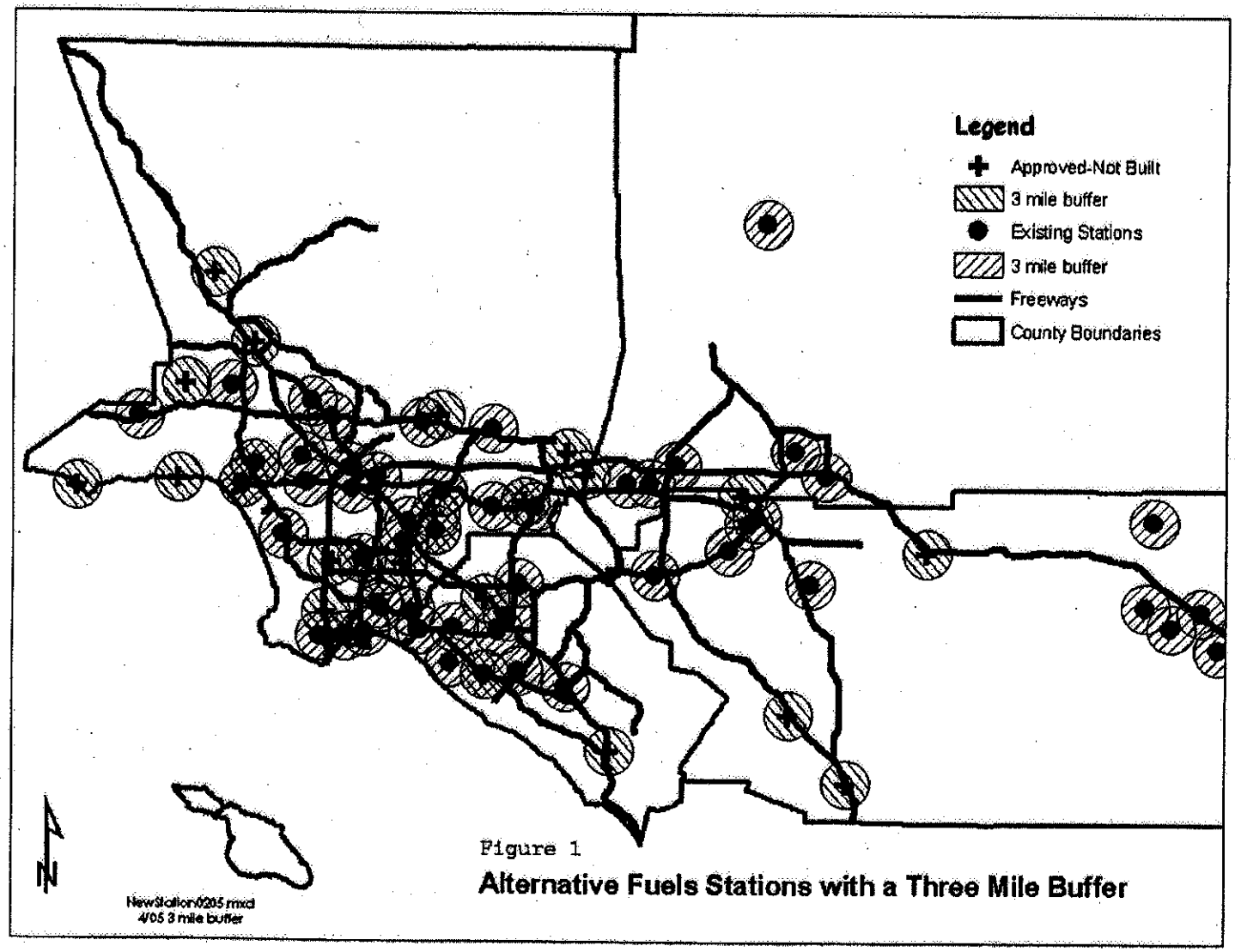


Figure 1

Alternative Fuels Stations with a Three Mile Buffer

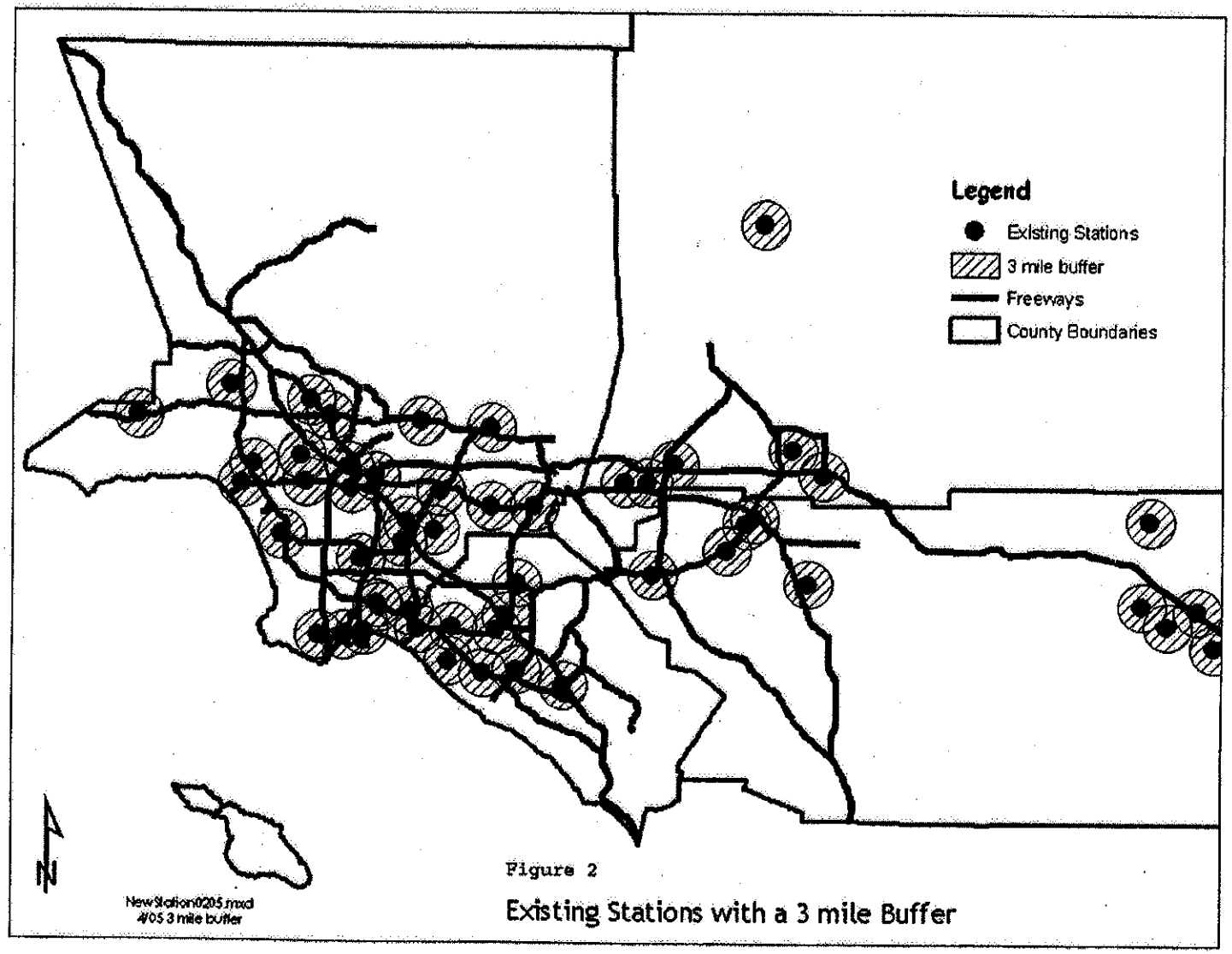


Figure 2

Existing Stations with a 3 mile Buffer

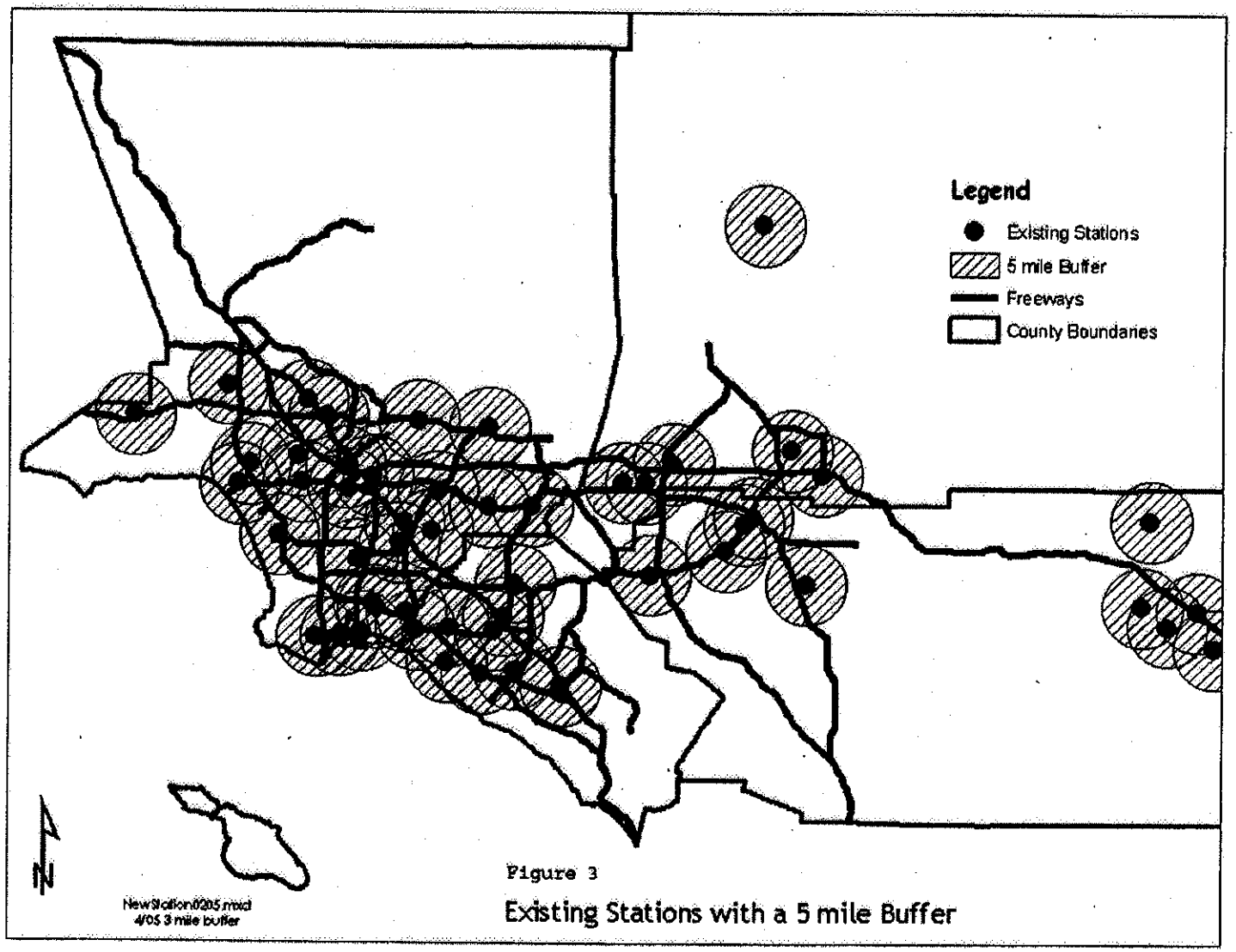
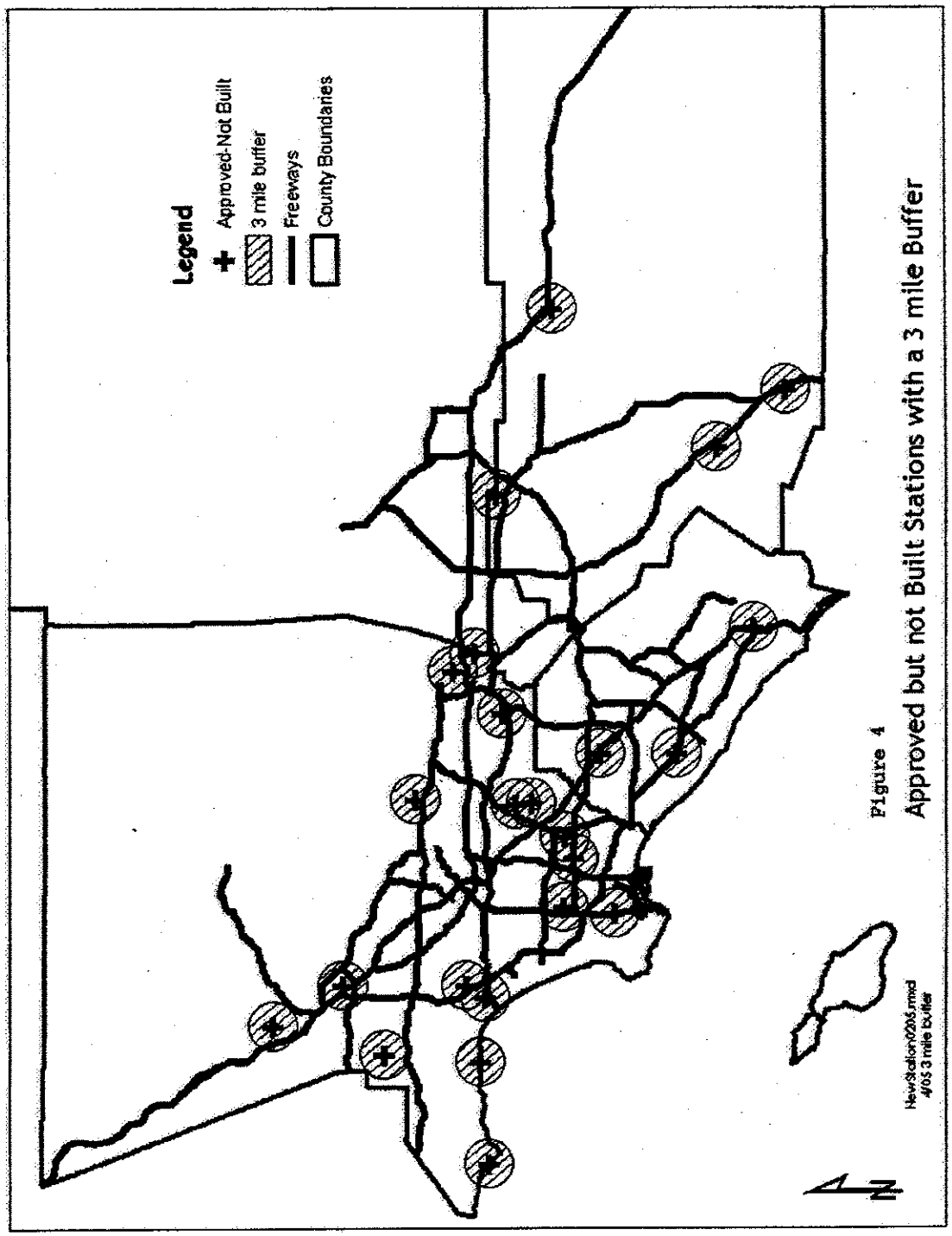


Figure 3

Existing Stations with a 5 mile Buffer


Legend
Approved-Not Built
3 mile buffer
Freeways
County Boundaries
Figure 4
Approved but not Built Stations with a 3 mile Buffer
NewStation0205.mxd
#05 3 mile buffer

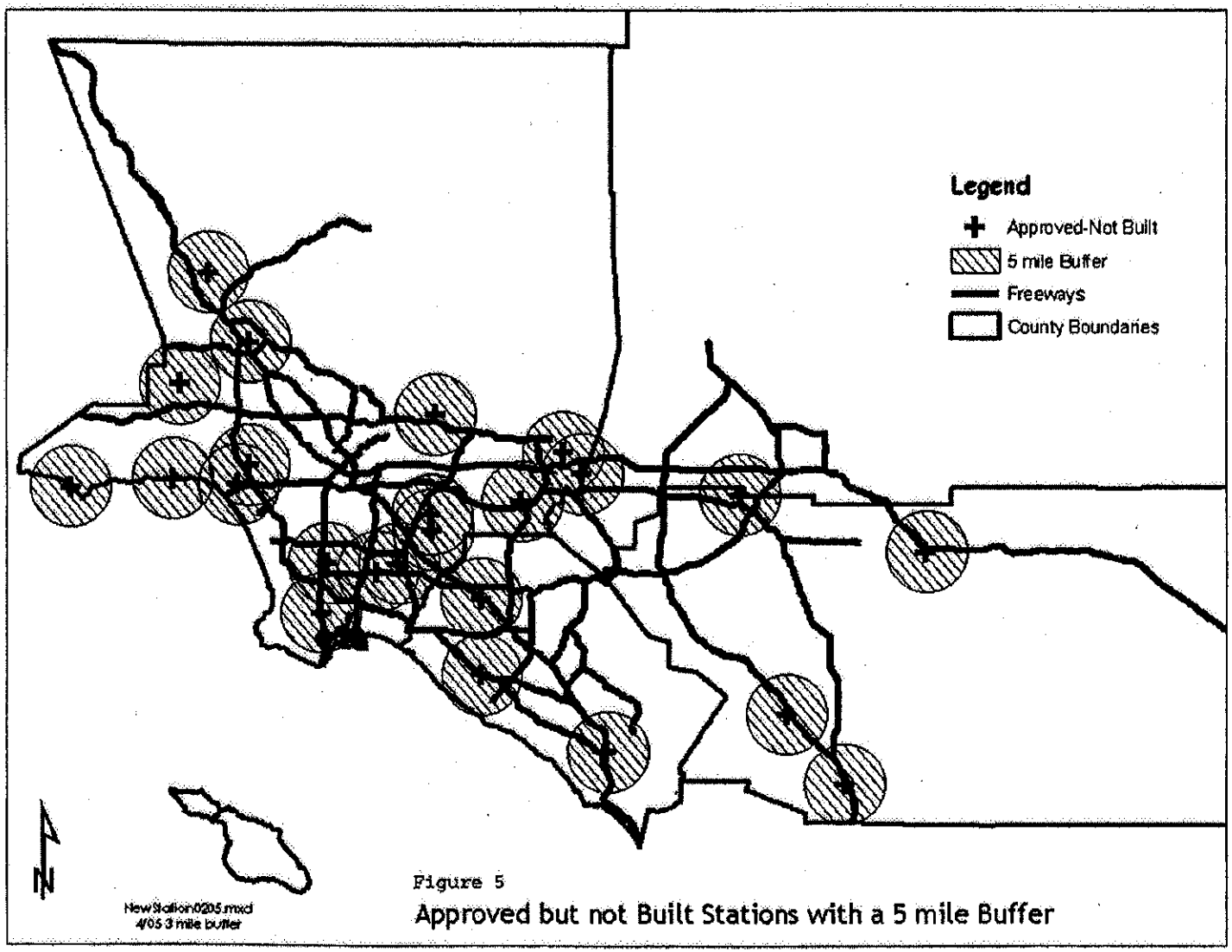


Figure 5
Approved but not Built Stations with a 5 mile Buffer

TITLE 13. CALIFORNIA AIR RESOURCES BOARD

NOTICE OF PUBLIC HEARING TO CONSIDER PROPOSED AMENDMENTS TO THE EXHAUST EMISSION STANDARDS FOR 2007-2009 MODEL-YEAR HEAVY DUTY URBAN BUS ENGINES AND THE FLEET RULE FOR TRANSIT AGENCIES

The Air Resources Board (the Board or ARB) will conduct a public hearing at the time and place noted below to consider adoption of amendments to the exhaust emission standards and test procedures for urban bus engines and vehicles and to the ARB fleet rule for transit agencies. The purposes of these amendments are to achieve emission reductions from the operations of transit agencies throughout the state, and to make specific changes in the regulations to specifically address transit vehicles used in the South Coast Air Quality Management District (SCAQMD or District). This notice summarizes the significant amendments. The staff report presents the proposal in greater detail.

DATE: September 15-16, 2005

TIME: 9:00 a.m.

PLACE: South Coast Air Quality Management District
Auditorium
21865 E. Copley Drive
Diamond Bar, California 91765

This item will be considered at a two-day meeting of the Board, which will commence at 9:00 a.m., September 15, 2005, and may continue at 8:30 a.m., September 16, 2005. This item may not be considered until September 16, 2005. Please consult the agenda for the meeting, which will be available at least 10 days before September 15, 2005, to determine the day on which this item will be considered.

If you have a disability-related accommodation need, please go to http://www.arb.ca.gov/html/ada/ada.htm for assistance or contact the ADA Coordinator at (916) 323-4916. If you are a person who needs assistance in a language other than English, please contact the Bilingual Coordinator at (916) 324-5049. 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 amendments to title 13, California Code of Regulations, sections 1956.1, 1956.2, and 1956.8.

Staff has identified two policy decisions to be considered by the Board. They are:

- The appropriate emission standards for new 2007 and later model-year urban bus engines, and the potential amendment of ARB's transit fleet rule to require the use of alternative fuel transit buses statewide; and
- The need for Board adoption of a fleet rule requiring the use of alternative fuel buses by the six "diesel path" transit agencies within SCAQMD.

Background: California's current oxides of nitrogen (NOx) emission standard for new 2007 and later model-year diesel urban bus engines is 0.2 grams per brake horsepower-hour (g/bhp-hr) – a tightening of the 0.5 g/bhp-hr NOx standard that has applied for the 2004-2006 model years. The California and federal national heavy-duty truck new engine standard for 2007, which includes urban buses for all but California, is also 0.2 g/bhp-hr NOx, and applies to one-half of the new engines sold in 2007 through 2009. The heavy-duty truck standard, however allows manufacturers the flexibility to choose, for each engine type, any emission level between the current standard 2.4 g/bhp-hr (non-methane hydrocarbon plus NOx) and the new 0.2 g/bhp-hr NOx standard. This results in the option of certifying all engines to an average NOx level of 1.2 g/bhp-hr during 2007 through 2009, and this is what engine manufacturers have stated they plan to do. Thus, California's new urban bus engine standard is more stringent than the national urban bus engine standard.

Along with the exhaust emission standards for urban bus engines and vehicles, in 2000 ARB also adopted a Fleet Rule for Transit Agencies. It has required each transit agency in the state to select a non-revocable compliance path – either the "diesel" path or the "alternative-fuel" path – by January 1, 2001. Path selection establishes the fuel type for new urban bus purchases or leases through model year 2015 and is a non-revocable election. There are 76 transit agencies statewide that report to ARB under ARB's Fleet Rule for Transit Agencies (28 are on the alternative fuel path and 48 are on the diesel path). Most air quality districts are fairly evenly split, with some transit agencies on the alternative fuel path and some on the diesel path. Exceptions are the Bay Area, where most agencies are on the diesel path, and the South Coast, where most agencies are on the alternative fuel path.

The trends in certification and purchases of new urban buses show that manufacturers are not certifying any diesel urban bus engines that meet California's standards of 0.5 g/bhp-hr for 2004 to 2006 model years, leading to little or no turnover of diesel buses in 2004-2006 for transit agencies on the diesel fuel path reluctant to switch to alternative fuel. Engine manufacturers have indicated they do not plan to certify diesel urban bus engines to meet the California NOx standard of 0.2 g/bhp-hr for 2007 to 2009 model year, so diesel engines for buses would continue to be unavailable for three additional years.

In June 2004, ARB staff, with concurrence of the Board, postponed a decision on a staff proposal to align ARB's current urban bus engine standards with the California 2007 heavy-duty standard because of an ongoing evaluation of available 2007 urban bus

engine technology. Of particular interest to the Board was whether natural gas engines would comply with the 2007 urban bus NOx emission standard.

Potential Amendments to the Emission Standards for New Urban Bus Engines or Other Statewide Amendments

Staff has assessed urban bus engine availability based on the current 2007-2009 model year standard versus what could be available if the Board were to amend the NOx standard to align with the current 2007-2009 model year heavy-duty truck engine standards, and is presenting the results of its assessment to the Board. The Board has two basic options. The first is to keep the urban bus NOx standard as it is. Under this option, there will not be any diesel engines that meet the current standard for 2007 through 2009 available to transit agencies on the diesel path. Starting in 2010 however, diesel urban bus engines are expected to meet the required standard and will become available for purchase. Alternative fuel engines will likely be available beginning in 2007 meeting the 0.2 g/bhp-hr NOx standard, and thus transit agencies on the alternative fuel path may continue to buy alternative fuel urban buses and are not directly affected by potential amendments to the urban bus engine emission standard.

Under the first option, many transit agencies favoring diesel buses have indicated that, if no diesel buses are available during 2007 through 2009, they do not plan to purchase alternative fuel buses and instead will delay purchases of new buses until diesel buses are available in 2010. As a result, higher emitting older buses that would have been replaced during 2007 through 2009 will stay in operation until at least 2010, adding to the older buses already held onto during the 2004 through 2006 time period. Supporters of alternative fuels favor this option because it increases the incentive to purchase alternative fuel buses. However, transit agencies on the diesel path oppose it because it disrupts their purchase process of new buses and keeps their older buses on the road longer.

The second option available to the Board is to relax the urban bus NOx emission standard for 2007 through 2009 to align it with the comparable emission standard for heavy-duty truck engines. As a result of this option, urban buses would be required to meet the same standards that most other diesel engines for trucks and buses are required to meet. Manufacturers would accordingly provide compliant diesel engines for urban buses, and urban buses with these engines would be available for transit agencies to purchase beginning in 2007. This results in lower emissions compared to retaining the current standards, at least for the first few years, because higher emitting older diesel buses will be replaced during 2007 through 2009 with the new, cleaner engines meeting a 1.2 g/bhp-hr level for NOx. Under the first option these older diesel buses would remain in service until at least 2010, and perhaps beyond.

Under the second option however, total statewide emissions will be somewhat higher than under the first option after about 2011. This occurs because, under the first option, transit agencies would begin after 2009 to make up for purchases deferred during 2007 through 2009. The engines in the new buses purchased in 2010 and later will meet the

0.2 g/bhp-hr NOx standard rather than the less stringent 1.2 g/bhp-hr NOx standard that would have applied in 2007-2009 under the second option. Thus, in the longer term there will be some engines meeting the 1.2 g/bhp-hr NOx level in the bus fleet under the second option, whereas all would meet 0.2 g/bhp-hr under the first option.

Agencies on the diesel path favor the second option because it allows them to continually purchase diesel buses beginning in 2007 without disruption. Proponents of alternative fuel buses believe that this option undercuts their investment in alternative fuels and sends the signal that the State no longer favors alternative fuels.

A third option the staff considered is amending ARB's Fleet Rule for Transit Agencies to require that all transit agencies statewide use alternative fuel buses when making purchases or leases through 2015. Under this option, transit districts now on the diesel path would no longer have the option of deferring purchases while waiting for diesel engines to be available in 2010. These agencies would have to switch to alternative fuel in order to buy buses and maintain transit service.

The third option results in slightly lower emissions than the second option (align). Compared to the first option (keep current standard), emissions are lower from 2007 to 2012. Transit agencies on the diesel path, particularly those in the Bay Area, strongly oppose this option because they believe the use of alternative fuel buses results in less reliable service, and diesel as clean as alternative fuel buses will be available in 2010 for purchase. They also point out they were allowed to make a choice of fuel type when the ARB Fleet Rule for Transit Agencies was adopted in 2000, and they should not be forced to change now at great cost and disruption, for little air quality benefit. Smaller transit agencies in less urbanized areas have expressed concern about the cost of alternative fuel engines, and the lack of alternative fuel availability. Proponents of alternative fuel strongly favor this approach because it creates a growing demand for their products and a strong incentive to develop new engines.

The rulemaking documents prepared in connection with this notice set forth the language necessary to implement the option of aligning the urban bus standards with the heavy-duty truck standards beginning with the 2007 model year. Should the Board favor the first option – keeping the urban bus standards as they are – no regulatory changes are necessary. Should the Board decide that all transit agencies statewide should be required to purchase alternative fuel, a 15-day modification to ARB's Fleet Rule for Transit Agencies would be needed accomplish this (and no change to the urban bus emission standards would be necessary).

Amending ARB's Fleet Rule to Mandate the Alternative Fuel Path for Transit Agencies Within the SCAQMD

Under its Clean Fleets Program, SCAQMD adopted seven fleet rules during 2000 and 2001. The rules were developed to gradually shift public agencies and certain private entities to lower emission and alternative-fuel vehicles whenever a fleet operator purchases or leases a vehicle for replacement or addition to a fleet. The District

adopted these rules based on Health and Safety Code section 40447.5, which authorizes SCAQMD to adopt regulations that require operators of 15 or more public and commercial fleet vehicles, when adding or replacing vehicles, to purchase vehicles that are capable of operating on methanol or other equivalently clean-burning alternative fuel. One of the fleet rules adopted is Rule 1192 - Clean On-Road Transit Buses.

Shortly after the District adopted its fleet rules, the Engine Manufacturers (EMA) and the Western States Petroleum Association (WSPA) sued the District in federal court challenging its authority to adopt the rules. In April 2004, the United States Supreme Court ruled that it appears likely that at least certain aspects of the fleet rules were preempted by section 209(b) of the federal Clean Air Act. The Supreme Court remanded the case back to the federal District Court to determine whether some parts of the fleet rules could be characterized as state purchasing decisions and, if so, whether preemption applied. In response to this decision, SCAQMD requested that ARB submit the District's rules to the United States Environmental Protection Agency (U.S. EPA) for a waiver of preemption pursuant to section 209(b) of the Clean Air Act. The ARB requested public comment and consulted with U.S. EPA regarding the legal requirements for obtaining a waiver for a rule adopted by a local government.

Based on its review, ARB staff concluded that these fleet rules, as written and adopted by the District, would not receive a Section 209(b) waiver because these rules have not been adopted by the ARB as state regulations (applicable within the SCAQMD). For this reason, staff has developed this proposal which is designed to maintain the reductions anticipated from the full implementation of SCAQMD's Rule 1192 and will ensure that statewide alignment does not allow the six transit agencies in the District that are currently on the diesel fuel path to purchase higher emitting diesel engines.

Of the 17 transit agencies in SCAQMD that are subject to ARB's Fleet Rule for Transit Agencies, 11 are on the alternative fuel path and accordingly must continue to purchase alternative fuel buses through 2015 under the existing ARB rule. These agencies represent 90 percent (4120 buses) of the transit buses in the District. Of the six transit agencies currently on the diesel path in the District, most have been planning to purchase alternative fuel buses only, in order to comply with SCAQMD Rule 1192.

Meanwhile, on May 5, 2005, the federal District Court ruled that, under the "market participant" doctrine, the SCAQMD fleet rules are not preempted to the extent they apply to purchasing decisions made by state and local governmental entities. However, the District Court has not yet addressed questions whether the fleet rules are preempted as they apply to private entities under contract with state or local governments or to used or leased vehicles. It is also possible that EMA or WSPA could appeal the "market participant" decision.

In this rulemaking, the Board will have the option of amending the ARB's Fleet Rule for Transit Agencies to mandate that the six diesel path transit agencies in SCAQMD switch to the alternative fuel path, in order to have the state rule achieving the

alternative fuel objectives of the District's Rule 1192. The ARB's adoption of a unique fleet requirement for the transit agencies in the District would have the effect of addressing the Court's decision while reflecting the Legislature's intent that SCAQMD be authorized to establish an alternative fuel fleet rule for transit districts within the District operating 15 or more buses. Proponents of alternative fuels believe this option will encourage further development of alternative fuel engines and infrastructure, and is a good policy necessary to prepare California for a more energy secure future. Diesel engine manufacturers and California businesses oppose, on principle, any rule that mandates alternative fuels.

If the Board wishes to assure that alternative fuel urban transit buses are purchased throughout the District, and determines it wise to provide a backstop to the current District Rule 1192 in case litigation overturns the District rule, the rulemaking documents include regulatory language that would amend ARB's Fleet Rule for Transit Agencies to require diesel path transit agencies in SCAQMD to switch to the alternative fuel path.

COMPARABLE FEDERAL REGULATIONS

There are comparable federal regulations for 2007 and subsequent model-year heavy-duty engines, which are codified in title 40, Code of Federal Regulations, part 86, subparts A, I, and N. One of the regulatory options developed by staff would align the exhaust emission engine standards for new urban bus engines with the federal standards.

There are no federal regulations comparable to the California fleet rule for transit agencies.

AVAILABILITY OF DOCUMENTS AND AGENCY CONTACT PERSONS

The Board staff has prepared a Staff Report: Initial Statement of Reasons (ISOR) for the proposed regulatory action, which includes a summary of the economic and environmental impacts of the proposal. The staff has also prepared a technical support document (TSD) that summarizes technology available and feasible for rule compliance.

Copies of the staff ISOR, the TSD, and the full text of the proposed regulatory language, in underline and strikeout format to allow for comparison with the existing regulations, may be accessed on the ARB's website 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 September 15, 2005.

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 ARB's website listed below.

Inquiries concerning the substance of the proposed regulation may be directed to the designated agency contact persons, Mr. David Salardino by email at dsalardi@arb.ca.gov or by phone at (626) 575-6679, or to Ms. Annette Hebert by email at ahebert@arb.ca.gov or by phone at (626) 575-6973.

Further, the agency representative and designated back-up contact person to who nonsubstantive inquiries concerning the proposed administrative action may be directed are Ms. Artavia Edwards, Manager, Board Administration & Regulatory Coordination Unit, (916) 322-6070, and Ms. Alexa Malik, Regulations Coordinator, (916) 322-4011. 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 contact persons.

This notice, ISOR and all subsequent regulatory documents, including FSOR, when completed, are available on ARB's Internet site for this rulemaking at www.arb.ca.gov/regact/sctransit/sctransit.htm

COSTS TO PUBLIC AGENCIES AND TO BUSINESSES AND PERSONS AFFECTED

The determinations of the Board's 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 not create costs or savings to any state agency or in federal funding to the state, costs or mandate to school districts 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. However, the staff's proposal to require all transit buses in the SCAQMD to follow the alternative-fuel path, combined with the proposal to align the California urban bus standards with the federal 2007 and later model-year heavy-duty engine standards may result in costs to local agencies operating transit properties, but those costs are expected to be recovered through appropriate fare increases. Statewide, these costs are expected to range from about $6-$8 million over the life of the regulations.

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

The Executive Officer has made an initial determination that the proposed regulatory action to require transit buses in the SCAQMD to follow the alternative-fuel path and to align the California urban bus standards with the federal 2007 and later model-year heavy-duty engine standards would not have a significant statewide adverse economic

impact directly affecting businesses, including the ability of California businesses to compete with businesses in other states, or on representative private persons.

In accordance with Government Code section 11346.3, the Executive Officer has determined that the proposed regulatory action to require transit buses in the SCAQMD to follow the alternative-fuel path and to align the California urban bus standards with the federal 2007 and later model-year heavy-duty engine standards would not affect the creation or elimination of jobs within the State of California, the creation of new businesses or elimination of existing businesses within the State of California, or the expansion of businesses currently doing business within the State of California. A detailed assessment of the economic impacts of the proposed regulatory action can be found in the ISOR.

The Executive Officer has also determined, pursuant to title 1, CCR, section 4, that the proposed regulatory action to require transit buses in the SCAQMD to follow the alternative-fuel path and to align the California urban bus standards with the federal 2007 and later model-year heavy-duty engine standards would not affect small businesses because the proposed amendments do not impose a mandate to produce but open a potential market by allowing the sale and purchase of urban buses. In addition, the proposal requiring the alternate-fuel path for all transit agencies in the District is expected to have a positive impact on the alternative-fuel engine and bus manufacturers.

Before taking final action on the proposed regulatory action, the Board must determine that no reasonable alternative considered by the Board or that has otherwise been identified and brought to the attention of the Board 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.

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 **no later than 12:00 noon, September 14, 2005,** 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: sctransit@listserv.arb.ca.gov and received at the ARB **no later than 12:00 noon, September 14, 2005.**

Facsimile transmissions 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, September 14, 2005.**

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 Board encourages members of the public to bring to the attention of 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, 39667, 39701(b), 43013, 43018, 43100, 43101, 43104, 43105, 43701(b) and 43806, and section 28114 of the Vehicle Code. This action is proposed to implement, interpret and make specific sections 39002, 39003, 39017, 39033, 39500, 39650, 39657, 39667, 39701, 40000, 43000, 43000.5, 43009, 43013, 43018, 43100, 43101, 43102, 43104, 43106, 43202, 43204, 43206, 43210, 43211, 43212, 43213, 43701(b), 43801 and 43806 of the Health and Safety Code, and sections 233 and 28114 of the Vehicle Code.

HEARING PROCEDURES

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 ARB's 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: July 19, 2005

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.

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

AIR RESOURCES BOARD

STAFF REPORT: INITIAL STATEMENT OF REASONS

PROPOSED AMENDMENTS TO THE EXHAUST EMISSION STANDARDS FOR 2007-2009 MODEL-YEAR HEAVY DUTY URBAN BUS ENGINES AND THE FLEET RULE FOR TRANSIT AGENCIES

Date of Release: July 29, 2005
Scheduled for Consideration: September 15-16, 2005

This report has been reviewed by the staff of the California Air Resources Board and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Air Resources Board, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

State of California
California Environmental Protection Agency
AIR RESOURCES BOARD

PROPOSED AMENDMENTS TO THE EXHAUST EMISSION STANDARDS FOR 2007-2009 MODEL-YEAR HEAVY DUTY URBAN BUS ENGINES AND THE FLEET RULE FOR TRANSIT AGENCIES

Staff Report

July 29, 2005

TABLE OF CONTENTS

EXECUTIVE SUMMARY 1
I. INTRODUCTION 1
A. Background 1
1. ARB's Regulations Affecting Transit Agencies 2
2. SCAQMD Rule 1192 3
3. Amendments to be Considered by the Board 4
a. Amend the Statewide Urban Bus Emission Requirements 4
b. Alternative Fuel Path Mandate for All Transit Agencies in the District 5
B. Regulatory Authority 5
C. Current Regulations and Voluntary Programs 6
1. Federal Regulations 6
a. Current Standards 7
b. 2007 and Later Standards 7
2. California Regulations 8
a. General New Heavy-Duty Engine Regulations 8
b. General In-Use Heavy-Duty Engine Regulations 10
c. In-Use Urban Bus and Transit Fleet Vehicle Regulations 11
3. Local Regulations 13
a. General Air District Authority 13
b. Specific South Coast Air Quality Management District Authority 13
4. Voluntary and Incentive Programs 14
a. Federal Incentives 14
b. State Incentives 15
c. Local Funding 15
II. PUBLIC OUTREACH 16
A. Environmental Justice 17
B. Outreach Efforts 18
1. Amend the Statewide Urban Bus Emission Requirements 18
2. Alternative Fuel Path Mandate for all Transit Agencies in the District.. 19
III. NEED FOR EMISSION REDUCTIONS 20
A. Ozone 21
B. Particulate Matter (PM) 21
IV. NEED FOR A POLICY DECISION BY THE BOARD TO AMEND ARB'S CURRENT REGULATIONS 21
A. Amend the Statewide Urban Bus Emission Requirements 22
B. Alternative Fuel Path Mandate for All Transit Agencies in the District 22
V. ASSESSMENT OF THE POLICY DECISION TO BE PRESENTED TO THE BOARD 24
A. Amend the Statewide Urban Bus Emission Requirements 24
B. Alternative Fuel Path Mandate for All Transit Agencies in the District 26
VI. Inventory of Urban Buses and Emissions 27
A. Inventory of Urban Buses 27
B. Emission Inventory for Urban Buses 28

VII. SUMMARY OF THE CONTROL MEASURES TO BE CONSIDERED BY THE BOARD 30
A. Scope and Applicability 31
B. Amend the Statewide Urban Bus Emission Requirements 31
C. Alternative Fuel Path Mandate for All Transit Agencies in the District, Amend Section 1956.2 32
D. Comparison of ARB's Fleet Rule for Transit Agencies and Rule 1192 32
VIII. ENGINE TECHNOLOGY AND AVAILABILITY 33
A. Current Engine Availability 33
1. Diesel Fueled Engines 33
2. Alternative Fuel Engines 34
B. Mid-term Future Engine Availability (2007 – 2009) 34
1. Diesel Fueled Engines 34
2. Alternative Fuel Engines 34
C. Long Term Engine Availability (2010 and beyond) 35
IX. END-USER EXPERIENCE: ALTERNATIVE FUELS 35
A. Description of the Survey 35
B. End-User Experience with Alternative Fuels 36
1. Propane 36
2. Compressed and Liquefied Natural Gas (CNG/LNG) 36
a. Fueling 36
b. Maintenance Shop Modifications for Alternative Fuel Vehicles 36
c. Maintenance and Down Time for Alternative Fuel Vehicles 37
d. Training Staff for Alternative Fuel Vehicles: 37
3. Conclusion 37
X. REGULATORY ALTERNATIVES 37
XI. ECONOMIC IMPACT 38
A. Legal Requirement 38
B. Affected Businesses 39
C. Potential Impact on Businesses 39
D. Potential Impact on Business Competitiveness 39
E. Potential Impact on Employment 40
F. Potential Impact on Business Creation, Elimination, or Expansion 40
G. Estimated Costs to Local Transit Agencies 40
1. Cost Estimates for Statewide Alignment 41
2. Cost Estimates Associated With the Alternative Fuel Path Mandate for All Transit Agencies, Statewide 41
3. Cost Estimates Associated With the Alternative Fuel Path Mandate for All Transit Agencies in the District 41
XII. ENVIRONMENTAL IMPACTS AND COST-EFFECTIVENESS 41
A. Benefits within the District and Statewide 41
1. Impacts on the Air Quality Management Plan 42
2. Emission Benefits 42
a. Statewide Alignment 45
b. Alternative Fuel Path Mandate for All Transit Agencies, Statewide .. 45

c. Alternative Fuel Path Mandate for All Transit Agencies in the District 48
B. Cost and Cost-Effectiveness 49
1. Amend the Statewide Urban Bus Emission Requirements 49
a. Statewide Alignment 49
b. Alternative Fuel Path Mandate for All Transit Agencies, Statewide .. 49
2. Alternative Fuel Path Mandate for All Transit Agencies in the District . 50
C. Toxics from Diesel and Alternative Fueled Engines 51
XIII. ISSUES 53
A. Statewide Alignment 53
B. Alternative Fuel Path Mandate for All Transit Agencies, Statewide 53
C. Alternative Fuel Path Mandate for All Transit Agencies in the District . 54
D. Issues Related to Federal Clean Air Act Waiver of Preemption 55
E. Waiver Process Will Delay Rule Implementation and Reduce Benefits Achieved 56
XIV. STAFF CONCLUSION 57
XV. REFERENCES 59
XVI. AVAILABILITY OF TECHNICAL SUPPORT DOCUMENT 61

TABLE OF FIGURES

Figure 1. NOx Emissions – Original Estimate and Current Estimate 44
Figure 2. PM Emissions – Original Estimate and Current Estimate 44
Figure 3. NOx Emissions – Comparison of Options 47
Figure 4. PM Emissions – Comparison of Options 47

TABLE OF TABLES

Table 1. Federal Emission Standards for New Heavy-Duty Trucks and Buses 6
Table 2. California Emission Standards for New Heavy-Duty Trucks and Buses 9
Table 3. California Optional, Low NOx Emission Standards for New Heavy-Duty Trucks and Urban Buses 10
Table 4. Fleet NOx Average Requirements for Transit Agencies (g/bhp-hr) .. 12
Table 5. Fleet Diesel PM Reduction Requirements for Transit Agencies 12
Table 6. Workshop Locations and Times. 19
Table 7. Transit Agencies in the SCAQMD 26
Table 8. Reported California Urban Bus Inventory as of January 1, 2005, by the Selected Fuel Path of the Transit Agency 28
Table 9. NOx Statewide Diesel Emissions Inventory (tpd) 30
Table 10. PM Statewide Diesel Emissions Inventory (lbs/day) 30
Table 11. Diesel Versus Alternative Fuel Path NOx Fleet Averages for Agencies in the District (g/bhp-hr) 42
Table 12. NOx Emission Benefits (tpd) in the District - Mandatory Alternative Fuel Path 48
Table 13. Emission Comparison - Diesel Bus vs Natural Gas Bus 52

TABLE OF APPENDICES

APPENDIX A: PROPOSED REGULATION ORDER

APPENDIX B: URBAN BUS SURVEY

APPENDIX C: INVENTORY AND EMISSIONS MODELING

APPENDIX D: COST ANALYSIS METHODOLOGY

EXECUTIVE SUMMARY

The following provides a summary of policy decisions to be considered by the Air Resources Board (ARB or the Board). The modifications, as described herein, are consistent with the California authority to control emissions from mobile sources.

What vehicles would be impacted?

Staff has developed amendments to the regulations that affect emissions from urban buses owned or operated by transit agencies.

What regulations currently apply to these vehicles?

The ARB has two programs specifically designed to reduce emissions from urban buses. One program establishes emission standards that new urban buses must meet. The other program affects emissions from in-use urban buses that are already in service. In addition, the South Coast Air Quality Management District (SCAQMD or the District) has adopted its own rule related to new transit bus purchases.

Long-term emission reductions are achieved through establishing more stringent new engine standards. California has adopted standards that affect new urban buses which are more stringent than federal new engine standards for urban buses and heavy-duty trucks.

For nearer-term emission reductions, the ARB Fleet Rule for Transit Agencies is designed to reduce emissions from in-use urban buses by increasing turnover and through the application of retrofit particulate filters.

The District has adopted various fleet rules, one of which, Rule 1192, "Clean On-Road Transit Buses," applies only to transit agencies operating in the South Coast air district. Rule 1192 dictates that transit agencies may only acquire alternative-fuel buses when procuring or leasing buses. The rule applies to government agencies and private companies under contract to government agencies.

What regulatory changes are staff requesting the Board consider?

Staff has identified two policy decisions for the Board's consideration, and has developed proposed regulatory amendments to support decisions the Board may make. First, staff is presenting three options for the Board to consider regarding the appropriate emission standards for new urban bus engines in 2007 through 2009. The three options are: 1) keep the current new urban bus emissions standards as they are, 2) change the oxides of nitrogen (NOx) emission standard

for 2007 through 2009 model year new urban buses from 0.2 grams per brake horsepower-hour (g/bhp-hr) to 1.2 g/bhp-hr, which would align it with the equivalent model year heavy-duty truck NOx emission standard, and 3) require all transit agencies to purchase/lease only alternative fuel buses.

The second policy decision for the Board's consideration is whether to require that all transit agencies operating in the South Coast Air Quality Management District follow the alternative-fuel compliance path, as defined in ARB's regulations. Under ARB's current regulations, transit agencies made a non-revocable election to follow either the diesel fuel path or the alternative-fuel path, as of January 1, 2001. Of the 17 transit agencies in the District, 11 chose the alternative-fuel path, and six chose the diesel path. If the Board adopts the new requirement, the six transit agencies in the District currently on the diesel fuel compliance path would be required to change to the alternative-fuel path effective January 1, 2006. This change would lock these transit agencies into purchasing alternative-fuel engines through 2015, consistent with the District's Rule 1192.

FIRST POLICY DECISION: Whether to revise the emission standards for new urban buses

California's current 2007 and beyond NOx requirement for new urban bus engines is 0.2 g/bhp-hr. The California and national heavy-duty truck new engine standard for 2007, which includes urban buses for all but California, is also 0.2 g/bhp-hr, but flexibilities in the heavy-duty truck rule, result in the option of certifying all engines to an average NOx standard of 1.2 g/bhp-hr between 2007 and 2009. This is what engine manufacturers have stated they plan to do, so it is unlikely that diesel engines meeting California's urban bus NOx standard will be available.

Staff Assessment

Staff has assessed urban bus engine availability based on the current 2007-2009 standard versus what could be available if the Board modifies the standard to align with the current 2007-2009 model year heavy-duty truck standards. Without alignment, there are essentially three scenarios that could occur. The first is that manufacturers could certify both diesel and alternative-fuel engines for sale in California in time to meet the standard of 0.2 g/bhp-hr NOx in 2007. Discussions with diesel engine manufacturers, however, have convinced staff that this scenario is highly unlikely.

The second scenario is that manufacturers make only alternative fuel engines available to meet the 0.2 g/bhp-hr NOx standard in 2007. Multiple manufacturers have stated publicly that they intend to produce alternative fuel urban bus engines that meet the California 2007 standard. Staff has reviewed development plans for these engines and agrees these engines will be available in 2007 if all

goes as planned. Therefore, staff believes that there is a reasonable likelihood that one or more urban bus engines using alternative fuels will be commercially available by 2007, although there is some risk that these engines will be delayed or will not be certified and marketed because development of the new technology engines is not complete at this time.

The third scenario is that there will be no diesel or natural gas engines available for California urban buses for 2007-2009. In this case, California transit agencies would not be able to purchase new engines until 2010, at which time staff expects both diesel and alternative fuel engines will meet the 2010 heavy-duty truck NOx standard of 0.2 g/bhp-hr. As noted above, staff's assessment is that no diesel urban bus engines will be available in 2007 through 2009, but is likely alternative fuel urban bus engines will be available.

There are 76 transit agencies statewide that report to ARB under the Fleet Rule for Transit Agencies. The 28 agencies on the alternative fuel path will continue to purchase complying engines in 2007 through 2009, because staff believes complying engines will be available. However, if the current 2007 urban bus emission standards are not modified, the 48 agencies on the diesel path will not be able to purchase new diesel buses until 2010. These diesel path transit agencies operate 62 percent of the California urban buses, and if they continue on the diesel path the result is that these agencies will keep their older diesel buses longer or repower their buses. Emission reductions staff anticipated from the original rule due to fleet turnover will not be realized from diesel path transit agencies.

Staff expects that manufacturers will certify diesel urban bus engines that meet the 1.2 g/bhp-hr NOx level if the Board relaxes the NOx standard to that value for 2007-2009. Staff also expects that, even with Board adoption of alignment, some manufacturers will produce alternative fuel engines that meet the 0.2 g/bhp-hr NOx level in 2007 and that transit agencies on the alternative fuel path will purchase these engines because of their lower emissions and the potential for the availability of incentive funds for the lower emitting engines.

How would the three options impact emissions?

The impact on emissions depends on the emission level of the engines purchased and replaced, and in scenarios where diesel engines are not available, if purchases are deferred or foregone. Staff has concluded that no diesel engines will be available for purchase in 2007 to 2009, and that alternative fuel engines meeting a 0.2 g/bhp-hp NOx standard will be available. For transit agencies required to purchase alternative fuels (those on the alternative fuel path), staff assumes they will purchase these engines. For diesel path agencies, staff assumes they will purchase diesel engines in 2007 to 2009 if the NOx standard is changed to 1.2 g/bhp-hr. If the NOx standard is kept at the current 0.2 g/bhp-hr, staff assumes the diesel path agencies will not buy any engines in

2007-2009, and that they will make up for these deferred purchases in 2010-2012, when diesel engines are again available.

Compared to the option 1 (no change in the standards), option 2 (revise the NOx standard to 1.2 g/bhp-hr) provides emission reductions in each year 2007 through 2010, reaching about 1.6 tons per day (tpd) in 2009. This occurs because 1.2 g/bhp-hr new engines replace higher emitting older engines, whereas in option 1 no new engines are purchased by diesel path agencies until 2010 or later, and higher emitting buses remain in operation. However, once the deferred purchases are made in 2010 and beyond, no change option 1 provides slightly greater reductions than option 2 from 2012 on, reaching up to about 1.2 tpd. This occurs because by deferring purchases until 2010 or after, all purchases are 0. 2 g/bhp-hr engines, whereas the buses purchased in 2007-2009 (option 2) have higher emissions (1.2 g/bhp-hr). Staff estimates that by 2025, there will be no difference in emissions because all engines remaining in the fleet are 0.2 g/bhp-hr (i.e. any 1.2 g/bhp-hr engines are over 15 years old and have been replaced).

Option 3 (require all diesel path agencies statewide to switch to the alternative fuel path) provides the lowest emissions. Compared to option 1, option 3 provided emission reductions in each year 2007 through 2011, reaching about 2.6 tpd in 2009. This occurs because staff assumes all agencies will purchase alternative fuel engines emitting at 0.2 g/bhp-hr beginning in 2007, and no deferred purchases will occur. It should be noted that agencies previously on the diesel path will have to invest in new alternative fuel infrastructure, and this could result in deferred or forgone purchases, which would reduce the emission benefit of this option. Compared to option 2, option 3 will provide lower emissions until 2025, reaching a maximum of about 1.0 tpd in 2009. This occurs because option 2 allows for 1.2 g/bhp-hr engines to enter the fleet during 2007 through 2009. However, staff estimates that by 2025, there will be no difference in emissions because all engines remaining in the fleet are 0.2 g/bhp-hr (i.e. any 1.2 g/bhp-hr engines are over 15 years old and have been replaced).

Staff estimates that by 2025, the statewide NOx emissions will be equivalent under all three options because all engines remaining in the fleet will meet a 0.2 g/bhp-hr NOx standard.

What are the costs associated with modifying the statewide urban bus emission requirements as outlined in staff's three options?

Staff has determined there is no additional cost of the option to revise the new urban bus engine emission standards to align with the current truck standards. This option will allow purchase of diesel engines by diesel path agencies in 2007-2009, and may reduce operating and maintenance costs by replacing older engines. If the current standards are retained, diesel path agencies are expected to defer purchases until 2010 and beyond. These engines will cost

more than the engines that could be purchased in 2007-2009 if the standards are aligned.

If the Board chooses to adopt a statewide alternative-fuel purchase mandate, capital and operations and maintenance costs would be increased for those engines now on the diesel path. The Federal Transportation Administration (FTA) provides 80%-83% of the capital cost of new buses, so transit agencies must fund the remainder. As a conservative estimate, staff assumed a 20 percent transit agency share of capital costs, in addition to operation and maintenance costs associated with the bus, fueling facilities, labor and training. Thus, staff estimates a typical incremental total cost of $76,517 per bus funded by the local transit agency.

In order to determine cost-effectiveness, ARB took the typical total incremental cost of the buses to be purchased, with FTA funding, and divided by the total NOx emission reductions for the life of the regulation. These values were based on NOx emission reductions only. The expected cost-effectiveness ratio is $119,030 per ton ($59.51 per pound). These values are much higher than other mobile source regulations, which typically have cost-effectiveness values of $10,000 per ton, or less.

SECOND POLICY DECISION: Whether to mandate the alternative-fuel path for transit agencies operating in the South Coast Air Quality District?

Shortly after the District adopted its fleet rules, including Rule 1192.2, the Engine Manufacturers Association and the Western States Petroleum Association sued the District regarding its authority to adopt these rules. On April 28, 2004, the United States Supreme Court ruled that the purchase requirements in the District rules were an emission standard that required a waiver of federal preemption prior to implementation. The Court returned the case to the federal district court for further proceedings consistent with its decision. In response to this decision, the District requested that ARB submit the District's rules to the United States Environmental Protection Agency (U.S. EPA) for a waiver of preemption pursuant to section 209(b) of the Clean Air Act. On October 1, 2004, ARB requested public comment on the District's request. ARB staff completed a thorough review of the comments submitted in response to the notice, and consulted with the U.S. EPA regarding the legal requirements for obtaining a waiver of a rule adopted by a local government.

Based on ARB review, staff concluded that these fleet rules, as written and adopted by the District, would not receive a Section 209(b) waiver because these rules have not been adopted by the ARB as state regulations (applicable in the South Coast). For this reason, staff has initiated a state rulemaking process to cover some of the fleets subject to the District rules. This process requires a new

public record that updates relevant information on the effectiveness and costs of these rules.

Meanwhile the federal district court has continued its proceedings on the District rules. On May 5, 2005, the federal district court ruled that the District's authority is not preempted under the market participant doctrine for the aspects of the District fleet rules that relate to purchasing decisions made by state and local governments. Most transit agencies are considered local government. The order, however, noted that it did not address whether other aspects of the District rules may still be subject to preemption.

If the Board chooses to amend the ARB's Fleet Rule for Transit Agencies to mandate that the six diesel path transit agencies in SCAQMD switch to the alternative fuel path, the state rule would achieve the alternative fuel objectives of the District's Rule 1192. The ARB's adoption of a unique fleet requirement for the transit agencies in the District would address concerns that the Court's decision may change or weaken.

Staff has developed amendments that the Board may adopt if the Board wishes to assure that alternative fuel urban transit buses are purchased throughout the District, and determines it wise to provide a backstop to the current District Rule 1192 in case litigation overturns the District rule.

How will the alternative-fuel mandate for transit agencies in the District impact emissions?

Eleven of the transit districts in the District have chosen the alternative fuel path under the ARB transit fleet rule, and this decision in not revocable. Thus the Board's decision affects the remaining six transit districts, who operate 10 percent of the transit buses in the SCAQMD. If the SCAQMD prevails in legal challenges, alternative fuel buses will be purchased by the six transit districts regardless of ARB's action, and no federal waiver would be needed. However, if the SCAQMD's rule is invalidated, several outcomes are possible.

Five of the six transit districts have been planning alternative fuel bus purchases notwithstanding their election of the diesel path under ARB's fleet rule. Thus one outcome is they could continue to purchase alternative fuel buses in the absence of a SCAQMD or ARB rule.

Another outcome is they could also decide to purchase diesel fuel buses. In 2007-2009, these diesel buses would have higher emissions than available alternative fuel buses. (Beyond 2009, emissions of diesel and alternative fuel bus engines are expected to be equivalent.) Note however that purchase of diesel buses in 2007-2009 would only be possible if the Board also acts to align the statewide emission standard for buses. If it chooses not to do this, no diesel buses will be available for purchase in 2007.

To quantify the emission benefit of mandating the six transit agencies change to the alternative fuel path, staff assumed the SCAQMD rule is invalidated, the Board aligns the statewide standard for new bus engines so that diesel engines are available for purchase, and all six transit agencies choose to purchase diesel engines in 2007-2009. Adoption of the ARB rule requiring alternative fuel purchase would prevent purchase of diesel engines by these districts, and staff assumed they would purchase alternative fuel engines in 2007-2009 instead. NOx emissions would be reduced by a small amount - up to 0.02 tons per day. There would be no impact on PM emissions because all engines meet the same PM standard from 2007 on.

What is the cost-effectiveness of the District alternative-fuel path mandate option?

Staff expects that the six transit providers affected by this option will be able to obtain fuel from facilities that are already, or will soon be, available, based on staff's survey of transit agencies. Most transit agencies that plan to purchase compressed natural gas (CNG) buses have already either built a fueling station or have one planned and financed. In addition, transit agencies that are purchasing gasoline hybrid-electric buses (HEBs) will use existing facilities. Staff based the cost-effectiveness analysis on estimates of expected emissions reductions and costs for implementation of an alternative fuel mandate. In order to determine cost-effectiveness, ARB used the typical incremental cost of the buses to be purchased, including FTA funding, and divided by the total NOx emission reductions for the life of the regulation. These values were based on NOx emission reductions only as there is no PM benefit from this option. The cost-effectiveness is $67,837 per ton ($33.92 per pound).[1] These values are much higher than other mobile source regulations, which typically have cost-effectiveness values of $10,000 per ton, or less.

[1] Actual cost-effectiveness values could be higher if the transit agencies choose to purchase alternative fuel buses during 2007 through 2009 with NOx emissions higher than 0.2 g/bhp-hr thereby decreasing the emissions benefits.

I. INTRODUCTION

The Air Resources Board (ARB or Board) seeks to provide clean, healthful air to the residents of California. ARB is the state agency responsible for protecting public health and the environment from the harmful effects of air pollution. ARB oversees all air pollution control efforts in California, including the activities of 35 independent local air districts, and works in cooperation with the districts and the U.S. Environmental Protection Agency (U.S. EPA) on strategies to attain State and federal ambient air quality standards and to reduce air toxic emissions.

The South Coast Air Quality Management District (SCAQMD or District) is the local governmental agency primarily responsible for air quality assessment and improvement in the South Coast Air Basin and the desert portion of Riverside County in the Salton Sea Air Basin. The South Coast Air Basin, which includes Orange County and the non-desert portions of Los Angeles, Riverside and San Bernardino Counties, is designated as a serious nonattainment area for particulate matter (PM10 - particulate matter under 10 microns) and an extreme nonattainment area for ozone. The Coachella Valley, located in the desert portion of Riverside County, is classified as a serious nonattainment area for PM10 and a severe nonattainment area for ozone.

A. Background

Public transportation has important societal benefits, including providing access to work and education, reducing traffic congestion, and meeting the mobility needs of the public, including the elderly and disabled. California's transit agencies are responsible for providing basic transportation services for the public. Transit agencies provide both fixed-route service within urban places, such as traditional urban bus and neighborhood routes, and between urban places such as commuter routes, and non-fixed-route services such as paratransit, dial-a-ride and charter services.

Most types of public transportation, however, are also sources of polluting engine exhaust emissions. Significant amounts of both particulate matter (PM) and oxides of nitrogen (NOx) are emitted from mobile sources, including urban buses. NOx and hydrocarbons (HC) contribute to the atmospheric formation of ozone and fine particles. NOx is a reactive, oxidizing gas that contributes to the atmospheric formation of ozone and fine particles, and causes respiratory illness and impaired lung function. Carbon monoxide (CO) is a colorless, odorless gas that reduces the ability of the body to transport oxygen to cells. Diesel PM is classified as a toxic air contaminant (TAC) because it is a cancer-causing pollutant that also has significant short- and long-term negative cardiovascular impacts.

Following the identification of diesel PM as a toxic air contaminant, ARB staff spent two years working with stakeholders to determine the best control measures for diesel PM. The result was the "Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles" (Diesel Risk Reduction Plan, or DRRP), which was approved by the Board in September 2000 (ARB 2000a). This plan directs staff to develop measures to reduce diesel PM emissions from all new and in-use diesel-fueled engines and vehicles. Included are, "new retrofit requirements for existing on-road, off-road, and stationary diesel-fueled engines and vehicles where determined technically feasible and cost-effective."

The ARB adopted the 2003 State and Federal Strategy for the California State Implementation Plan (SIP) for ozone in September 2003. Most of the existing near-term SIP measures have been adopted, along with additional controls to reduce emissions. The baseline emission inventory in the 2003 SIP reflects the benefits of State and federal measures adopted since the 1994 ozone SIP.

1. ARB's Regulations Affecting Transit Agencies

The ARB has adopted two programs specifically designed to reduce emissions from urban buses. One program affects emissions from new urban buses and the other program affects emissions from in-use urban buses operated by transit agencies (Fleet Rule for Transit Agencies). Long-term emission reductions are achieved through establishing more stringent new engine standards. California has adopted standards that affect new urban buses, which are more stringent than federal new engine standards for urban buses and heavy-duty trucks.

In February 2000, the Board adopted a fleet rule for transit agencies operating urban buses, and more stringent emission standards for new urban bus engines and vehicles (ARB 1999; ARB 2000b). The rules were designed to reduce emissions of NOx and PM by setting fleet emission reduction requirements that require the purchase of cleaner engines and the retrofit of existing engines. By January 1, 2001, transit agencies were required to make a non-revocable decision to follow either a diesel path or an alternative-fuel path, which established purchasing requirements for the transit agencies through 2015.

The rule also promoted advanced technologies by adopting requirements for zero-emission bus (ZEB) demonstrations and acquisition that are applicable to larger transit agencies. New, more stringent mid- and long-term emission standards were also adopted that apply to new urban bus engines, and the rule encourages the purchase of diesel hybrid electric buses from 2004 through 2006 by diesel path agencies. On February 24, 2005, the Board amended the fleet rule for transit agencies to reduce emissions from buses and vehicles not covered by the original fleet rule for transit agencies.

In 2000, the SCAQMD adopted various fleet rules, including Rule 1192, "Clean On-Road Transit Buses" (adopted on June 16, 2000). Rule 1192 requires that public transit agencies with 15 or more public transit vehicles or urban buses operating in the SCAQMD may only acquire alternative-fuel vehicles when procuring or leasing these vehicles (SCAQMD 2000). The rule applies to government agencies and private companies under contract to government agencies. Despite this rule, six transit agencies in the SCAQMD chose the diesel path under ARB's fleet rule for transit agencies.

As a result of the ARB and SCAQMD rules, many transit agencies have made significant changes in their operations to incorporate natural gas and other alternative-fuel buses into their fleets. They have installed natural gas refueling infrastructure and purchased alternative-fuel urban buses; repowered old diesel engines to engines meeting cleaner exhaust emission standards; installed diesel particulate filters on diesel engines; and experimented with developing technologies, such as hybrid-electric buses, NOx aftertreatment systems and cleaner fuels. Many of California's transit agencies consider themselves to be innovators and incubators for advanced technologies.

2. SCAQMD Rule 1192

Under its Clean Fleets Program, the District adopted seven fleet rules during 2000 and 2001. The rules were developed to gradually shift public agencies and certain private entities to lower emission and alternative-fuel vehicles whenever a fleet operator purchases or leases a vehicle for replacement or addition to a fleet. The District adopted these rules based on legislative authority [Health & Safety Code (HSC) section 40447.5(a)], which restricts the scope of any rules to public and certain commercial operators of fleets of 15 or more vehicles. The adopted rules apply to transit buses, school buses, refuse collection vehicles, airport shuttles and taxis, street sweepers, light and medium-duty publicly owned vehicles, and heavy-duty publicly owned vehicles.

As noted above, one of the fleet rules adopted is Rule 1192 - Clean On-Road Transit Buses. The Rule was developed in an effort to reduce public exposure to air pollution emitted from transit buses, including toxic particulates and ozone precursor emissions. Many of these fleets emit pollutants, including air toxics, into heavily urbanized areas, where improvements in air quality are critical given environmental justice and other concerns.

Shortly after the District adopted its fleet rules, including Rule 11922, the Engine Manufacturers Association and the Western States Petroleum Association sued the District regarding its authority to adopt these rules. On April 28, 2004, the United States Supreme Court ruled that the purchase requirements in the District rules were an emission standard that required a waiver of federal preemption prior to implementation. The Court returned the case to the federal district court for further proceedings consistent with its decision. In response to this decision,

the District requested that ARB submit the District's rules to EPA for a waiver of preemption pursuant to section 209(b) of the Clean Air Act. On October 1, 2004, ARB requested public comment on the District's request. ARB staff completed a thorough review of the comments submitted in response to the notice, and consulted with the U.S. EPA regarding the legal requirements for obtaining a waiver of a rule adopted by a local government.

Based on ARB review, staff concluded that these fleet rules, as written and adopted by the District, would not receive a Section 209(b) waiver because these rules have not been adopted by the ARB as state regulations (applicable in the South Coast). For this reason, staff has initiated a state rulemaking process to cover some of the fleets subject to the District rules. This process requires a new public record that updates relevant information on the effectiveness and costs of these rules.

Meanwhile the federal district court has continued its proceedings on the District rules. On May 5, 2005, the federal district court ruled that the District's authority is not preempted under the market participant doctrine for the aspects of the District fleet rules that relate to purchasing decisions made by state and local governments. Most transit agencies are considered local government. The order, however, noted that it did not address whether other aspects of the District rules may still be subject to preemption.

3. Amendments to be Considered by the Board

The amendments presented in this report modify the ARB rules that affect urban buses owned or operated by transit agencies. Staff has identified two policy decisions to be considered by the Board and has developed proposed regulatory amendments to support decisions the Board may make.

a. Amend the Statewide Urban Bus Emission Requirements

Staff is presenting three options for the Board to consider regarding the appropriate emission standards for new urban bus engines in 2007 through 2009. The three options are: 1) keep the current new urban bus emissions standards as they are, 2) change the NOx emission standard for 2007 through 2009 model year new urban buses, from 0.2 g/bhp-hr to 1.2 g/bhp-hr, which would align emission standards with the equivalent model year heavy-duty truck NOx emission standard, and 3) require all transit agencies to purchase/lease only alternative fuel buses.

The amendments provided in this report (set forth in the proposed regulation order in Appendix A) set forth the language necessary to implement the option of aligning the urban bus standards with the heavy-duty truck standards beginning with the 2007 model year. Should the Board favor the option to keep the urban bus standards as they are, no regulatory changes are necessary. Should the

Board decide that all transit agencies statewide should be required to purchase alternative fuel, a 15-day modification to ARB's Fleet Rule for Transit Agencies would be needed to accomplish this (and no change to the urban bus emission standards would be necessary).

b. Alternative Fuel Path Mandate for All Transit Agencies in the District

Staff has also developed an option to mandate that all transit agencies operating in the District be required to follow the alternative-fuel compliance path, as defined in title 13, CCR, section 1956.2.[2] Under the current regulations, transit agencies made a non-revocable election to follow either the diesel fuel path or the alternative-fuel path, as of January 1, 2001. Of the 17 transit agencies in the District, 11 chose the alternative-fuel path, and six chose the diesel path. Under the new option being presented to the Board for consideration, transit agencies in the District currently on the diesel fuel compliance path would be required to change to the alternative-fuel path effective January 1, 2006. This change would lock these transit agencies into purchasing alternative-fuel engines through 2015.

The scope of this option overlaps with the District's Rule 1192, and ARB has worked closely with the District to craft the amendments. The District has assisted ARB staff in the information gathering process and with other logistics such as stakeholder meetings, identification of affected fleets, and understanding the current District rules. Great efforts have been taken by ARB staff to obtain current, objective information on the challenges, cost-effectiveness, and emission benefits from the various technology options.

B. Regulatory Authority

The California Legislature enacted the California Clean Air Act of 1988, which declared that attainment of state ambient air quality standards is necessary to promote and protect public health, particularly the health of children, older people, and those with respiratory diseases. The Legislature directed that these standards be attained by the earliest practicable date.

The Federal Clean Air Act grants California, alone among the states, the authority to adopt more stringent controls of emissions from new mobile sources. The California Clean Air Act establishes the ARB as the state agency that sets standards for mobile sources. The California Legislature also granted ARB the authority to identify TACs and establish airborne toxic control measures (ATCMs) to reduce risk.

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[2] The existing Fleet Rule for Transit Agencies is located with engine emission standards in title 13, CCR, sections 1956.2-1956.4. At the February 2005 hearing, the Board approved staff's proposal to move the existing sections for the Fleet Rules for Transit Agencies to new sections which cover rules for controlling diesel emissions from existing in-use engines or fleets. As a result, upon final approval by the Office of Administrative Law, section 1956.2 will be moved to section 2023.1.

C. Current Regulations and Voluntary Programs

Both the Federal government and the State of California have adopted rules that reduce PM and NOx, among other pollutants, from on- and off-road vehicles. The following sections briefly describe the existing federal, state, local and voluntary programs that currently apply to diesel-fueled engines and vehicles operating in California.

1. Federal Regulations

Standards for smoke emissions from on-road heavy-duty diesel vehicles were first set by the United States Environmental Protection Agency (U.S. EPA) in 1970. New engines were subject to PM and NOx exhaust emission standards beginning with model year 1988 (Table 1). Over the years, more stringent emission standards have paralleled improvements in control technology. Recent amendments to the on-road standards regulate the heavy-duty vehicle and its fuel as a single system, including diesel-fuel sulfur content requirements.

Table 1. Federal Emission Standards for New Heavy-Duty Trucks and Buses

Emissions Standards (g/bhp-hr)				
Model Year	Heavy-Duty Truck		Urban Bus	
	NOx	PM	NOx	PM
1988	10.7	0.6	10.7	0.6
1990	6.0	--	6.0	--
1991	5.0	0.25	5.0	0.25
1993	--	0.25	--	0.1
1994	--	0.10	--	0.07
1996	5.0	--	5.0	0.05 (c)
1998	4.0	--	4.0	--
October 2002	2.2 (a)	--	2.2 (a)	0.05 (c)
2004	2.2 (a)	--	2.2 (a)	--
2007	1.2 (b)	0.01	1.2 (b)	0.01
2010	0.2 (b)	--	0.2 (b)	--

a. Nominal NOx value of 2.2 g/bhp-hr is based on emission standards of 2.4 g/bhp-hr for NOx plus non-methane hydrocarbons (NMHC) or 2.5 g/bhp-hr NOx plus NMHC with 0.5 g/bhp-hr NMHC cap, which took effect in October 2002 for those engines subject to the U.S. EPA Consent Decrees and the California Settlement Agreements. The Consent Decree-complying engines had to comply with 2004 standards by October 1, 2002.
b. Between 2007 and 2009, U.S. EPA requires 50 percent of heavy-duty diesel engine family certifications to meet the 0.2 g/bhp-hr NOx standard. Averaging is allowed, and it is expected that most engines will conform to the fleet NOx average of approximately 1.2 g/bhp-hr.
c. In-use standard or 0.07 g/bhp-hr.

a. Current Standards

The current federal heavy-duty vehicle standards apply to 2004 and subsequent model years. The current federal PM engine emission standard for new on-road heavy-duty diesel truck engines is 0.1g/bhp-hr and the current federal PM emission standard for new urban transit bus engines is 0.05 g/bhp-hr. The current NOx emission standard for both new on-road heavy-duty diesel truck and new urban transit bus engines is 2.4 g/bhp-hr for NOx plus non-methane hydrocarbons (NMHC) or 2.5 g/bhp-hr NOx plus NMHC with 0.5 g/bhp-hr NMHC cap. Only engines subject to the U.S. EPA Consent Decrees signed in 1998 had to comply with this 2004 standard in October 2002; for all the rest the requirement began with the 2004 model year engines.

On April 23, 1993, the U.S. EPA finalized the Urban Bus Retrofit/Rebuild Program to reduce the ambient levels of diesel PM in urban areas. The program was limited to 1993 and earlier model year urban buses operating in metropolitan areas with 1980 populations of 750,000 or more, whose engines are rebuilt or replaced after January 1, 1995. Approximately 40 urban areas are affected. Operators of the affected buses were required to choose between two compliance options: Program 1 set PM emissions requirements for each urban bus engine in an operator's fleet which is rebuilt or replaced; Program 2 was a fleet averaging program that establishes specific annual target levels for average PM emissions from urban buses in an operator's fleet.

Other than the Urban Bus Retrofit/Rebuild Program, no other federal regulations mandate reducing emissions from in-use urban buses or other heavy-duty engines.

b. 2007 and Later Standards

The particulate standard that takes effect with 2007 model year heavy-duty diesel engines is 0.01 grams per brake-horsepower hour (g/bhp-hr), which is a 90 percent reduction from the existing standard. That standard is based on the use of high-efficiency exhaust emission control devices or comparably effective advanced technologies. Because these devices are less efficient when used with the current formulation of diesel fuel, refiners are also required to reduce the level of sulfur in highway diesel fuel by 97 percent to 15 parts per million by weight (ppmw) by mid-2006.

The NOx standard in 2007 for new heavy-duty diesel engines, both trucks and buses, is 0.2 g/bhp-hr. However, between 2007 and 2009, U.S. EPA requires that only 50 percent of the heavy-duty diesel engine family certifications to meet this standard; the remaining 50 percent may meet the applicable 2006 model year engine standard. Through the use of the federal averaging provision, the result is a nominal NOx standard of 1.2 g/bhp-hr from 2007 through 2009. Some engine manufacturers will meet this by producing all or most of their engines to a

NOx standard of 1.2 g/bhp-hr; others will use averaging to produce engines certified to levels both above and below this NOx standard.

Beginning in 2010, there is a family emission limit cap of 0.5 g/bhp-hr NOx. Engines will be required to meet the 0.2 g/bhp-hr standard for all engines produced, however some manufacturers may have accumulated credits in prior years, resulting in some engines being certified above this standard, to as high as the family emission limit cap.

2. California Regulations

California is the only state granted the authority in the Federal Clean Air Act to set standards for new motor vehicles. While its passenger car standards are more stringent than federal standards, in the area of new heavy-duty diesel engines California has generally harmonized with federal rules since 1988.

a. General New Heavy-Duty Engine Regulations

For new engines, long-term emission reductions are achieved through establishing more stringent new engine standards. California has adopted standards that affect new heavy-duty vehicles and urban buses (Table 2).

Table 2. California Emission Standards for New Heavy-Duty Trucks and Buses

Emissions Standards (g/bhp-hr)				
Model Year	Heavy-Duty Vehicles		Urban Bus	
	NOx	PM	NOx	PM
1988	6.0	0.6	6.0	0.6
1990	6.0	--	6.0	--
1991	5.0	0.25	5.0	0.1
1993	--	0.25	--	0.1
1994	--	0.10	--	0.07
1996	5.0	--	4.0	0.05 (c)
1998	4.0	--	4.0	--
October 2002	2.2 (a)	--	2.2 (a)	0.01 (f)
2004	2.2 (a)	--	0.5 (d), 2.2 (e)	--
2007	1.2 (b)	0.01	0.2	0.01
2010	0.2 (b)	--	0.2	--

a. Nominal NOx value of 2.2 g/bhp-hr is based on emission standards of 2.4 g/bhp-hr for NOx plus non-methane hydrocarbons (NMHC) or 2.5 g/bhp-hr NOx plus NMHC with 0.5 g/bhp-hr NMHC cap, which took effect in October 2002 for those engines subject to the U.S. EPA Consent Decrees and the California Settlement Agreements. The Consent Decree-complying engines had to comply with 2004 standards by October 1, 2002.
b. Between 2007 and 2009, U.S. EPA requires 50 percent of heavy-duty diesel engine family certifications to meet the 0.2 g/bhp-hr NOx standard. Averaging is allowed, and it is expected that most engines will conform to the fleet NOx average of approximately 1.2 g/bhp-hr.
c. In use standard of 0.07 g/bhp-hr.
d. Standard applies to urban bus equipped with diesel-fuel, dual fuel, or bi-fuel engines.
e. Standard applies to urban bus equipped with alternative-fueled engines. Nominal expected NOx level of 2.2 g/bhp-hr is based on ARB emission standards of 2.4 g/bhp-hr NOx plus NMHC or 2.5 g/bhp-hr NOx plus NMHC with 0.5 g/bhp-hr NMHC.
f. Standard applies to urban bus equipped with diesel-fuel, dual fuel, or bi-fuel engines. Urban bus equipped with alternative fueled engines may certify to optional standard of 0.03, 0.02, or 0.01 g/bhp-hr.

California also has optional low-emission standards for new heavy-duty vehicles and urban buses. In general, vehicles that are eligible for incentive funding have been certified to an optional low-emission standard (Table 3).

Table 3. California Optional, Low NOx Emission Standards for New Heavy-Duty Trucks and Urban Buses

Model Year	Optional Standards (g/bhp-hr)	Increment (g/bhp-hr)
2000	2.5-0.5	0.5
October 2002	1.8-0.3[c]	0.3
2004-2006 [a,b]	1.8-0.3[c]	0.3

a. For urban buses, emission standards apply only to alternative fueled engines. Diesel-fuel, dual fuel and bi-fuel engines may not exceed 0.5 g/bhp-hr.
b. For urban buses, engine manufacturers may sell diesel hybrid-electric buses certified at 1.8 g/bhp-hr standard to diesel path transit agencies with approved NOx offset plans.
c. Optional emission standards of 1.8 – 0.3 g/bhp-hr are for NOx plus non-methane hydrocarbons (NMHC). Engines certified to the optional NOx standard are excluded from participating in the Averaging, Banking, and Trading (ABT) program.

ARB has adopted regulations to ensure compliance with smoke standards, or visible emissions. California's Heavy Duty Vehicle Inspection and Periodic Smoke Inspection Programs reduce excessive smoke emissions and tampering with diesel-fueled vehicles over 6,000 pounds gross vehicle weight rating (lbs GVWR) traveling within California. The regulations impose limits on the opacity of smoke from diesel engines when measured in accordance with a snap-acceleration test procedure, and have been in effect since 1991, with amendments adopted in 1997.

b. General In-Use Heavy-Duty Engine Regulations

In recent years, California has adopted regulations for in-use buses and trucks operated by transit agencies, in-use solid waste collection vehicles (collection vehicles), transportation refrigeration units and portable engines. California has also developed guidelines establishing criteria for the purchase of new school buses and retrofits of existing school buses called the Lower-Emissions School Bus Program. Emission reductions are achieved through retiring or retrofitting the existing engines or repowering with a newer cleaner engine.

California has also adopted idling limits for buses and heavy-duty trucks. California's school bus idling requirements became effective July 16, 2003. California limits school bus idling and idling by heavy-duty diesel trucks at or near schools to only when necessary for safety or operational concerns. A driver of a transit bus or other commercial motor vehicle is prohibited from idling more than five minutes at each stop within 100 feet of a school. Idling limits applicable to all other buses and heavy-duty trucks were effective February 1, 2005 and restrict idling, in most cases, to no more than 5 minutes. Examples of some exemptions include buses while passengers are on board and trucks doing work that requires the engine to be idling.

c. In-Use Urban Bus and Transit Fleet Vehicle Regulations

California has adopted specific fleet rules that impact transit agencies. In 2000 the Board adopted the Fleet Rule for Transit Agencies to reduce emissions from urban buses. At the February 24, 2005 hearing, the Board amended the Fleet Rule for Transit Agencies to include transit fleet vehicles.

Statewide Fleet Rule for Transit Agencies - Urban Bus Requirements

The urban bus part of ARB's statewide Fleet Rule for Transit Agencies regulates urban buses that are owned or leased by public transit agencies and meet the definition of an urban bus. An urban bus is a bus that is normally powered by a heavy heavy-duty diesel engine, or of a type that would normally be powered by a heavy heavy-duty diesel engine. These buses are generally 35 feet in length or longer and weigh more than 33,000 lbs GVWR. Urban buses usually operate on a fixed route consisting of frequent stops and starts as passengers are routinely picked up and delivered to their destinations. A transit agency is a public entity responsible for administering and managing transit services.

California's urban bus fleet rule has fleet-wide requirements for urban buses applicable to each transit agency, requiring each transit agency to consider its urban bus fleet as a whole to meet emission reduction goals. Each transit agency was required to select a non-revocable compliance path – either the "diesel" path or the "alternative-fuel" path – by January 1, 2001. Path selection establishes the fuel type for new urban bus purchases or leases through model year 2015 and is a non-revocable election. Transit agencies on either path were required to achieve a maximum NOx fleet average of 4.8 g/bhp-hr as of October 1, 2002. The requirement was typically met by retiring older buses or bus engines.

The rule has a multi-step PM emission reduction requirement that is being met by replacement of older buses and bus engines and retrofit of diesel engines with particulate filters. Additionally, the Fleet Rule for Transit Agencies requires ultra low sulfur fuel to be used in urban buses beginning July 1, 2002 to facilitate the use of particulate filters. For the larger transit agencies, 15 percent of their future bus purchases must be zero-emission buses (ZEBs). Large diesel path agencies are also required to conduct a demonstration of ZEBs prior to implementation of the purchase requirement.

Statewide Fleet Rule for Transit Agencies - Transit Fleet Vehicle Requirements

On February 24, 2005, the Board amended the Fleet Rule for Transit Agencies to expand its scope.[3] Per the amendments, a transit fleet vehicle is defined as an

[3] This rule amendment has not been finalized as of the date of this staff report.

on-road vehicle greater than 8,500 lbs GVWR powered by a heavy-duty engine fueled by diesel or alternative-fuel, owned or operated by a transit agency, and which is not an urban bus. These vehicles include small buses and trolleys, paratransit, dial-a-ride vehicles, large commuter buses, and non-revenue generating trucks. A commuter service bus is defined as a bus that would otherwise meet the definition of an urban bus except that its operations include very little of the stop-and-go operations of an urban bus. Gasoline-powered vehicles operated by transit agencies are not subject to the amendments.

The amendments establish a fleet average NOx standard and PM emission reduction requirement for transit fleet vehicles owned or operated by transit agencies. The rule requirements implement in two steps. For the fleet average NOx standard, transit agencies must meet an average of 3.2 g/bhp-hr NOx by December 31, 2007 and 2.5 g/bhp-hr by December 31, 2010 (Table 4). Transit agencies will likely meet the fleet average NOx standards through fleet turnover, purchasing alternative-fuel vehicles, repowering older trucks, or retrofitting with a verified diesel emission control strategy (DECS) that reduces NOx.

Table 4. Fleet NOx Average Requirements for Transit Agencies (g/bhp-hr)

Fleet Type	Compliance Date		
	October 1, 2002	December 31, 2007	December 31, 2010
Urban Buses	4.8	—	—
Transit Fleet Vehicles	—	3.2	2.5

A transit agency is also required to reduce diesel PM emissions from its transit fleet vehicles by 40 percent as of December 31, 2007 and 80 percent as of December 31, 2010, compared to total emissions as of January 1, 2005 (Table 5). Transit agencies will achieve these reductions by purchasing new, cleaner transit fleet vehicles, retrofitting with a particulate filter, or repowering with a cleaner engine.

Table 5. Fleet Diesel PM Reduction Requirements for Transit Agencies

Fleet Type	Baseline Year	Percent Reduction From Baseline				
		2004	2005	2007	2009	2010
Urban Buses						
Alternative Path	2002	20	40	60	85[1]	—
Diesel Path	2002	40	60	85[1]	—	—
Transit Fleet Vehicles	2005	—	—	40	—	80[1]

1. In the final year of compliance and beyond the transit agency can meet a fleet average of 0.01 g/bhp-hr times the number of vehicles in the fleet.

3. Local Regulations

Local Air Pollution Control Districts and Air Quality Management Districts (air districts) have authority to regulate stationary sources and some area wide sources, but also participate in programs to reduce emissions from mobile sources.

a. General Air District Authority

Air districts participate with local transportation agencies to develop and implement transportation control measures aimed at reducing vehicle activity and emissions. Some air districts have developed model ordinances to reduce idling of trucks and buses, to encourage the purchase of low-emission vehicles for public fleets, and to require public agency contracting that is "green." Other air districts have reduced the number of smoking vehicles by mailing letters to the registered owners to request that the vehicle be repaired.

Air districts also have programs to distribute revenue to cities and counties to fund transportation-related projects that reduce air pollution. Funds are also available for the air districts to distribute to private business and public agencies that use heavy-duty vehicles to defray the costs of new lower emission technologies for diesel engines. These monies are available to projects, such as cleaner transit buses, trash trucks, school buses, and street sweepers, that go beyond established regulatory requirements.

Public outreach is an important component of the air districts' programs to reduce emissions from mobile sources. Public outreach can include forums to present new technologies, programs, and opportunities to reduce emissions. These opportunities might also include encouraging bicycle use and exchanging gasoline lawn mowers for electric lawn mowers, in addition to programs that provide funding for purchases of cleaner engines and vehicles.

b. Specific South Coast Air Quality Management District Authority

The District implements many of the programs identified above. Additionally, to reduce both toxic and smog-forming air pollutants, the Legislature granted the District special authority to adopt fleet rules, as was discussed earlier, in Health and Safety Code Section 40447.5. Based on this authority, the District adopted seven fleet rules during 2000 and 2001. The rules were developed to gradually shift public agencies and certain private entities to lower emission and alternative-fuel vehicles and apply whenever a fleet operator with 15 or more vehicles purchases or leases a vehicle for replacement or addition to its fleet.

The District defines alternative fuels slightly differently in each of its rules, but generally follows the definition adopted by ARB, in its fleet rule for transit agencies. In Rule 1192 for transit buses, alternative fuel is defined to include

"compressed or liquefied natural gas, liquefied petroleum gas, methanol, electricity, fuel cells, or other advanced technologies that do not rely on diesel fuel." A more detailed description of the Rule 1192 is provided in Section IV.B of this report.

There is variation among the District fleet rules due to the different functional demands and accompanying circumstances for each type of fleet vehicle. For light and medium-duty vehicles and commercial airport ground access vehicles, the fleet rules require the acquisition of low-emitting gasoline or alternative-fuel vehicles. For transit buses and sweepers, the fleet rules specify the acquisition of alternative fuel vehicles only. For refuse collection vehicles, the rules provide the choice of acquiring alternative-fuel, pilot ignition, or for a limited time frame, dual-fuel vehicles. For heavy-duty public fleet vehicles, the rule provides the option of acquiring alternative-fuel, dual-fuel, or dedicated gasoline vehicles. For school buses, many compliance options are available depending on the fleet size, bus type, and availability of funding.

It is critically important to note that each rule also provides specific exemptions and alternative compliance or offsetting options. For several rules, the requirements also vary depending on the availability of incentive funding. Additionally, each fleet rule has alternative compliance provisions for cases in which the requirements are demonstrated to be technically infeasible.

4. Voluntary and Incentive Programs

Voluntary efforts play a key role in helping to achieve air quality goals. Incentives can induce vehicle owners to reduce vehicle emissions prior to compliance deadlines or to reduce emissions beyond regulatory requirements. Owners and operators of transit buses, collection vehicles, school buses, and street sweepers are eligible for available funding for vehicles that go beyond the established requirements.

a. Federal Incentives

On the federal level, the U.S. EPA established a Voluntary Diesel Retrofit Program in 2000 to address pollution from diesel construction equipment and heavy-duty on-highway vehicles. This program allows fleet operators to choose appropriate, U.S. EPA-verified technologies that will reduce the emissions of the vehicles and engines in their fleets and identify potential funding sources to assist air quality planners and fleet operators as they create and implement retrofit programs. The program assists air quality planners in determining the number of State Implementation Plan credits produced by their retrofit projects. The U.S. EPA has also established a program to fund school bus retrofits and replacements from penalty revenues.

Additionally, the Federal Transit Administration (FTA) pays 80 to 83 percent of the purchase cost of a new urban bus. The remaining cost can be made up from local and state transportation funds.

b. State Incentives

In 1998, the Governor and Legislature appropriated $25 million to implement the Carl Moyer Memorial Air Quality Standards Program (Carl Moyer Program.) Administered by the ARB and the local air districts, the program provides grants to local air districts to fund the extra capital cost of cleaner-than-required diesel-powered heavy-duty vehicles and equipment. During the first five years, the Carl Moyer Program received budget appropriations totaling $153 million.

In 2000, the Legislature approved new funds to reduce emissions from school buses. The ARB, in coordination with the California Energy Commission and the local air pollution control districts, established guidelines for the Lower-Emissions School Bus program. The goal of this incentive program is to reduce the exposure of school children to both cancer-causing and smog-forming compounds. This program utilizes two strategies to attain these goals: pre-1987 model year school bus replacement and in-use controls for later model year diesel-fueled school buses. Over fiscal years 2000/2001 and 2001/2002, program funding was $66 million total.

Voters approved Proposition 40, the California Clean Water, Clean Air, Safe Neighborhood Parks, and Coastal Protection Act of 2002, which granted additional funding to reduce diesel emissions. The measure provides about $50 million over two years to ARB, 20 percent of which is to be spent for the acquisition of "clean, safe, school buses for use in California's public schools." The remainder is allocated to the Carl Moyer Program.

In 2004, the Governor and the Legislature approved Assembly Bill (AB) 923 that provided up to $140 million a year of long-term incentive funding. The bill also modified requirements governing the funds to include:

- Expanding pollutants from NOx-only to include particulate matter (PM) and reactive organic gases (ROG).
- Adjusting Smog Check, tire, and Department of Motor Vehicle (DMV) fees to provide an ongoing source of funding through 2015.
- Including fleet modernization, light-duty vehicle projects, and an expanded agricultural assistance program as projects eligible for incentive funds.

c. Local Funding

The revenue that air districts distribute to cities, counties, public agencies, and businesses to fund projects that reduce air pollution comes from DMV fees and the incentive programs previously discussed. State law authorizes districts to

impose a registration surcharge of $4 dollar per vehicle upon adoption of a resolution that provides for both the fee and the program to reduce air pollution from motor vehicles and for related planning monitoring, enforcement and technical studies. The DMV collects the fees at the request of the district.

AB 923 allows some local districts to vote to approve an additional $2 dollar per vehicle fee in addition to the $4 dollar per vehicle DMV fee. These funds can be used for Carl Moyer Program projects, Lower-Emission School Bus Program purchases, accelerated vehicle scrap, and some agricultural projects.

The SCAQMD has imposed the $4 dollar per vehicle fee (as provided under AB 2766) and adopted the additional $2 dollar per vehicle fee (as provided in AB 923) for the south coast air district. In the South Coast, the $4 dollar per vehicle fee is distributed 30 percent to the district's general fund, 40 percent to cities and counties, and 30 percent to the Mobile Source Reduction Review Committee (MSRC) to contribute a funding match towards qualifying projects. MSRC has funded $42 million dollars for school buses, transit buses, street sweepers, and refuse trucks since the 1995-1996 fiscal year. The cities and counties portion of the DMV fees has funded some infrastructure needs for alternative-fuel school buses.

The SCAQMD anticipates $22 million dollars annually from the $2 dollar increase in DMV fees in the South Coast district. Over the next 18 months (to the end of calendar year 2006), the district has designated $14 million dollars for Clean On-Road School Buses, $4 million dollars for accelerated vehicle scrap, $11 million for Carl Moyer projects, and $4 million for agricultural sources. The SCAQMD has distributed approximately $28 million dollars of Carl Moyer funding to transit buses, refuse trucks, and street sweepers. The Carl Moyer Program has not been a significant source of funding for school buses due to the very low mileage of those vehicles contributing to a higher cost effectiveness. Funding for alternative school buses, cleaner diesel school buses, and diesel school bus particulate trap retrofits have come from the Lower-Emissions School Bus Replacement Program and the SCAQMD Governing Board school bus initiatives.

South Coast Rule 2202 - Air Quality Investment Program (AQIP) allows employers with 250 or more employees to participate in an air quality investment program in order to meet their emission reduction target. An employer may elect to participate in the program by investing annually $60 per employee or triennially $125 per employee into an AQMD administered restricted fund. Since 2000, over $1.6 million dollars from AQIP has funded alternative fueled street sweepers and refuse trucks.

II. PUBLIC OUTREACH

The ARB is committed to ensuring that all California communities have clean, healthful air by addressing not only the regional smog that hangs over our cities

but also the nearby toxic pollution that is generated within our communities. The ARB works to ensure that all individuals in California, especially the children and elderly, can live, work and play in a healthful environment that is free from harmful exposure to air pollution.

A. Environmental Justice

On December 13, 2001, the Board approved Environmental Justice Policies and Actions,[4] which formally established a framework for incorporating environmental justice into the ARB's programs, consistent with the directives of State law and policy (ARB 2001). "Environmental justice" is defined as the fair treatment of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies. These policies apply to all communities in California, but environmental justice issues have been raised more in the context of low-income and minority communities because of past land use policies and the cumulative impact of a concentration of emitting facilities in some neighborhoods.

To achieve this ambitious goal, the ARB established a Community Health Program and emphasized community health issues in our existing programs. To provide people with the basic tools and information needed to understand and participate in air pollution policy planning, permitting, and regulatory decision-making processes, ARB has published "The Public Participation Guide to Air Quality Decision Making in California."[5]

In addition, at its April 28, 2005, public meeting, the Board adopted the "Air Quality and Land Use Handbook: A Community Health Perspective"
This document was developed to provide technical information to local land use and transportation agencies for considering impacts of local sources of air pollution in the land use decision-making process.

The Environmental Justice Policies are intended to promote the fair treatment of all Californians and cover the full spectrum of ARB activities. Underlying these Policies is a recognition that we need to engage community members in a meaningful way as we carry out our activities. People should have the best possible information about the air they breathe and what is being done to reduce unhealthful air pollution in their communities. The ARB recognizes its obligation to work closely with all stakeholders; communities, environmental and public health organizations, industry, business owners, other agencies, and all other interested parties to successfully implement these Policies. Our outreach efforts, described below, facilitate this objective.

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[4] Complete information for these programs can be found at http://www.arb.ca.gov/ch/ej.htm.
[5] Complete information on this program can be found at http://www.arb.ca.gov/ch/public_participation.htm

The amendments presented in this report for the Board's consideration may provide air-quality benefits by reducing NOx and diesel PM emissions from urban buses that operate in neighborhoods in the District. NOx emissions contribute to respiratory impacts in children, to the formation of fine particulate matter, and to the formation of ozone, a criteria pollutant, as discussed in Section III.A. Diesel PM has been identified as a TAC and is discussed in Section III.B. The actions we have taken in applying these policies in our rulemaking reflect the Board's commitment to the fair treatment of all people throughout California.

B. Outreach Efforts

Consistent with ARB's environmental justice policy for strengthening our outreach efforts in all communities, staff utilized many avenues to engage stakeholders in the rulemaking effort.

1. Amend the Statewide Urban Bus Emission Requirements

Staff conducted six public workshops and additional focused meetings to discuss modifying the statewide urban bus emission requirements (Table 6). Those workshops held in Sacramento were webcast for individuals who could not travel to the meeting locations. Notices for the workshops were mailed to more than 3,700 individuals and companies and were posted to ARB's Public Transit Agencies web site[6] and e-mailed to subscribers of ARB's electronic listserves related to this item.

[6] http://www.arb.ca.gov/msprog/bus/bus.htm

Table 6. Workshop Locations and Times.

Date	Location	Time	Topics Discussed
December 2, 2003	El Monte	1:30 – 3:00 PM	Statewide Rule
December 3, 2003	Sacramento	1:30 – 3:00 PM	Statewide Rule
March 29, 2004	Sacramento	1:30 – 3:00 PM	Statewide Rule
March 30, 2004	El Monte	1:30 – 3:00 PM	Statewide Rule
April 7, 2005	El Monte	1:30 – 4:00 PM	Statewide Rule/ District Rule
April 27, 2005	Sacramento	1:00 – 4:00 PM	Statewide Rule/ District Rule

Attendees of the workshops included representatives from environmental organizations, transit agencies, engine manufacturers, bus manufacturers, air pollution control districts, cities and counties, the California Association for Coordinated Transportation, Regional Council of Rural Counties, Manufacturers of Emission Control Association, Engine Manufacturers Association, California Department of Transportation, California Natural Gas Association, California Energy Commission, consultants, and other parties interested in urban bus emissions.

Staff also met with a number of stakeholders in focused meetings throughout the rulemaking process to get feedback on modifying the current emission requirements. These stakeholders included manufacturers of engines and buses; natural gas advocates; and environmental organizations. Staff attended and made presentations at the California Transit Association conference in November 2003 and 2004 and the California Association for Coordinated Transportation conferences in April and September 2004, and April 2005.

2. Alternative Fuel Path Mandate for all Transit Agencies in the District

In October 2004, ARB posted a request for public comment concerning the District's fleet rules on its website. We requested comment on whether ARB should submit the District's fleet rules to U.S. EPA for a waiver of preemption, pursuant to section 209(b) of the Clean Air Act.

ARB received thousands of comments, including over 4,800 electronic submittals. After a thorough review of the comments and consultation with U.S. EPA, staff made a decision to pursue a new rulemaking process for some

fleet rules, as discussed earlier, with the generation of a new public record that would update relevant information on the effectiveness and costs of these rules.

Staff generated a webpage dedicated to the rulemaking effort.[7] On this webpage, ARB provided notice of the rulemaking process with relevant background and contact information. Then staff generated a list serve from all those who had provided electronic comments. Along with those on ARB's mobile sources listserve, over 5,700 emails were sent to inform stakeholders of the rulemaking activity.

Staff conducted one public workshop in El Monte and one in Sacramento to discuss urban bus fleet requirements in the South Coast Air Basin (see Table 6 above). These workshops also covered modifying the statewide urban bus emission requirements. Notices for these workshops were mailed to more than 2000 individuals and companies and were posted to ARB's Fleet Rules for the South Coast Air Basin web site, as well as e-mailed to over 5,000 list serve subscribers.

With regard to the requirement that all transit agencies operating in the District be required to follow the alternative-fuel compliance path, staff also met with over fourteen stakeholders in focused meetings throughout the rulemaking processl. These stakeholders included manufacturers of engines and buses and natural gas advocates. In addition, staff conducted telephone interviews with the transit agencies operating in the District to discuss the amendments presented in the report and obtain specific fleet information.

To generate additional public participation and to enhance the information flow between ARB and interested persons, staff made all documents, including workshop presentations, available via the Public Transit Agencies web site and/or the Fleet Rules for the South Coast Air Basin web site. In addition, these web sites provide background information and serve as portals to other web sites with related information.

III. NEED FOR EMISSION REDUCTIONS

Many regions of California have serious to severe problems with air quality. In particular, the South Coast Air Basin, which includes Orange County and the non-desert portions of Los Angeles, Riverside and San Bernardino Counties, is designated as a serious nonattainment area for PM_{10} (particulate matter under 10 microns) and a severe nonattainment area for ozone. The Coachella Valley, located in the desert portion of Riverside County, is classified as a serious nonattainment area for PM_{10} and a severe nonattainment area for ozone.

[7] http://www.arb.ca.gov/msprog/scfleet/scfleet.htm

A. Ozone

Ground-level ozone is created by the photochemical reaction between NOx and reactive organic gases (ROG). Breathing ozone can trigger a variety of health problems including chest pain, coughing, throat irritation, shortness of breath, and congestion. It can worsen bronchitis, emphysema, and asthma. Ozone can also reduce lung function and inflame the linings of the lungs. Repeated exposure may permanently scar lung tissue. The elderly, children, and people with compromised respiratory systems are among those persons who may be most affected by exposure to ozone.

Ground-level ozone also damages vegetation and ecosystems. It leads to reduced agricultural crop and commercial forest yields, reduced growth and survivability of tree seedlings, and increased susceptibility to diseases, pests, and other stresses such as harsh weather. Ground-level ozone also damages the foliage of trees and other plants, affecting the landscape of cities, parks and forests, and recreational areas.

B. Particulate Matter (PM)

PM emissions result primarily from incomplete combustion of fuel in the cylinder and lubrication oil that has entered the cylinder incidentally. Secondarily produced diesel PM is formed as a result of atmospheric reactions with diesel NOx emissions. The majority of diesel PM, approximately 98 percent, is smaller than ten microns in diameter. Diesel PM is a mixture of materials containing over 450 different components, including vapors and fine particles coated with organic substances. More than 40 chemicals in diesel exhaust are considered TACs by the State of California.

Diesel PM has been linked to a wide range of serious health problems. Particles that are deposited deep in the lungs can result in lung cancer, increased hospital admissions; increased respiratory symptoms and disease; decreased lung function, particularly in children and individuals with asthma; alterations in lung tissue and respiratory tract defense mechanisms; and premature death. Long-term ambient concentrations of PM_{10} are associated with increased risks of all natural-cause mortality in males, mortality with any mention of nonmalignant respiratory causes in both sexes, and lung cancer mortality in males (Abbey, et al., 1999; McDonnell, et al., 2000).

IV. NEED FOR A POLICY DECISION BY THE BOARD TO AMEND ARB'S CURRENT REGULATIONS

Public transportation has important societal benefits, providing access to work and education, reducing traffic congestion, and meeting mobility needs of the public. However, this service is generally performed by heavy-duty urban buses that run on diesel fuel and make multiple trips with frequent start/stop operation

through residential and business communities. Since diesel exhaust has been identified as contributing to both toxic PM and ozone-generating NOx emissions it remains in society's best interest to reduce diesel emissions to the maximum feasible extent.

A. Amend the Statewide Urban Bus Emission Requirements

One of the major strategies used to reduce emissions of both NOx and PM from urban buses is the acceleration of bus replacement with newer buses. While transit agencies may receive funding to replace urban buses once they are 12 years old, staff has found that transit agencies will keep these buses in the fleet years longer. Fleet turn over – that is, transit agencies replacing their older buses with new buses using cleaner engine technologies – reduces emissions.

The California market for new urban bus engines is small, and meeting the California 2004 and 2007 NOx urban bus engine exhaust standards proved to be technologically challenging for diesel engines. In addition, the U.S. EPA adopted new heavy-duty engine standards for trucks and urban buses that were less stringent than the urban bus standards previously adopted by ARB. As a result, diesel engine manufacturers decided not to attempt to comply with California's new urban bus engine standards but instead to work towards achieving the less stringent, but still technologically challenging, national heavy-duty truck engine standards.

At the time the Board adopted California's rule, engine manufacturers told ARB they would not certify engines to meet the 2006 engine exhaust emission standards. In response, the Board adopted an alternative strategy that transit agencies could use to purchase urban bus engines certified to the 2002 emission standards so long as they reduced fleet NOx emissions as if they had purchased engines certified to 0.5 g/bhp-hr NOx. Only seven transit agencies completed the application process and qualified for the "alternative NOx strategy exemption."

In June 2004, staff, with concurrence of the Board, postponed a decision on a staff proposal to align the urban bus engine standards with the California 2007 heavy-duty standard because of an ongoing evaluation of available 2007 urban bus engine technology. Of particular interest to the Board was if natural gas engines would comply with the 2007 urban bus NOx emission standard.

B. Alternative Fuel Path Mandate for All Transit Agencies in the District

On June 16, 2000, the SCAQMD adopted Rule 1192 - Clean On-Road Transit Buses. Rule 1192 requires public transit fleets operating in the SCAQMD to acquire alternative-fuel vehicles when procuring or leasing transit fleet vehicles. The rule applies to government agencies and private companies under contract to government agencies, with fleets of 15 or more public transit vehicles or urban

buses that are providing passenger transportation services including intra- and intercity shuttle services. The scope of the rule includes: 1) vehicles having a GVWR of at least 14,000 pounds but no greater than 33,000 pounds, that are used for the express purpose of transporting passengers; and 2) buses having a GVWR greater than 33,000 and defined by ARB as "urban buses." Paratransit vehicles, as defined in Sections 226 and 462 of the California Vehicle Code, are excluded from Rule 1192.

SCAQMD defines an alternative-fuel heavy-duty vehicle as one that uses compressed or liquefied natural gas, propane, methanol, electricity, fuel cells, or other advanced technologies that do not rely on diesel fuel, and meets the emission requirements of title 13, CCR, section 1956.1, as adopted February 24, 2000. Rule 1192 does not consider diesel-based hybrid-electric and dual-fuel vehicles that use diesel fuel to be alternative-fuel vehicles.

Fleet operators of 15 or more transit vehicles or urban buses, except for municipal or included municipal operators with fewer than 100 transit vehicles or urban buses, were required to meet the requirements of Rule 1192 beginning July 16, 2000. This implementation deadline was July 1, 2001, for fleet operators that are considered municipal operators or included municipal operators with 15 or more, but less than 100 transit vehicles or urban buses. SCAQMD allowed additional lead time for the smaller fleets to identify funding sources as well as to construct the necessary infrastructure to support the operation of alternative-fuel transit vehicles. SCAQMD also provided an exemption for vehicles for which purchase or lease contracts existed prior to June 16, 2000.

In this rulemaking, the Board will have the option of amending the ARB's Fleet Rule for Transit Agencies to mandate that the six diesel path transit agencies in SCAQMD switch to the alternative fuel path, in order to have the state rule achieving the alternative fuel objectives of the District's Rule 1192. The ARB's adoption of a unique fleet requirement for the transit agencies in the District would have the effect of addressing the Court's decision regarding preemption while reflecting the Legislature's intent that SCAQMD be authorized to establish an alternative fuel fleet rule for transit districts within the District.

The Board may adopt the District fleet requirement presented in this report if the Board wishes to assure that alternative fuel urban transit buses are purchased throughout the District, and determines it wise to provide a backstop to the current District Rule 1192 in case litigation overturns the District rule.

V. ASSESSMENT OF THE POLICY DECISION TO BE PRESENTED TO THE BOARD

This report presents two policy decisions to be considered by the Board.

A. Amend the Statewide Urban Bus Emission Requirements

Staff has assessed urban bus engine availability based on the current 2007-2009 model year standard versus what could be available if the Board modifies the standard to align with the current 2007-2009 model year heavy-duty truck engine standards. There are essentially three scenarios that could occur. The first is that manufacturers could certify both diesel and alternative-fuel engines for sale in California in time to meet the standard of 0.2 g/bhp-hr NOx in 2007. Discussions with diesel engine manufacturers, however, have convinced staff that this scenario is unlikely. Since 2001 the Engine Manufacturer's Association (EMA) has been warning ARB that the major urban bus engine manufacturers would not meet California's 2007 NOx standard of 0.2 g/bhp-hr and requested that ARB align its 2007 urban bus standards with the federal 2007 standards, adopted in 2001. More recently, the engine manufacturers have reiterated their position in verbal and written comments at the various public workshops for this rulemaking. Engine manufacturers have informed ARB that they plan to produce diesel engines nationwide that meet a nominal 1.2 g/bhp-hr NOx standard and that they do not plan to produce diesel engines meeting the 0.2 g/bhp-hr NOx standard until 2010.

The second scenario staff assessed is that manufacturers will make alternative fuel engines available to meet the 0.2 g/bhp-hr NOx standard. Multiple manufacturers have stated publicly that they intend to produce natural gas or other alternative fuel urban bus engines that meet the California 2007 standard (CalNGV News 2004; Cummins-Westport 2005). Therefore, staff believes that there is a reasonable likelihood that one or more urban bus engine will be commercially available by 2007 for users of alternative fuels. There is some risk that these engines will be delayed or will not be certified and marketed, as these are all engines that require new technology.

The third scenario is that there will be no diesel or natural gas engines available for California urban buses for 2007-2009. In this case, California transit agencies would not be able to purchase new engines until 2010, at which time staff expects all engines, both diesel and alternative fuel, will meet the 2010 heavy-duty truck NOx standard of 0.2 g/bhp-hr. As noted above, staff's assessment is that no diesel urban bus engines will be available in 2007 through 2009, but it is likely alternative fuel urban bus engines will be available.

There are 76 transit agencies statewide that report to ARB under the Fleet Rule for Transit Agencies. The 28 agencies on the alternative fuel path will still continue to purchase complying engines in 2007 through 2009, because staff

believes complying engines will be available. However, if the current 2007 urban bus emission standards are not modified, the 48 agencies on the diesel path will not be able to purchase new diesel buses until 2010. These diesel path transit agencies operate 62 percent of the California urban buses, and if they continue on the diesel path the result is that these agencies will likely keep their older buses longer or repower their buses until complying diesel buses are available in 2010. Emission reductions staff anticipated from the original rule will not be realized from diesel path transit agencies.

There is the potential that, with no diesel buses available in 2007 through 2009, a transit agency on the diesel path could purchase alternative fuel engines. However, based on their workshop comments and purchasing practices as reported to ARB annually, most agencies are unlikely to voluntarily replace their existing diesel buses with alternative-fuel engines for two reasons. The first is that the diesel path agencies expect there to be diesel engines available no later than 2010, and they have stated that they have the ability to forgo purchasing new buses until 2010. The second reason is that switching to alternative fuel requires a significant investment in infrastructure, training, and modifications to facilities. Transit agencies are unlikely to make these investments and changes in order to purchase buses for a short, three-year period. Therefore, it is unlikely that leaving the 2007 through 2009 model year urban bus NOx standard at 0.2 g/bhp-hr would cause diesel path transit agencies to switch to the alternative fuel path.

Staff expects that manufacturers will certify diesel urban bus engines that meet the 1.2 g/bhp-hr NOx level if the Board relaxes the NOx standard for 2007 through 2009 model years. Staff also expects that, even if the Board changes the NOx standard to 1.2 g/bhp-hr for 2007, some manufacturers will offer alternative fuel engines that meet the 0.2 g/bhp-hr NOx level in 2007. Staff believes this to be the case because these manufacturers profess to have the technology to meet the 0.2 g/bhp-hr level, and will be required to meet this level by 2010. Thus, to avoid another design cycle and to capture sales resulting from incentive funds available for early-introduction engines, it is likely that some manufacturers will instead opt to produce 0.2 g/bhp-hr engines early.

Within these various scenarios, staff believes the most likely outcome for the 2007 through 2009 model years is that there will be 0.2 g/bhp-hr NOx alternative fuel engines available, and that transit agencies on the alternative fuel path will purchase these engines. By aligning the 2007 through 2009 model year NOx standard to the heavy-duty truck standard, diesel path agencies will also be able to purchase new engines in 2007 through 2009. If a requirement were adopted that required all transit agencies to follow the alternative fuel path, staff believes transit agencies would be forced to purchase alternative fuel engines in 2007 and later.

B. Alternative Fuel Path Mandate for All Transit Agencies in the District

As discussed earlier, there are 17 transit agencies that fall under Rule 1192 in the District (Table 7). All but one of these transit agencies operates urban buses and is subject to ARB's Fleet Rule for Transit Agencies. One transit agency, Commerce, has fewer than 15 buses and is therefore not subject to Rule 1192, but is subject to ARB's current transit fleet rule.

Of the 17 transit agencies in the District subject to ARB's Fleet Rule for Transit Agencies, eleven are on the alternative fuel path and under current state law must continue to purchase alternative fuel buses through 2015. These agencies represent 90 percent (4120 buses) of the transit buses in the District. Under ARB's Fleet Rule for Transit Agencies, the six transit agencies on the diesel path have the ability to purchase diesel engines, although Rule 1192 prohibits them from doing so.

Table 7. Transit Agencies in the SCAQMD

Transit Agency	Urban Buses[1]
Commerce[2]	9
Culver City	46
Foothill Transit	306
Gardena Municipal Bus Lines[3]	47
Glendale	26
Long Beach Transit[3]	191
Los Angeles County MTA	2473
Los Angeles DOT	142
Montebello[3]	72
Norwalk[3]	30
Omnitrans	176
Orange County Transportation Authority	612
Pasadena[4]	0
Riverside Transit Agency	114
Santa Clarita Transit[3]	64
Santa Monica Big Blue Bus	174
Sunline Transit Agency	42
Torrance Transit System[3]	53
Total	4577

[1] Based on annual reports to ARB and March 2005 survey of SCAQMD transit agencies.
[2] Commerce's fleet is below the 15 bus limit and is thus not subject to Rule 1192.
[3] Agencies on the diesel compliance path.
[4] Pasadena operates no urban buses; all of its buses are transit fleet vehicles regulated under ARB's February 24, 2005, amendments to the Fleet Rule for Transit Agencies.

In February and March of 2005, staff contacted each transit agency in the District on the diesel path to determine their future purchasing plans. Based on the

survey, staff estimates that all but one transit agency, Torrance, plans to purchase alternative-fuel buses (CNG or gasoline hybrid-electric).

Gardena expects to complete a new facility with a CNG refueling station by the end of 2006, but is currently purchasing gasoline hybrid-electric buses (gHEB). Santa Clarita has contracted to purchase 14 CNG buses, but obtained a waiver from the SCAQMD for purchasing diesel-fueled commuter buses.

Long Beach Transit and Montebello are purchasing gHEBs and neither agency intends to upgrade its facility to handle CNG. Norwalk is purchasing gHEBs, and may update its facility to accommodate CNG in the future. Both Montebello and Norwalk are interested in diesel hybrid-electric buses, however under Rule 1192 they cannot be purchased.

Thus, staff expects that without Board adoption of an alternative fuel requirement in the District, five of the six agencies on the diesel path will purchase alternative fuel buses, regardless. However, these agencies would have the ability to purchase diesel buses, and therefore staff's analysis assumes that, without an alternative fuel mandate in the District, all six of these transit agencies will purchase diesel buses if available.

VI. Inventory of Urban Buses and Emissions

This section discuses the inventory for urban buses and their emissions.

A. Inventory of Urban Buses

As part of the Fleet Rules for Transit Agencies, transit agencies must submit an annual report to ARB listing all their urban buses, including fuel use. Based on these reports, the statewide 2004 population was 9,845 urban buses, of which 3,764 were operated by transit agencies on the alternative-fuel path and 6,081 were operated by transit agencies on the diesel fuel path (Table 8). Note that alternative-fuel path agencies operate diesel buses, which are mostly older diesel. Also, some diesel path agencies operate alternative-fuel buses; these are mainly transit agencies located in the District. Most of the electric buses are operated by San Francisco MUNI, which is on the diesel path.

Table 8. Reported California Urban Bus Inventory as of January 1, 2005, by the Selected Fuel Path of the Transit Agency

Fuel Type	Statewide		SCAQMD	
	Alt Fuel Path	Diesel Path	Alt Fuel Path	Diesel Path
Diesel	1947	3758	1321	452
LNG	269	0	269	0
Propane	175	2	41	0
CNG:H2	2	0	2	0
CNG	3378	55	2477	0
Electric	5	366	0	0
Gasoline HEB	19	0	2	0
Diesel HEB*	2	4	2	2
Total	5657	4187	4114	454

*Operating with an urban bus engine or with an experimental permit, not certified as an HEB.

The major manufacturers of urban bus engines currently in operation are Cummins and Detroit Diesel, although Caterpillar and John Deere have also recently begun to enter the urban bus market. ARB provides a website to obtain information on California certified engines for use in urban buses. For the current 2005 model year, the web address is:
http://www.arb.ca.gov/msprog/onroad/cert/mdehdehdv/2005/2005.htm

B. Emission Inventory for Urban Buses

The California on-road vehicle emission inventory data consists of two elements: emissions-related and activity-related. The emissions-related data reflect new vehicle testing information and the latest vehicle registration data from the DMV. The activity-related data are updated by the regional transportation agencies that estimate of the daily vehicle miles of travel, the distribution of travel by speed, and the number of starts per vehicle per day by year. The on-road emission inventory is then derived using the EMFAC model (Appendix C).

ARB staff calculated the urban bus emission inventory using a model developed from EMFAC specifically incorporating the turnover rates from their reports and emission factors for urban buses. Gasoline vehicles were not included in the emissions analysis.

Under California's current urban bus emission standards from 2004 through 2009, staff assumed urban bus turnover in most diesel path transit agencies to be almost non-existent. Transit agencies that repower existing diesel buses will use engines meeting the same engine standards as the existing engine. The

consequence of this mismatch between California's urban bus engine exhaust emission standards and the statements by the major urban bus engine manufacturers is that emissions from California's urban buses will remain high for many years. Transit agencies on the diesel path are unwilling to purchase alternative fuel buses to turn over their old diesel buses, but instead are waiting to purchase new, cleaner emission diesel urban buses in 2010.

At the June 24, 2004, and February 24, 2005, hearings, the Board adopted modifications to the standards for diesel HEBs. The modifications enabled manufacturers to certify diesel HEBs for 2004 through 2006. With prior approval from the executive officer, these buses are available for purchase or lease to transit agencies on the diesel path. Seven agencies have already qualified for the "alternative NOx strategy exemption" and a total of ten diesel path agencies have applied to purchase a total of approximately 190 diesel HEBs for 2006. These diesel HEB buses will meet a standard of 1.8 g/bhp-hr NOx and 0.01 g/bhp-hr PM. In addition, approximately seventeen ISE Corporation (ISE) gasoline HEBs are on order for Central California transit agencies, and approximately 70 are on order for South Coast fleets.

Modeling these assumptions suggests that California's urban bus engine exhaust emission standards for 2007 through 2009 have the unintended consequence of keeping urban bus emissions artificially high. The predicted emission reductions as a result of the 2000 rule are unlikely to be achieved. Staff estimates that there will be a shortfall between the NOx reductions expected if engine manufacturers had produced diesel urban bus engines meeting California's standards from 2004 through 2009 of 2.06 tpd in 2010; 1.31 tpd in 2015; and 0.72 tpd in 2020 (Table 9). For particulate matter (PM), the predicted emission reduction shortfall is 80 pounds per day (lbs/day) in 2010; 30 lbs/day in 2015; and 24 lbs/day in 2020 (Table 10). The baseline emissions for urban buses gradually decline over time because of turnover from dirtier engines to cleaner engines, along with the NOx and PM reductions mandates in the Fleet Rule for Transit Agencies. See Appendix C for an explanation of the emissions inventory methodology.

Table 9. NOx Statewide Diesel Emissions Inventory (tpd)

	2010	2015	2020
2000 Regulation Projected	5.87	2.41	0.65
Current Estimate – No Turnover[1]	7.93	3.72	1.37
Shortfall	**-2.06**	**-1.31**	**-0.72**

[1] Assumes no turnover of diesel engines from 2004-2009.

Table 10. PM Statewide Diesel Emissions Inventory (lbs/day)

	2010	2015	2020
2000 Regulation Projected	240	112	76
Current Estimate – No Turnover[1]	320	142	100
Shortfall	**-80**	**-30**	**-24**

[1] Assumes no turnover of diesel engines from 2004-2009.

VII. SUMMARY OF THE CONTROL MEASURES TO BE CONSIDERED BY THE BOARD

Staff has identified two policy decisions for the Board's consideration and has developed proposed regulatory amendments to support these decisions the Board may make. First, staff is presenting three options for the Board to consider regarding the appropriate emission standards for new urban bus engines in 2007 through 2009. The three options are: 1) keep the current new urban bus emissions standards as they are, 2) change the NOx emission standard for 2007 through 2009 model year new urban buses from 0.2 to 1.2 g/bhp-hr, which would align it with the equivalent model year heavy-duty truck NOx emission standard, and 3) require all transit agencies to purchase/lease only alternative fuel buses. The rulemaking documents prepared in connection with this report contain amendments to title 13, CCR, sections 1956.1, 1956.8 and 2023.1 (Appendix A), and set forth the following:

- Language to implement the option to align the 2007 and later emission standards for new urban buses with the 2007 and later emission standards that apply to new heavy duty trucks (for NOx this results in an average level of 1.2 g/bhp-hr in 2007 and 0.2 g/bhp-hr in 2010);
- Language to require that transit agencies operating within the jurisdiction of SCAQMD follow the alternative-fuel compliance path under Title 13, CCR, Section 2023.1.

The amendments provided in this report (set forth in the proposed regulation order in Appendix A) set forth the language necessary to implement the option of aligning the urban bus standards with the heavy-duty truck standards beginning with the 2007 model year. Should the Board favor the option to keep the urban

bus standards as they are, no regulatory changes are necessary. Should the Board decide that all transit agencies statewide should be required to purchase alternative fuel, a 15-day modification to ARB's Fleet Rule for Transit Agencies would be needed to accomplish this (and no change to the urban bus emission standards would be necessary). The language modifying the fleet rule for transit agencies applies to the purchase of urban buses by transit agencies operating in the District, and assures that alternative fuel transit buses are purchased throughout the District.

A. Scope and Applicability

Staff is requesting the Board to consider regulatory amendments that affect urban buses and transit agencies. California's standards for urban buses are set forth in title 13, CCR, section 1956.1 and the fleet requirements for urban buses are covered under Fleet Rules for Transit Agencies - Urban Bus Requirements title 13, CCR, sections1956.2 – 1056.4 [to be recodified as 2023.1, per Board action on February 24, 2005].

B. Amend the Statewide Urban Bus Emission Requirements

Staff is presenting three options for the Board to consider regarding the appropriate emission standards for new urban bus engines in 2007 through 2009. The three options are: 1) keep the current new urban bus emissions standards as they are, 2) change the NOx emission standard for 2007 through 2009 model year new urban buses from 0.2 to 1.2 g/bhp-hr, which would align it with the equivalent model year heavy-duty truck NOx emission standard, and 3) require all transit agencies to purchase/lease only alternative fuel buses.

Should the Board favor the first option, to keep the current standards as they are, no regulatory changes are needed.

Should the Board favor the second option, to align the California urban bus engine exhaust emission standards with the current California truck engine exhaust emission standards for the 2007 through 2009 model years, the corresponding urban bus regulations and heavy-duty truck regulations will need to be modified. The truck engine regulations include standards for NOx, PM, carbon monoxide and non-methane hydrocarbons. Currently the standards for urban buses are located in title 13, CCR, section 1956.1. Specifically, the 2007 and later model year standards for urban buses are provided in subsection (a)(12). The heavy-duty engine and vehicle standards are located in title 13, CCR, section 1956.8. Paragraph (a)(12) of section 1956.1 would be deleted. Section 1956.8 would concurrently be modified to include urban buses for the 2007 and later model years. Thus, 2007 and later model year urban bus engines would be certified as heavy-duty engines.

Should the Board decide that all transit agencies statewide should be required to purchase only alternative fuel buses, language would need to be included into the ARB's Fleet Rule for Transit Agencies (section 1958.2) mandating this requirement. The requirement would mandate that 85 percent of a transit agency's annual purchases must be alternative fuel through 2015.

C. Alternative Fuel Path Mandate for All Transit Agencies in the District, Amend Section 1956.2

As discussed earlier, there are currently 17 transit agencies operating in the District that are subject to ARB's Fleet Rule for Transit Agencies (see Table 7). The amendments developed by staff are designed to increase the number of alternative-fueled urban buses operating in the District by requiring all of the transit agencies on the diesel path to change to the alternative-fuel path. This requirement mandates that 85 percent of a transit agency's annual purchases be alternative fuel through 2015. Those six transit agencies on the diesel fuel path must change to the alternative-fuel compliance path effective January 1, 2006. Multiple manufacturers have stated that they intend to have alternative fuel buses available in 2007 that meet a 0.2 g/bhp-hr level for NOx. Therefore, staff believes that this requirement will likely result in the purchase of buses meeting a 0.2 g/bhp-hr NOx level beginning in 2007 by the six transit agencies on the diesel path. However, because of the alignment option outlined above, alternative fuel buses meeting a 1.2 g/bhp-hr NOx level or higher may also be available.

D. Comparison of ARB's Fleet Rule for Transit Agencies and Rule 1192

While SCAQMD's Rule 1192 and ARB's fleet rule for transit agencies, for the most part, affect the same set of vehicles, there are some differences between them. Pasadena's fleet is not subject to ARB's Fleet Rule for Transit Agencies because Pasadena does not operate any urban buses, although it is subject to the new requirements for transit fleet vehicles. Pasadena does, however, have a large enough fleet of buses over 14,000 pounds GVWR that it falls under the authority of Rule 1192. Commerce, which is on the alternative-fuel path under ARB's rule, is not included under Rule 1192 because it has fewer than the fleet minimum of 15 vehicles.

In addition, Rule 1192 only affects vehicles at or above 14,000 pounds GVWR.[8] The Board amended the Fleet Rule for Transit Agencies on February 24, 2005, to expand its scope to all heavy-duty buses and vehicles (greater than 8,500 lbs GVWR) owned or operated by a transit agency. ARB's rule also includes vehicles not included in Rule 1192, such as paratransit and non revenue producing vehicles. As a result, over 35 additional fleets operating in the District

[8] SCAQMD adopted an additional rule, Rule 1191, "Clean On-Road Light- and Medium-Duty Public Fleet Vehicles" which includes requirements for transit fleets operating trucks and buses below 14,000 pounds GVWR.

are subject to ARB's fleet rule. These fleets, consisting primarily of non-urban buses, would not be subject to the alternative-fuel purchase requirement.

VIII. ENGINE TECHNOLOGY AND AVAILABILITY

This section discusses the current and expected availability of engines for urban buses. The information was obtained from engine manufacturers and other published sources. We have omitted information that engine manufacturers have indicated is confidential. A more in-depth discussion is included in the Technical Support Document for this rule. Information on how to access the Technical Support Document for this rule making can be found at the end of this report.

Conventional diesel engines use compression-ignition to generate power, whereas engines that operate on an alternative fuel, such as compressed natural gas (CNG), liquefied natural gas (LNG), and liquid petroleum gas (LPG), are typically spark-ignited. In the heavy-duty engine market, CNG and LNG are the most commonly used alternative fuels. Diesel hybrid-electric, dual fuel and bi-fuel trucks and buses are not considered to be alternative-fueled, although they can have significantly lower emissions than a straight diesel engine. Alternative-fueled engines are typically certified to lower engine exhaust emissions than same model year diesel-fueled engines, although a diesel engine equipped with exhaust aftertreatment may have emissions comparable to an alternative-fuel engine.

A. Current Engine Availability

Manufacturers have been able to meet the current heavy-duty truck engine exhaust standards without the use of aftertreatment technologies, relying instead on modifications to engine and combustion-related components. Engine modifications include such changes as improved electronic controls, improved turbocharger systems, and improved exhaust gas recirculation. Combustion modifications include improved engine timing, improved fuel injection systems, and improved cylinder design.

1. Diesel Fueled Engines

California has no urban bus diesel engine certified to its standards of 0.5 g/bhp-hr NOx and 0.01 g/bhp-hr PM for the 2004 to 2006 model year. California regulations provide for an exception to this standard for the seven transit agencies that applied for and received a so-called "alternative NOx strategy exemption." Engine manufacturers can certify urban bus diesel engines to the standards for 2003 in the 2004 to 2006 model year for sale to those transit agencies only. There is one diesel urban bus engine family, the Caterpillar C9 that is certified to 2.3 g/bhp-hr NOx + NMHC and 0.004 g/bhp-hr PM, via the alternative NOx strategy exemption.

In 2004 California adopted new engine standards of 1.8 g/bhp-hr NOx and 0.01 g/bhp-hr PM for diesel hybrid-electric buses (dHEB), applicable only to the 2004 to 2006 model year. Transit agencies on the diesel path were allowed to apply for permission to purchase these buses, subject to certain requirements. Based on conversations with manufacturers, the staff expects that there will be one or more engine families certified and available for purchase in 2006, thus providing some transit agencies with an additional option for a diesel engine purchase.

2. Alternative Fuel Engines

For urban buses, there are currently two natural gas engine families certified by Cummins, two certified by DDC, and one certified by John Deere.

The outlook for natural gas urban bus engine availability in 2006 is the same as for 2005. However, Deere is currently involved in a demonstration project with U.S. DOE's National Renewable Energy Laboratory (NREL) and the SCAQMD to certify an oxidation catalyst equipped engine for use in urban buses to the 1.2 g/bhp-hr NOx standard. Deere intends to have this product available by October 2005.

B. Mid-term Future Engine Availability (2007 – 2009)

The California diesel urban bus engine particulate emission standard is 0.01 g/bhp-hr, which applies to engines produced after October 1, 2002. Urban buses equipped with alternative fuel engines may certify to optional standards of 0.03, 0.02, or 0.01 g/bhp-hr. However, beginning in 2007, these engines must also meet the particulate standard of 0.01 g/bhp-hr. All alternative fuel urban bus engines currently are certified at a 0.01 g/bhp-hr level. The current NOx standard for urban bus engines is 0.2 g/bhp-hr for 2007 and beyond.

While most manufacturers have released details about their 2007 engines, some have not. Thus the information that follows is necessarily incomplete and includes general information where specifics are unavailable for publication. Staff's evaluation includes both publicly available and confidential information.

1. Diesel Fueled Engines

As mentioned above, manufacturers have indicated that they do not intend to make diesel urban bus engines available that meet the 0.2 g/bhp-hr NOx level until 2010. It is also unlikely that any dHEB would be able to meet this standard.

2. Alternative Fuel Engines

Two engine manufacturers, Cummins, through its joint partnership with Westport Innovations, Cummins Westport Inc.; and John Deere plan to offer alternative fuel urban buses that meet the 2007 emissions standards of 0.2 g/bhp-hr NOx

and 0.01 g/bhp-hr PM. John Deere intends to produce a 250-325 horsepower, 9 liter natural gas engine. Cummins Westport Inc. has partnered with NREL to develop a lower emission version of the L Gas Plus (8.9 L) natural gas engine. This engine is scheduled to be commercially available in early-2007. The SCAQMD is also currently sponsoring a project with Cummins to commercialize the C Gas Plus engine (8.2 L) to 0.2 g/bhp-hr NOx by 2007.

C. Long Term Engine Availability (2010 and beyond)

In 2004, U.S. EPA published its second review outlining the status and progress of engine and vehicle technology toward meeting the federal 2007 standards for heavy-duty diesel vehicles (U.S. EPA 2004). In its report, U.S. EPA concluded that manufacturers will meet the 2007 and 2010 standards in a two step process and that "engine manufacturers' 2007 compliance plans are a building block for the technology package they plan to use to meet the 0.20 g/bhp-hr NOx standard in 2010." Thus, it is likely that selective catalytic reduction (SCR) and NOx adsorbers for NOx reduction, along with further improvements in engine technology, such as Clean Diesel Combustion, will play a large role for diesel technology in 2010 and beyond. Additional information on long-term engine availability is found in the Technical Support Document for this rule.

IX. END-USER EXPERIENCE: ALTERNATIVE FUELS

In March 2005, ARB staff surveyed maintenance managers of all 11 transit agencies in the District that operate all or a portion of their fleets on alternative fuel and that are subject to the ARB's Fleet Rule for Transit Agencies. The survey collected information on the experiences transit agencies have had to date with buses operating on alternative fuel. The cost data collected by this survey was used in the cost analysis and is discussed in Appendix D. Electric buses were not included in this survey.

A. Description of the Survey

Questions 1 through 4 were designed to elicit specific information on the number of buses in the fleet by fuel type, how long various fuels had been used, and whether the ability existed to re-fuel buses in the field. Questions 5 through 9 dealt with issues of maintenance and maintenance facilities for alternative fuel vehicles and additional staff training that might be needed to deal with maintenance of these vehicles. Question 10 was open-ended, asking for any additional comments the respondent wanted to make in connection with topics mentioned or not mentioned in the survey. A copy of the survey can be found in Appendix B.

B. End-User Experience with Alternative Fuels

Transit agencies rely mainly on three types of alternative fuels to power their buses: CNG, propane, and LNG. Many transit agencies will be purchasing gasoline HEBs that are arriving in 2005 through 2007. Since the gasoline HEB is a new technology, there was no in-use experience available at the time of the survey.

1. Propane

Only one transit agency in the survey was using propane or liquefied petroleum gas (LPG) to fuel their buses. Of their 189 buses, only 45 met the definition of urban bus. The transit agency contracts out for fuel and therefore had no experience with the maintenance or cost of the fueling equipment. The transit agency did not express any concerns or issues and plans to purchase over 50 more buses in the next 3 years.

2. Compressed and Liquefied Natural Gas (CNG/LNG)

In-use experience with alternative fuels, primarily CNG, was initiated in the mid-1990's. Of those surveyed, experience with CNG ranged from 3 to 11 years and LNG five years.

a. Fueling

Nine of the eleven transit agencies maintain their own fueling stations on site, of which four are expanding their fueling sites. Fueling times are based on the equipment available. On-site operations can "quick fill" a bus in 8 to 15 minutes, or choose to slow fill a bus over night (6 hours). One facility uses an off-site station operated by the city, where fueling can take up to an hour per bus. The operator uses this time to clean the vehicles while waiting for the vehicle to fuel. Another facility contracts to private operations to provide their fuel.

Of the nine transit agencies with fueling stations, four reported that fuel storage was more complex and expensive with alternative fuel. One transit agency reported that CNG storage took six times the space as diesel, but one transit agency reported that fuel storage for diesel and CNG were about the same.

b. Maintenance Shop Modifications for Alternative Fuel Vehicles

Transit agencies must upgrade their maintenance facilities when working with gaseous or "lighter than air" fuels to meet fire code and safety regulations. These facilities require modification of the structure to prevent "pockets" where gases can pool, installation of sensors to detect buildup of gas and fire alarm systems, and up-grading air circulation systems. Specialized tools are also required for working on alternative fuel vehicles. Facilities that do not modify repair shops

must work on alternative fuel vehicles outside in the open air or send them to other repair facilities. Eight of the 11 agencies have modified their facilities; the other three contract out their maintenance work.

c. Maintenance and Down Time for Alternative Fuel Vehicles

Seven of the 11 transit agencies reported increased maintenance time and downtime with alternate fuels (six with CNG; one with LNG). Two transit agencies reported 15 to 20 percent increases in maintenance time. One transit agency stated that by increasing the maintenance schedules, downtime was close to what they experienced with diesel buses. Two transit agencies reported no difference between CNG and diesel. One transit agency experienced significant breakdowns with CNG buses. Two transit agencies stated that CNG technology has improved over the years to be equivalent to diesel buses.

As a result of increased maintenance, two transit agencies stated that they maintain a higher spare parts and bus ratio. Four transit agencies reported that parts for CNG fueled buses were more expensive.

d. Training Staff for Alternative Fuel Vehicles:

Nine of the 11 transit agencies that use alternative-fuel buses said staff must receive special training to operate and/or service these vehicles. Mechanics must be certified every 3 to 5 years. Drivers require specific training on alarms and manual shut off systems. One transit agency that contracts out for the work requires a demonstration of experience with CNG. Five of the 11 transit agencies reported ongoing training annually.

3. Conclusion

Strong opinions exist regarding the use of alternative fuels. For those transit agencies that have embraced the technology, they consider any increased maintenance or costs as marginal or a part of doing business and have adjusted their practices to meet any operational changes. Engine reliability issues appeared to be focused on older engine models, where the newer models are more reliable. For fueling and maintenance facilities, all the transit agencies consider diesel easier and less expensive.

X. REGULATORY ALTERNATIVES

Staff has provided three options for the Board's consideration regarding potentially amending the statewide urban bus emission requirement. Therefore staff has not evaluated any additional alternatives for the Board to consider.

With regard to the District specific fleet rule staff evaluated an alternative to not require transit agencies in the District to follow the follow the alternative-fuel path.

This alternative, in conjunction with Board adoption of statewide alignment of the urban bus and heavy-duty truck emission standards, would allow transit agencies on the diesel path, including the six in the District, to purchase diesel engines in 2007 through 2009. If the SCAQMD Rule 1192 were to be invalidated, the six transit agencies on the diesel path located in the District would be able to purchase diesel urban buses. There is some benefit associated with this alternative because of the turnover of older diesel engines to new, cleaner engines. However, this alternative would not provide the additional benefit in the District of mandating the purchase of alternative fuel buses for the six transit agencies currently on the diesel fuel path. It is worth noting that staff expects that without Board adoption of an alternative fuel requirement in the District, five of the six agencies on the diesel path will likely purchase alternative fuel buses, regardless. However, these agencies would have the ability to purchase diesel buses, and therefore, staff's analysis assumes that, without an alternative fuel mandate in the District, these transit agencies will eventually purchase diesel buses if available.

It should also be noted that this alternative is only viable if the Board chooses to also adopt the statewide alignment of the urban bus emission standards with the heavy-duty truck emission standards. If the Board chooses to leave the state urban bus standards as they are, or if the Board chooses to require all transit agencies statewide to follow the alternative fuel path, then Board adoption of a specific alternative fuel purchase requirement in the District is not necessary.

XI. ECONOMIC IMPACT

Staff is presenting to the Board for its consideration a requirement that transit agencies operating in the jurisdiction of the SCAQMD be mandated to follow the alternative-fuel compliance path, under section 2023.1, title 13, CCR. Six transit agencies operating in the District are currently on the diesel compliance path, and therefore would be required to change to the alternative-fuel compliance path.

In addition, staff is presenting to the Board for its consideration amendments that would modify the urban bus new engine standards or require the use of alternative fuel buses statewide.

Staff believes that the regulatory amendments presented here for Board consideration would cause no noticeably adverse impacts in California employment, business status, or competitiveness.

A. Legal Requirement

Sections 11346.3 and 11346.5 of the Government Code require state agencies proposing to adopt or amend any administrative regulation to assess the

potential for adverse economic impact on California business enterprises and individuals. The assessment shall include consideration of the impact of the proposed regulation on California jobs; on business expansion, elimination, or creation; and on the ability of California businesses to compete in other states.

State agencies are also required to estimate the cost or savings to any state or local agency or school district in accordance with instructions adopted by the Department of Finance. This estimate is to include nondiscretionary costs or savings to local agencies, and the costs or savings in federal funding to the state.

B. Affected Businesses

Businesses that may be affected as a result of the regulatory amendments presented in this report include manufacturers of diesel urban bus engines and alternative fuel technologies such as CNG, LNG, dual-fuel and hybrid-electric urban bus engines, manufacturers of urban buses, alternative fuel providers, and distributors and installers of bus engines. Most manufacturers of buses, trucks, and engines are located outside of California. One manufacturer of hybrid-electric systems is located in California. There is at least one company in California that specializes in conversions of standard diesel buses to alternative fuel buses.

C. Potential Impact on Businesses

The statewide alignment option should have a positive impact on engine and bus manufacturers by allowing them to certify and sell their products in California in 2007 through 2009. This regulatory modification does not impose a mandate but would open up the market for diesel and diesel hybrid-electric urban buses, benefitting engine manufacturers, bus manufacturers, and system integrators.

The statewide alternative fuel mandate option could impact engine manufacturers that only produce diesel engines. These manufacturers would need to produce alternative fuel buses or risk losing urban bus engine sales in California. Currently, only one manufacturer that certifies engines for use in urban buses, Caterpillar, does not produce alternative fuel engines for urban buses. Caterpillar is headquartered outside of California.

Should the Board elect to require the alternative fuel path for all transit agencies in the District the amendment is expected to have a positive impact on the alternative fuel engine and bus manufacturers. Any negative effect on the sales volume of diesel engines would be negligible.

D. Potential Impact on Business Competitiveness

The regulatory options presented in this report would have no significant impact on the ability of California urban bus engine and vehicle manufacturers to

compete with manufacturers of similar products in other states. This is because all manufacturers that produce urban bus engines and vehicles for sale in California are subject to the emission requirement regardless of their location. Furthermore, all of the engine manufacturers, and most of the vehicle manufacturers, are located outside of California.

E. Potential Impact on Employment

The statewide alignment option is expected to benefit manufacturers, who will be able to produce and sell diesel urban buses outside of the District in 2007 through 2009.

The statewide alternative fuel mandate option could impact engine manufacturers that only produce diesel engines. These manufacturers would need to produce alternative fuel buses or risk losing urban bus engine sales in California. Currently, only one manufacturer that certifies engines for use in urban buses, Caterpillar, does not produce alternative fuel engines for urban buses. Caterpillar is headquartered outside of California.

Should the Board elect to require the alternative fuel path for all transit agencies in the District there may be some impact on employment for those transit agencies currently following the diesel compliance path in the District, however the impact is expected to be small. Five of the six agencies currently on the diesel path are already intending to purchase alternative-fuel vehicles. In addition, any added costs are expected to be recovered through appropriate fare increases.

F. Potential Impact on Business Creation, Elimination, or Expansion

The regulatory options presented in this report are expected to have no impact on business creation, elimination or expansion.

G. Estimated Costs to Local Transit Agencies

This section discusses the costs that transit agencies may occur as a result of the regulatory options presented in this report.

1. Cost Estimates for Statewide Alignment

Staff has concluded that there are no significant adverse fiscal impacts on any state or local agencies. The statewide alignment option should have a positive impact on transit agencies outside the District by allowing the purchase of new diesel buses in California in 2007 through 2009 that are typically cheaper than comparable alternative-fuel buses. Therefore this option should result in a cost savings to a transit agency.

2. Cost Estimates Associated With the Alternative Fuel Path Mandate for All Transit Agencies, Statewide

This requirement would impact the 48 transit agencies currently on the diesel path. These agencies will be required to purchase or lease alternative fuel buses in place of diesel buses. The higher cost of alternative fuel buses along with costs associated with infrastructure modifications may result in a decreased budget for other operations.

3. Cost Estimates Associated With the Alternative Fuel Path Mandate for All Transit Agencies in the District

This requirement would have some impact on the six transit agencies operating in the District that are currently following the diesel fuel compliance path. These agencies will be required to purchase or lease alternative fuel buses in place of diesel buses. The higher cost of alternative fuel buses may result in a decreased budget for other operations. However, since five of the six affected transit agencies are already planning to purchase alternative fuel buses, the impact of this amendment will be minimal.

XII. ENVIRONMENTAL IMPACTS AND COST-EFFECTIVENESS

Described in this section are the air quality benefits and the cost-effectiveness of the regulatory options staff is requesting the Board to consider.

A. Benefits within the District and Statewide

The implementation of California's existing new engine standards and urban bus fleet requirements has resulted in a drastic decrease in the state and local fleet average NOx levels. On January 1, 2001, the statewide and the District median urban bus fleet average NOx emissions were 5.16 and 5.28 g/bhp-hr, respectively. As of January 1, 2005, the statewide and the District median urban bus fleet average NOx emissions have dropped to 3.63 and 3.53 g/bhp-hr, statewide and in the District, respectively. This represents a decrease in the statewide and District urban bus fleet average NOx emissions of 30% and 33%, respectively.

1. Impacts on the Air Quality Management Plan

Staff's analysis shows that the weighted average NOx fleet levels of agencies on the diesel-fuel compliance path are much higher (well over 1.0 g/bhp-hr higher) than those on the alternative-fuel compliance path (Table 11). Therefore, there has been an emission benefit associated with having fleets comply using the alternative-fuel path.

Table 11. Diesel Versus Alternative Fuel Path NOx Fleet Averages for Agencies in the District (g/bhp-hr)

Rule	Path	Ave.
1192	Alt. Fuel	3.01
	Diesel	4.26
ARB (Includes more Transit Agencies)	Alt. Fuel	3.14
	Diesel	4.26

2. Emission Benefits

The emission benefits of the policy decisions staff is requesting be considered by the Board are discussed in this section.

When the emission standards for new urban bus engines were adopted in 2000, staff believed diesel engines meeting these standards would be available for purchase. For NOx, the standard dropped from 2.4 g/bhp-hr HC+NOx (about 2.2 g/bhp-hr NOx) to 0.5 g/bhp-hr NOx in 2004-2006, and to 0.2 g/bhp-hr NOx in 2007 and beyond. As discussed earlier, engine manufacturers are not offering for sale diesel urban buses that meet the 2004-2006 standards, and will not offer diesel engines that meet the 0.2 g/bhp-hr standard until 2010. Thus no diesel engines have been available for purchase, and will not be available until 2010. As a result, little or no fleet turnover has occurred for diesel path transit agencies. (Seven agencies received an exemption to buy higher emitting diesel engines through 2006, and have been doing so. These agencies took other steps to reduce their fleet average NOx emissions).

Figures 1 and 2 show the urban transit emissions of diesel path agencies[9] staff expected as a result of the original rule, and an updated analysis that reflects the unavailability of diesel engines for purchase. Emissions are higher than had been expected, and will remain so even after purchases of diesel engines resumes in 2010.

[9] The following four figures show emissions for only those transit agencies on the diesel path. Staff assumes that transit agencies on the alternative fuel path will continue to purchase alternative fuel engines.

Staff has also estimated the emissions of the diesel path agencies should the board decide to change the statewide requirements and/or require the six SCAQMD diesel path agencies to switch to the alternative fuel path.

Figure 1. NOx Emissions – Original Estimate and Current Estimate

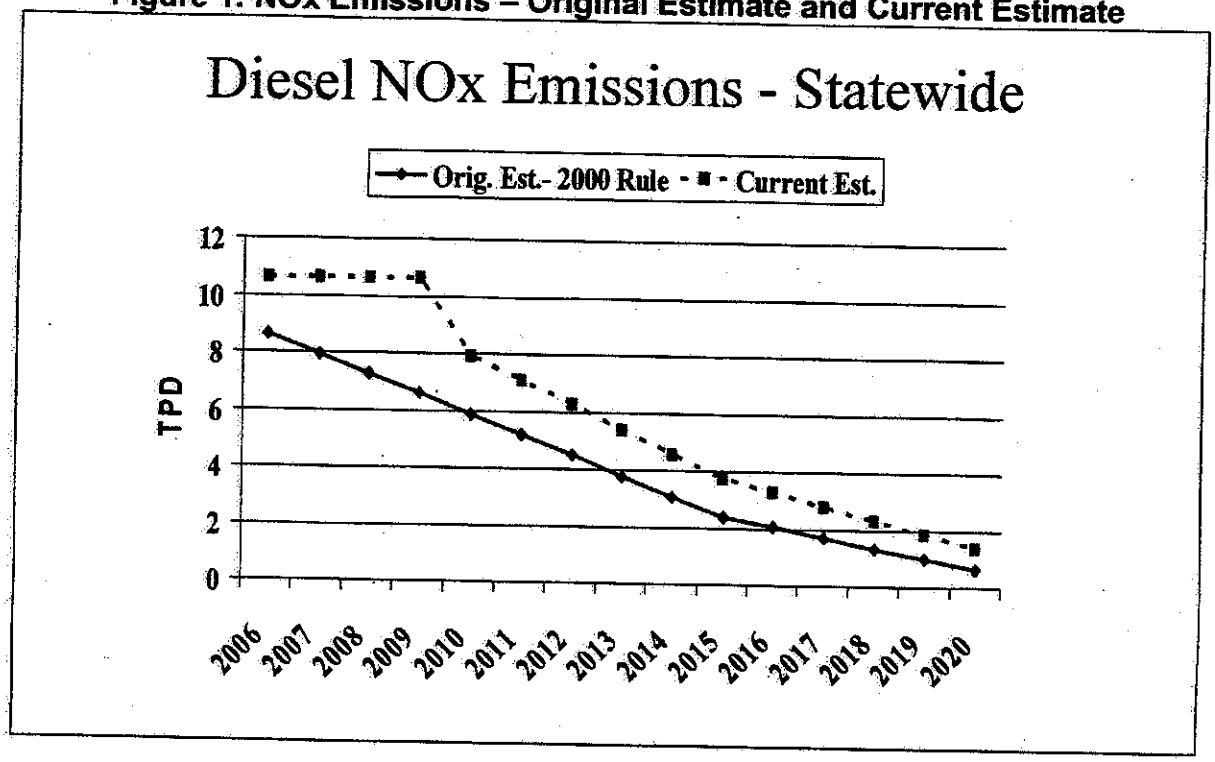
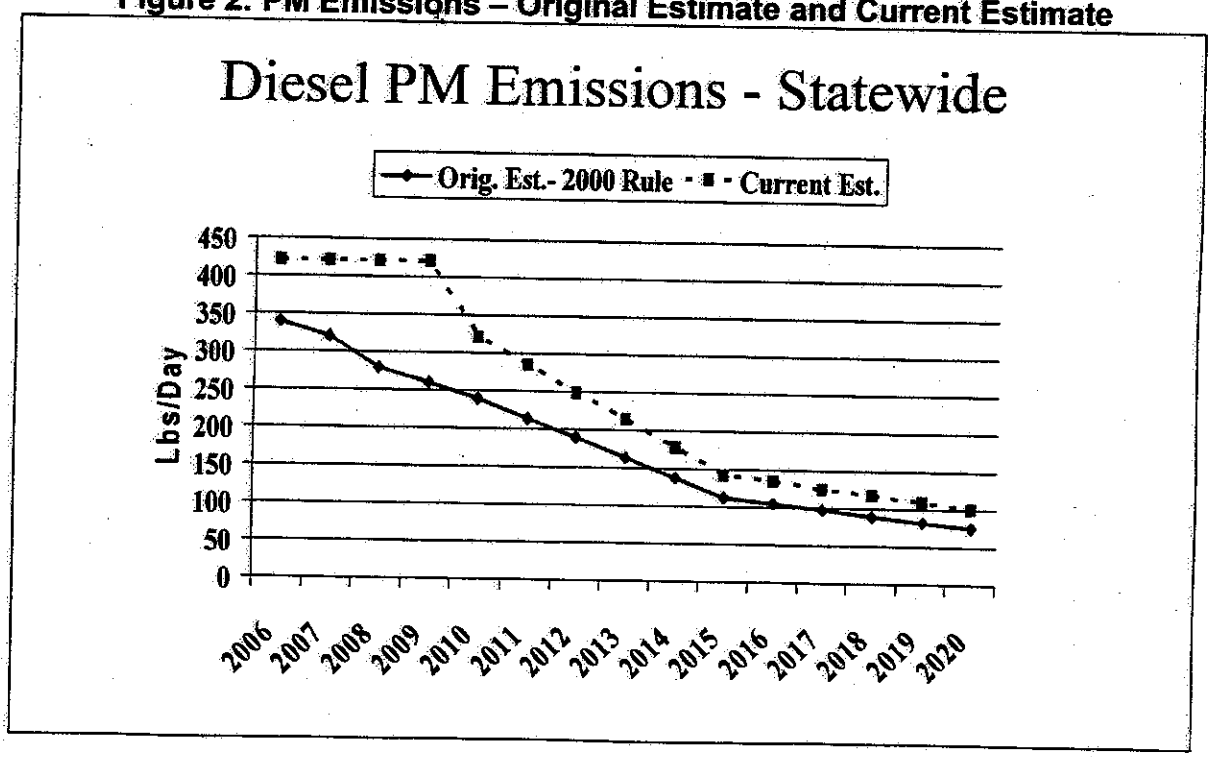


Figure 2. PM Emissions – Original Estimate and Current Estimate



a. Statewide Alignment

This option relaxes the NOx standard in 2007-2009 to align with the current diesel trucks standard. This will result in the availability of diesel bus engines in 2007-2009 that emit at 1.2 g/bhp-hr NOx. As a result purchases of diesel bus engines will resume in 2007, replacing older, dirtier engines. Emissions will be lower by up to about 1.6 tpd NOx and 80 pounds per day PM in 2009, compared to retaining the current 0.2 g/bhp-hr NOx standard.

In determining the emissions resulting if the Board does not change the current emission standard, staff assumed that funds that would have been used to purchase diesel buses in 2007-2009, had diesel engines been available, will be saved and deferred purchases will be made, in addition to normal purchases, beginning in 2010. Thus all new purchases of diesel buses will comply with the 0.2 g/bhp-hr NOx standard, whereas if the standards are aligned in 2007, some buses purchased in 2007-2009 will emit 1.2 g/bhp-hr. As a result, the no change option results in greater NOx emission reductions beginning in 2012 (by up to about 1.2 tpd NOx). Staff estimates that by 2025, emissions will be the same for both scenarios because the 1.2 g/bhp-hr NOx engines from the alignment option have been retired. Figures 3 and 4 illustrate these findings.

b. Alternative Fuel Path Mandate for All Transit Agencies, Statewide

Staff analyzed the emissions benefit of requiring diesel path transit agencies statewide to follow the alternative fuel path. This option would result in slightly lower tons per day NOx emissions than the option to align the standards. Emissions will be lower by up to about 1.0 tpd NOx 2009. This occurs because transit agencies would be purchasing buses that meet a 0.2 g/bhp-hr NOx standard beginning in 2007, as opposed to a 1.2 g/bhp-hr NOx level under the alignment option. This emissions benefit will continue, past 2020, until the entire fleet of 1.2 g/bhp-hr engines are turned over to new engines meeting the 0.2 g/bhp-hr level. However, should the Board decide to require that all transit agencies follow the alternative fuel path, some agencies currently on the diesel path may defer replacing their diesel engines while they prepare fueling infrastructure. If this occurs, there would be a short-term emission disbenefit to this option as compared to the alignment option until these engines are replaced.

In the short-term this option would also result in lower emissions than if the Board decides to retain the current urban bus standards. Emissions will be lower by up to about 2.5 tpd NOx and 80 pounds per day PM in 2009. This occurs because if the current standards are retained, diesel path agencies would defer purchasing new buses until 2010, thereby keeping older, more polluting buses in their fleet.

However, after 2010, once the engines whose replacement was deferred are replaced, the emissions associated with these two options will be similar.

Figure 3. NOx Emissions – Comparison of Options

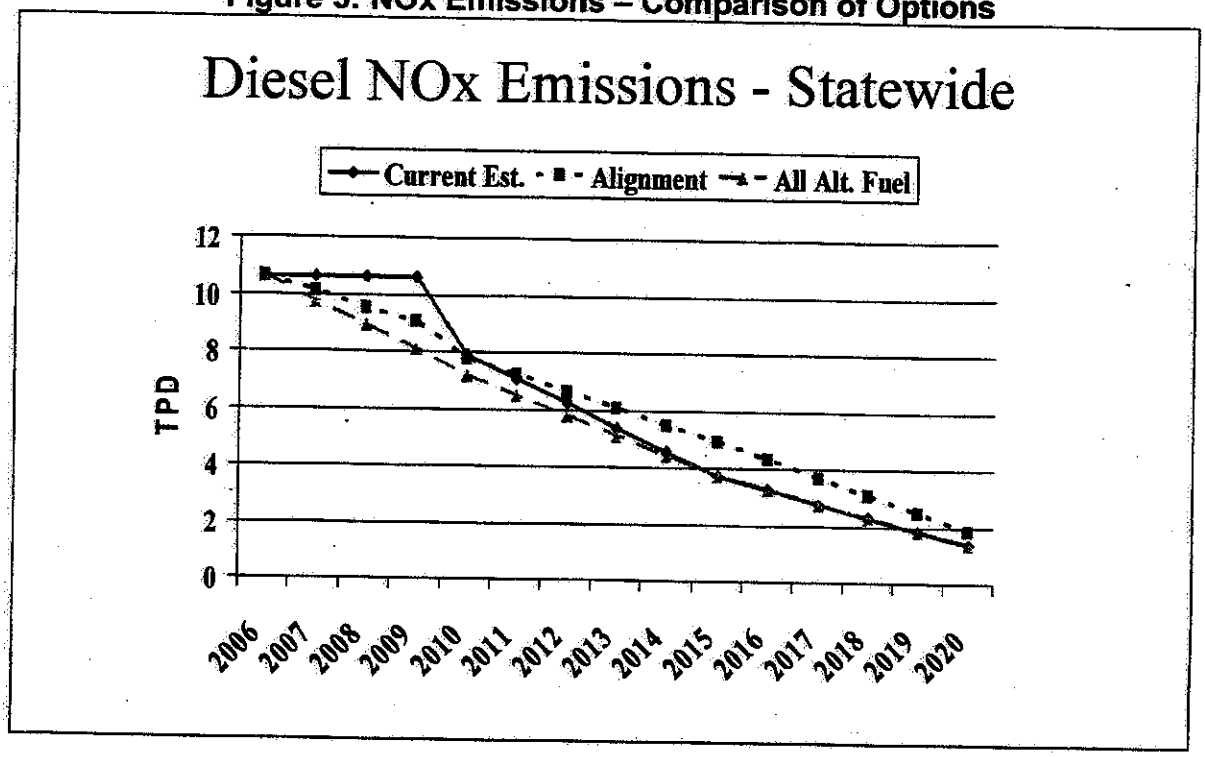
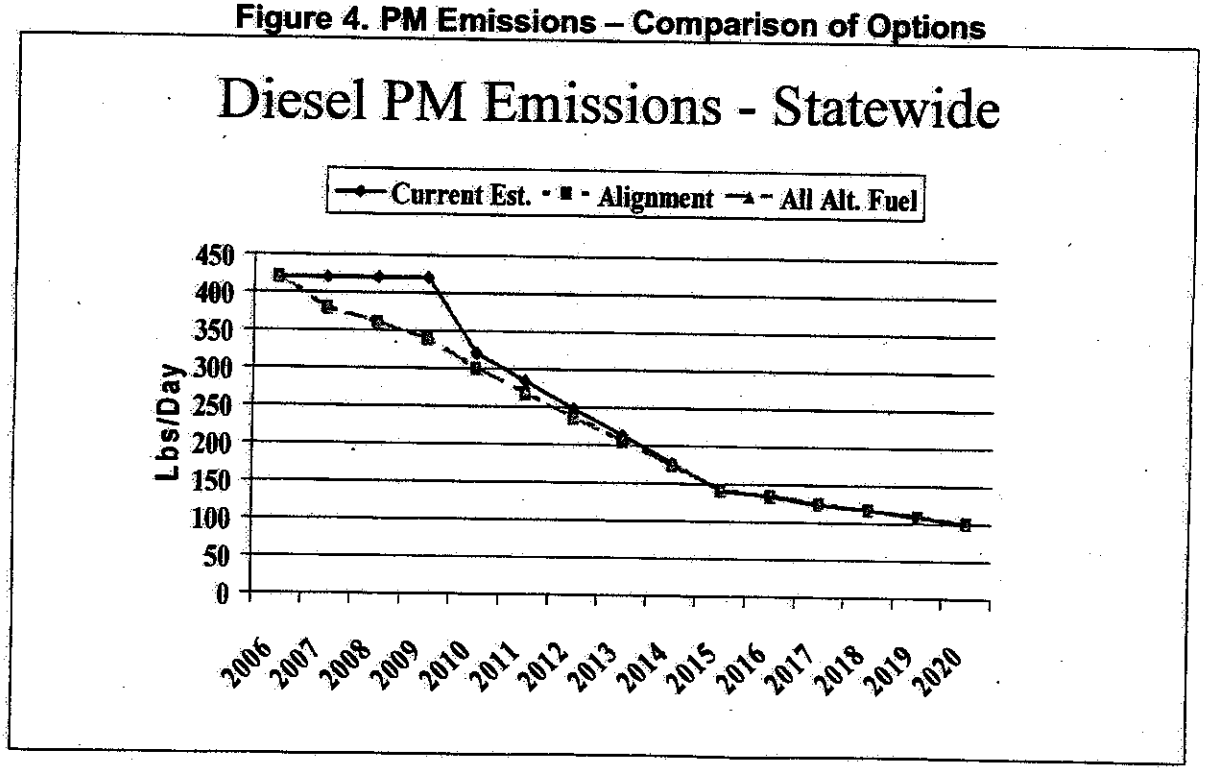


Figure 4. PM Emissions – Comparison of Options



c. Alternative Fuel Path Mandate for All Transit Agencies in the District

Small emission reductions of NOx will be achieved if the six transit agencies on the diesel path purchase cleaner, alternative fuel buses beginning in 2006 (Table 12). This assumes that the District cannot implement its current Rule 1192, and the six agencies would have switched to purchasing dirtier diesels in the absence of an ARB rule forcing them onto the alternative fuel path. If the District rule can be implemented, as now appears to be the case, no additional emission reductions would be achieved from adopting this requirement.

Several manufacturers have stated that they intend to have alternative fuel buses available in 2007 that meet a 0.2 g/bhp-hr level for NOx. Staff believes it is very likely that transit agencies on the alternative fuel path will purchase these engines. Therefore, staff's emission analysis assumed that the District alternative fuel requirement will result in the purchase of buses meeting a 0.2 g/bhp-hr NOx level beginning in 2007 by the six transit agencies currently on the diesel path. The benefits presented here are the incremental benefits of requiring the purchase of alternative fuel buses, assumed to meet a 0.2 g/bhp-hr NOx level, instead of purchasing diesel engines meeting 1.2 g/bhp-hr NOx level (as would be allowed with alignment and no District rule were in place) for the six transit agencies.

Table 12. NOx Emission Benefits (tpd) in the District - Mandatory Alternative Fuel Path

Year	Baseline	Alt. Fuel Mandate	Reduction
2010	7.37	7.36	0.01*
2015	5.86	5.84	0.02*
2020	3.34	3.34	0

*If the Board adopts the statewide alignment option, and if the six transit agencies chose to purchase alternative fuel buses that meet the 1.2 g/bhp-hr NOx level during 2007 through 2009, there would be no benefit associated with purchasing alternative fuel buses over diesel buses. Therefore, actual benefits could range between zero and the tons per day shown here.

Requiring transit agencies in the District to switch to the alternative fuel path will result in NOx benefits, but will not result in any change in PM emissions. A PM emission standard of 0.01 g/bhp-hr for diesel urban bus engines has been in effect in California for engines produced after October 1, 2002, all current alternative fuel urban bus engines are certified at a 0.01 g/bhp-hr level.

B. Cost and Cost-Effectiveness

The following section discusses the cost-effectiveness associated with each decision the Board may consider.

1. Amend the Statewide Urban Bus Emission Requirements

Staff is proposing three options for the Board to consider. There is no cost associated with the option to keep the emissions standards as they are. The other two options have been analyzed separately, and presented below.

a. Statewide Alignment

Staff has determined there is no additional cost of the option to revise the new urban bus engine emission standards to align with the current truck standards. This option will allow purchase of diesel engines by diesel path agencies in 2007-2009, and may reduce operating and maintenance costs by replacing older engines. If the current standards are retained, diesel path agencies are expected to defer purchases until 2010 and beyond. These engines will cost more than the engines that could be purchased in 2007-2009 if the standards are aligned.

b. Alternative Fuel Path Mandate for All Transit Agencies, Statewide

This option would mandate that at least 85 percent of a transit agency's annual purchases be alternative fuel through 2015. This requirement should have no cost impact on those transit agencies already on the alternative fuel path. However, transit agencies on the diesel path will be required to switch to alternative fuel. The additional cost to these transit agencies would include the incremental cost increase of alternative fuel bus compared to a diesel bus as well as the cost to upgrade infrastructure.

Staff estimated the incremental cost of this option by determining the difference between the capital and operations and maintenance costs of diesel urban buses and alternative-fuel urban buses. Staff estimates the total per bus cost increase to be $76,517. A discussion of the cost breakdown follows.

The FTA provides 80%-83% of the capital cost of new buses, so transit agencies see only a portion of the per-bus additional capital cost. As a conservative estimate, staff assumed a 20 percent transit agency share, although the cost to society is the full incremental cost difference. Thus, staff estimates a typical incremental purchase cost of for a CNG bus is $10,000 funded by the local transit agency.

If a transit agency does not already have an alternative fuel fueling facility, this option may make it necessary for the transit agency to upgrade its fueling facility

to handle alternative fuel. Staff assumed that half of the natural gas fueling facilities constructed would be L/CNG stations (gasification) at a cost of $25,000 per bus and that half would be CNG (compression) stations at a cost of $36,712 per bus. Upgrades to bus maintenance facilities for handling CNG buses are also required at the cost of $23,870 per bus.

Staff believes that maintenance costs for natural gas buses are likely to be somewhat higher than for diesel buses. Staff estimates the extra maintenance costs to be about $4,300 per year. In addition, there are cost associated with the maintenance of fueling facilities at a cost of $2,245 per bus per year.

Labor costs for natural gas buses and gasoline HEBs are expected to increase modestly over typical diesel bus costs. Initial training costs, and ongoing training associated with regular recertification of technicians for natural gas maintenance, are primarily responsible for expected minor increases in labor costs of about $18 per year per bus.

The estimated incremental bus cost does not include any costs associated with the difference between the cost of alternative fuel versus diesel fuel. Fuel cost differences are economically highly uncertain over the life of the regulation. Although at present natural gas is less expensive than diesel, it is impossible to be certain about fossil-fuel market conditions between now and 2020. To explore the sensitivity of fuel cost, staff analyzed both a lower and higher natural gas fuel cost relative to diesel. The result is that purchase incremental per bus costs could range from $28,227 (low cost) to $107,141 (high cost) per bus.

In order to determine cost-effectiveness, ARB took the typical total incremental cost of the buses to be purchased, with FTA funding, and divided by the total NOx emission reductions for the life of the regulation. These values were based on NOx emission reductions only. The expected cost-effectiveness ratio is $119,030 per ton ($59.51 per pound).

2. Alternative Fuel Path Mandate for All Transit Agencies in the District

As with the option to mandate alternative fuel statewide, for the option to require the District agencies to switch to the alternative fuel path, staff based the cost-effectiveness analysis on estimates of expected emissions reductions and of costs for implementation of this option.

Staff estimated the incremental cost of this option by determining the difference between the capital and operations and maintenance costs of diesel urban buses and alternative-fuel urban buses. Staff estimates the total per bus cost increase to be $26,745. This cost is different than the per bus incremental cost given above for the statewide alternative fuel mandate for the following reasons.

Staff surveyed the six transit fleets on the diesel path and requested their purchasing plans for 2005 to 2009. The results showed that a majority of the buses that would be purchased would be gasoline HEBs. Staff estimates that gasoline HEBs have an incremental purchase cost of $24,546.

In addition, staff expects that the six transit providers affected by this option will be able to obtain fuel from facilities that are already, or will soon be, available, based on staff's survey of transit agencies. Most transit agencies that plan to purchase CNG buses have already either built a fueling station or have one planned and financed. In addition, transit agencies that are purchasing gasoline HEBs will use existing facilities. Therefore, this analysis does not include capital costs of new fueling facilities.

In order to determine cost-effectiveness, ARB took the typical incremental cost of the buses to be purchased, with FTA funding, and divided by the total NOx emission reductions for the life of the regulation. These values were based on NOx emission reductions only. The expected cost-effectiveness ratio is $67,837 per ton ($33.92 per pound)[10]

C. Toxics from Diesel and Alternative Fueled Engines

Historically diesel engines were perceived as having higher PM emissions and other deleterious compounds known to have adverse health effects than similar natural gas engines. Natural gas engines were typically thought of as "low emission", as emitting less PM and NOx, than their diesel counterparts (Ahlvik et al 2000; Clark et al 1995; Clark et al 1999; Ayala et al 2002). However, with the advent of aftertreatment technologies such as diesel oxidation catalysts and diesel particulate filters, and the fact that vehicle exhaust is a complex composition of many compounds, not just PM and NOx, the assumption that natural gas engines are inherently less polluting than diesel equipped with aftertreatment was called into question.

To this end the ARB led a multi-agency research effort to compare emissions from diesel and natural gas engines. The study evaluated natural gas (NG) and diesel bus engines with and without exhaust aftertreatment. Summarized in Table 13 is a comparison of emissions based on this study. For NOx, natural gas engines are cleaner until 2010 (assuming a 0.2 g/bhp-hr NOx engine is certified in 2007). Beginning in 2002, diesel bus engines were equipped with a particulate filter, and natural gas engines utilized an oxidation catalyst. As a result, PM emissions are equivalent. Since both the oxidation catalyst and the diesel particulate filter oxidize most toxic compounds, natural gas bus engines since 2002 have roughly equivalent toxic emissions as diesel engines.

[10] Actual cost-effectiveness values could be higher if the transit agencies choose to purchase alternative fuel buses during 2007 through 2009 with NOx emissions higher than 0.2 g/bhp-hr thereby decreasing the emissions benefits.

Table 13. Emission Comparison - Diesel Bus vs Natural Gas Bus

Model Year Bus	Bus Emission Standards (g/bhp-hr)		Natural Gas, Compared to Diesel, Is Typically:		
	NOx	PM	NOx	PM	Other Toxics
Mid-1990s to 2002 (diesel w/o filter and NG w/o catalyst)	4	0.05	50% cleaner	40% cleaner	Varies
Today (2003 - 2006) (diesel w/ filter and NG w/o catalyst	~2.2[1]	0.01	25% cleaner	Same	Same
2007 (diesel w/ filter and NG w/ catalyst	1.2	0.01	80% cleaner[2]	Same	Same
2010 (diesel w/ filter + absorber and NG w/ 3-way catalyst	0.2	0.01	Same	Same	Same

1) NOx standard applies to alternative fuel engines and diesel engines available to seven transit agencies that provided NOx offsets. In 2004 through 2006, for transit agencies without an offset plan, the bus NOx emission standard is 0.5 g/bhp-hr - no diesel bus engines have been certified to this level.

2) Several natural gas bus engines are expected to comply with the 2010 0.2 g/bhp-hr NOx standard by 2007, in which case they would be about 80% cleaner. For other natural gas bus engines the NOx emissions will likely be the same as diesel.

XIII. ISSUES

Over the course of development of the regulatory options presented in this report, staff has met many times with various stakeholders and received written and verbal comments. Although staff has considered each comment, not all issues could be resolved. The following is a discussion of major outstanding issues.

A. Statewide Alignment

Staff has included an option for Board consideration to change the NOx emission standard for new urban bus engines from it current 0.2 g/bhp-hr to align it with the California new diesel truck engine standard of 1.2 g/bhp-hr. The benefit of this change is diesel engines will become available for purchase. Without this change diesel engines will be unavailable until 2010. Changing the standard will allow new diesel engine purchases and retirement of older, higher emitting engines, during these years, thus agencies on the diesel path favor this option.

During the public process, staff received comments from environmentalists and natural gas providers that ARB should keep the current standard. They stated a relaxation of the standard would send a signal that California did not want or value natural gas engines. As a result investment in developing a 0.2 g/bhp-hr CNG engine for 2007 might be in jeopardy. Their position also seemed to be based on a belief that in the absence of new diesel engines being available for purchase in 2007-09, transit agencies on the diesel path would choose to purchase natural gas engines, resulting in greater emission reductions than if the Board aligned the standards. However, as discussed previously, information provided to staff by transit agencies on the diesel path indicates they are prepared to forgo purchases of new buses until 2010 if the only bus engine available is alternative fueled. In 2010 diesel engines meeting the current standard will be available.

Regarding whether investment in low emission natural gas engine development will continue, staff points out that transit districts on the alternative fuel path account for nearly 60% of all California transit buses, and they will provide a continuing demand for natural gas and other alternative fuel engines through at least 2015.

B. Alternative Fuel Path Mandate for All Transit Agencies, Statewide

Another option for the Board's consideration is to require all transit agencies, including those currently on the diesel path, to purchase alternative fuel buses. Transit agencies currently on the diesel path, particularly those in the Bay Area, strongly oppose this option because they believe the use of alternative fuel buses results in less reliable service, and diesel buses that are as clean as alternative fuel buses will be available in 2010 for purchase. They also point out they were

allowed to make a choice of fuel type when the ARB Fleet Rule for Transit Agencies was adopted in 2000, and they should not be forced to change now at great cost and disruption, for little air quality benefit. Smaller transit agencies in less urbanized areas have expressed concern about the cost of alternative fuel engines, and the lack of alternative fuel availability. Proponents of alternative fuel strongly favor this approach because it creates a growing demand for their products and a strong incentive to develop new engines.

C. Alternative Fuel Path Mandate for All Transit Agencies in the District

The Board is also being asked to consider requiring the six transit agencies in the SCAQMD to switch from the diesel path to the alternative fuel path. This action would assure that the goal of District Rule 1192 is implemented regardless of the outcome of pending court actions.

Staff received comments from transit agencies that the ARB rules should be uniform statewide. Commenters suggested that requiring transit agencies in the SCAQMD to purchase alternative fuel is not fuel neutral, a policy they suggest the state has and should continue to practice. They also suggested that purchasing alternative fuel buses is not the most cost effective expenditure of transit district funds.

Staff points to legislation authorizing the district to implement rules requiring the use of alternative fuel vehicles as an important consideration. The effect of ARB adoption of a unique fleet requirement for the transit agencies in the District has the effect of addressing the Court's decision while remaining true to the Legislature's intent. Staff acknowledges that at this point in the court process, it appears that the District has the authority to implement Rule 1192 because the affected agencies are all local governments and the court has ruled that the District may impose requirements that affect local government purchasing choices. Although ARB adoption would remove any uncertainty regarding the final outcome of legal action, it does bring with it a new uncertainty regarding obtaining a waiver of federal preemption from U.S. EPA.

Regarding fuel neutral policy, it is true that most ARB regulations are performance based and do not favor one fuel over another. There are exceptions, however. In the past special light-duty vehicle emission standards were adopted for diesel engines. The ZEV mandate clearly favors electricity and hydrogen over petroleum fuels. Recommendations in the AB 2076 "Reducing Petroleum Dependency" report to the legislature suggest greater use of alternative, non-petroleum fuels has benefits for California. Given these examples, staff does not believe there is a hard fast rule that dictates no regulation should favor a specific fuel, and believes that the Board should look at each situation and the objective being sought in deciding whether fuel neutrality should be a guiding consideration.

One final consideration is, of the 17 transit agencies in the District, 16 are using and/or purchasing alternative fuel buses, including five of the six agencies on the diesel path. This is a result of ARB's fleet regulations and District Rule 1192. Thus the adoption of this regulatory amendment will have little affect on the status quo, and will serve mainly as a backstop to prevent any of the six agencies from purchasing higher emitting diesel engines during 2007 through 2009 should the District's authority be invalidated.

D. Issues Related to Federal Clean Air Act Waiver of Preemption

Some workshop commenters challenged California's authority to adopt and enforce fleet regulations in the SCAQMD based on federal statutory preemption. Federal Clean Air Act (CAA) section 209(a) preempts states and localities from adopting or enforcing any standard relating to the control of emissions from new motor vehicles or new motor vehicle engines. Notwithstanding this general preemption of state authority for new engines and new vehicles, CAA section 209(b) expressly authorizes the U.S. EPA's Administrator to waive the preemption for California.

One challenge is based on the view that ARB will not be able to obtain a waiver of preemption for state standards under CAA section 209(b) because the Board's regulations are subject to the requirements of CAA section 202(a)(3)(C). Section 202(a)(3)(C) requires that in adopting standards, U.S. EPA's Administrator is to provide specified periods of lead-time and stability to classes or categories of new heavy-duty vehicles or engines. As the text of the provision itself dictates, the provision is not applicable to California:

> Any *standard promulgated or revised under this paragraph* and applicable to classes or categories of heavy-duty vehicles or engines shall apply for a period of no less than 3 model years beginning no earlier than the model year commencing 4 years after such revised standard is promulgated. [Italics added for emphasis.]

The text states that "standards promulgated or revised under this paragraph," that is, under CAA section 202(a), must provide the specified lead-time and stability. In the person of the Administrator, U.S. EPA prescribes standards under 202(a). Clearly the provisions apply to U.S. EPA.

California, however, does not promulgate its standards under the grant of authority in section 202(a). California promulgates vehicular emission standards under grants of authority in state law[11] and under the waiver of federal preemption of state standards contained in CAA section 209(b). Since section 202(a)(3)(C) is only applicable to standards promulgated under section 202(a) and since California does not promulgate its standards under 202(a), the

[11] California Health & Safety Code Division 26.

provision does not apply to California. And, if the provision does not apply, its specified lead-time and stability requirements do not apply to California.

The inapplicability of CAA section 202(a)(3)(C) to the standards that California promulgates is also consistent with the legislative history of the CAA and the waiver of federal preemption. The legislative history of the waiver provision has emphasized that California is to have "the broadest possible discretion in selecting the best means to protect the health of its citizens." H.R.REP No. 95-294, at 302-02, quoted in Motor and Equipment Manufacturers Association, Inc. v. Environmental Protection Agency.[12] Other courts have also frequently noted that Congress consciously chose to permit California to blaze its own trail.[13]

A second challenge is based on the view that U.S. EPA will need to grant waivers of preemption under CAA section 209(b) prior to the enforcement of any aspect of the proposals. ARB already has waivers of preemption for all of the types of emissions and categories of new engines and new vehicles to which the proposed regulations would apply. For this reason, any new waiver would be needed only for those aspects of the regulations for which California has never before been granted a waiver of preemption. For any aspect of the regulations for which waivers have already been granted, ARB's practice has been to request confirmation that the regulations are within the scope of the previous waivers and to pursue enforcement against new engines and vehicles already covered by the waiver of preemption. For those aspects of the proposal that apply to in-use engines and vehicles, no waiver of preemption is needed since the preemption applies only to new vehicles and new vehicle engines.

E. Waiver Process Will Delay Rule Implementation and Reduce Benefits Achieved

When the U.S. Supreme Court ruled that a purchase requirement is in fact an emission standard under the federal Clean Air Act, implementation of the District rule required a waiver of federal preemption. The ARB determined that only the state can request a waiver of federal preemption, and that the rule subject to the request must be adopted by the state. This is the principle reason for this proposal being brought before ARB for consideration.

Stakeholders have pointed out that it can take several years following board adoption before a waiver is received from U.S. EPA. This does not usually create a problem because most requests for a waiver involve a regulation that includes

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[12] 627 F.2d 1095, at 1110 (D.C.Cir. 1979).

[13] Ford Motor Co. v. EPA, 606 F.2d 1293, at 1297 (D.C.Cir. 1979); Engine Manufacturers Association v. U.S. EPA, 88 F.3d 1075, at 1080 (D.C.Cir. 1996), Motor and Equipment Manufacturers Association, Inc. v. Nichols, 142 F.3d 449, at 463 (D.C.Cir. 1998).

lead time to develop new knowledge and will be implemented in three to four years. In the case of the District rule outlined in this report, the benefits of the rule accrue only from now until the end of 2009. If the waiver process takes several years, much of the benefit of the rule will be lost.

The ARB staff believes the rule qualifies as "within the scope" of a previous waiver. In such instances, ARB can implement the rule immediately. However, the Engine Manufacturers Association disagrees with the staff's position, and may challenge our waiver request. Discussions with U.S. EPA also have not resulted in a definitive picture of how it will approach ARB's waiver request. Thus, there is uncertainty regarding when the rule, if adopted, can be implemented, and any substantial delay will reduce the emission reductions achieved.

XIV. STAFF CONCLUSION

Staff has identified two policy decisions for the Board's consideration and has developed proposed regulatory amendments to support these decisions. First, staff is presenting three options for the Board to consider regarding the appropriate emission standards for new urban bus engines in 2007 through 2009. The three options are: 1) keep the current new urban bus emissions standards as they are, 2) change the NOx emission standards for 2007 through 2009 model year new urban buses from 0.2 to 1.2 g/bhp-hr, which would align it with the equivalent model year heavy-duty truck NOx emission standard, and 3) require all transit agencies to purchase/lease only alternative fuel buses. The amendments provided in this report (set forth in the proposed regulation order in Appendix A) set forth the language necessary to implement the option of aligning the urban bus standards with the heavy-duty truck standards beginning with the 2007 model year. Should the Board favor the option to keep the urban bus standards as they are, no regulatory changes are necessary. Should the Board decide that all transit agencies statewide should be required to purchase alternative fuel, a 15-day modification to ARB's Fleet Rule for Transit Agencies would be needed to accomplish this (and no change to the urban bus emission standards would be necessary).

Staff has also developed for the Board's consideration a new requirement that all transit agencies operating in the District follow the alternative-fuel compliance path, as defined in ARB's regulations. Under this new requirement, the six transit agencies in the District currently on the diesel fuel compliance path would be required to change to the alternative-fuel path effective January 1, 2006. This change would lock these transit agencies into purchasing alternative-fuel engines through 2015, consistent with the District's Rule 1192.

If the Board wishes to assure that alternative fuel urban transit buses are purchased throughout the District, and determines it wise to provide a backstop to the current District Rule 1192 in case litigation overturns the District rule, the

amendments provided in this report (set forth in the proposed regulation order in Appendix A) include regulatory language that would amend ARB's Fleet Rule for Transit Agencies to require diesel path transit agencies in SCAQMD to switch to the alternative fuel path.

XV. REFERENCES

1.Abbey, David E., Nishino, Naomi, McDonnell, William F., Burchette, Raoul J., Knutsen, Synnove F., Beeson, W. Lawrence, Yang, Jie X. 1999. "Long-term Inhalable Particles and Other Air Pollutants Related to Mortality in Nonsmokers." Am J Respir Crit Care Med. 159:373-382.

2.Ahlvik, P.J.E., Brandberg, A.R.L. 2000. "Relative Impact on Environment and Health from the Introduction of Low Emission City Buses in Sweden," SAE Tech. Paper 2000-01-1882.

3.ARB 1999. Staff Report: Initial Statement of Reasons, Proposed Regulation for a Public Transit Bus Fleet Rule and Emission Standards for New Urban Buses, December 10, 1999. http://www.arb.ca.gov/regact/bus/bus.htm

4.ARB 2000a. Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles, October 2000. http://www.arb.ca.gov/diesel/documents/rrpapp.htm

5.ARB 2000b. Final Statement of Reasons for Rulemaking, including Summary of Comments and Agency Responses, Public Hearing to Consider Adoption of a Public Transit Bus Fleet Rule and Emission Standards for New Urban Buses, December 8, 2000. http://www.arb.ca.gov/regact/bus/bus.htm

6.ARB 2001. Policies and Actions for Environmental Justice. http://www.arb.ca.gov/ch/ejpolicies_121301.pdf.

7.Ayala, A., N.Y. Kado, R.A. Okamoto, B.A. Holmen, P.A. Kuzmicky, R. Kobayashi, and K.E. Stiglitz 2002. "Diesel and CNG Heavy-duty Transit Bus Emissions over Multiple Driving Schedules: Regulated Pollutants and Project Overview." *Journal of Lubricants and Fuels*, SAE Transactions, Vol. 111, pp. 735-747 (Also SAE Tech. Paper 2002-01-1722)

8.CalNGV News 2004. The newsletter of the California Natural Gas Vehicle Coalition, March 22, 2004. 3 pp.

9.Clark, N. N., Gadapati, C. J., Kelly, K., White, C. L., Lyons, D. W., Wang, W., Gautam, M., and Bata, R. 1995 "Comparative Emissions from Natural Gas and Diesel Buses." SAE Tech. Paper 952746.

10.Clark, N. N., Gautam, M., Rapp, B.L., Lyons, D.W., Graboski, M.S., McCormick, R.L., Alleman, T.L., and Norton, P. 1999. "Diesel and CNG Transit Bus Emissions Characterization By Two Chassis Dynamometer Laboratories: Results and Issues." SAE Tech. Paper 1999-01-1469.

11.Cummins-Westport 2005. News Release: Cummins-Westport, DOE, and NREL Partner to Deliver Next Generation Natural Gas Engine Three Years Ahead of U.S. Regulations. February 09, 2005.

12.McDonnell, William F., Nishino-Ishikawa, Naomi, Petersen, Floyd F., Chen, Lie Hong, Abbey, David E. 2000. "Relationships of mortality with the fine and coarse fractions of long-term ambient PM_{10} concentrations in nonsmokers." Journal of Exposure Analysis and Environmental Epidemiology. 10: 427-436.

13.SCAQMD 2000. Staff Report: Proposed Rule 1192 - Clean On-Road Transit Buses, June 2000.

14.U.S. EPA 2004. United States Environmental Protection Agency, Assessment and Standards Division, Office of Transportation and Air Quality. Highway Diesel Progress Review Report 2. EPA420-R-04-004, March 2004. http://www.epa.gov/otaq/regs/hd2007/420r04004.pdf

XVI. AVAILABILITY OF TECHNICAL SUPPORT DOCUMENT

An electronic version of the technical support document for this report is available at http://www.arb.ca.gov/regact/sctransit/sctransit.htm. If you would like a hard copy of these documents please fill out this form and mail or fax it to:

Public Information Office
California Air Resources Board
P.O. Box 2815
Sacramento, CA 95812
Fax: (916) 445-5025

Please send or fax the **TECHNICAL SUPPORT DOCUMENT: PROPOSED REGULATION FOR THE PROPOSED SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT FLEET RULES** to:

Name:_____

Address:_____

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APPENDIX A

Proposed Regulation Order

PROPOSED REGULATION ORDER

Amend the following sections of title 13, California Code of Regulations, to read as set forth in the following pages:

Amend:	
Section 1956.1	Exhaust Emission Standards and Test Procedures – 1985 and Subsequent Model Heavy Duty Urban Bus Engines and Vehicles
Section 1956.8(a)(2)(A)	Exhaust Emissions Standards and Test Procedures – 1985 and Subsequent Model Heavy-Duty Engines and Vehicles
Section 2023.1(a)	Fleet Rule for Transit Agencies – Urban Bus Requirements

Notes: This document is printed in a style to indicate changes to the preexisting regulations. The proposed amendments are shown in underline to indicate additions and ~~strikeout~~ to indicate deletions. The symbol "* * * * *" means that intervening text not being amended is not shown. "[No Change]" means that no changes are being proposed to a specified subsection, the text of which is not shown. Subsection headings are shown in italics and should be italicized in Barclays California Code of Regulations.

The existing Fleet Rule for Transit Agencies is located with the heavy-duty engine emission standards in title 13, CCR, sections 1956.2-1956.4. At its February 24, 2005 hearing, the Board approved staff's proposal to move the existing sections for the Fleet Rules for Transit Agencies to new sections which cover rules for controlling diesel emissions from existing in-use engines or fleets. As a result, upon final approval by the Office of Administrative Law, section 1956.2 will be renumbered as section 2023.1, and will reflect amendments to the text of former 1956.2 approved at the February 2005 hearing. In this document, the Fleet Rule for Transit Agencies – Urban Bus Requirements is accordingly shown as section 2023.1, with the amendments to the text of former section 1956.2 approved at the February 2005 hearing shown in *italic underline* to indicate additions, and ~~*italic strikeout*~~ to indicate deletions.

The text of sections 2020 and 2021, with amendments approved by the Board at its February 24, 2005 hearing but not yet final, is provided for information only. As is the case above, amendments approved at that hearing to add language are shown in *italic underline*, and amendments deleting language are shown in ~~*italic strikeout*~~.

PROPOSED REGULATION ORDER

Amend title 13, California Code of Regulations, section 1956.1 to read as follows:

§ 1956.1 Exhaust Emission Standards and Test Procedures - 1985 ~~and Subsequent~~ - 2006 Model Year Heavy Duty Urban Bus Engines and Vehicles

(a) The exhaust emissions from new 1985 ~~and subsequent~~ through 2006 model year-heavy-duty diesel cycle urban bus engines and vehicles fueled by methanol, natural gas, liquefied petroleum gas, and petroleum shall not exceed the following, by model year:

(1) [No Change]

(2) [No Change]

(3) [No Change]

(4) [No Change]

(5) [No Change]

(6) [No Change]

(7) *October 1, 2002, PM standard* – For diesel-fueled, dual-fuel, and bi-fuel bus engines except for heavy-duty pilot ignition engines, the PM standard shall be 0.01 g/bhp-hr (0.01 PM g/bhp-hr in-use) for 2002 and subsequent model year engines produced beginning October 1, 2002. Manufacturers may choose to meet this standard with an aftertreatment system that reduces PM to 0.01 g/bhp-hr.

(8) *October 2002-2006 optional standards* – Except for diesel-fueled, dual-fuel, and bi-fuel engines but including heavy-duty pilot ignition engines, manufacturers may choose to certify 2002 – 2006 model year bus engines produced beginning October 1, 2002, to an optional 1.8 g/bhp-hr to 0.3 g/bhp-hr NOx plus NMHC standard, measured as the arithmetic sum of the NOx and NMHC exhaust component certification values, without restriction on individual component certification values; provided that engines certified to this optional reduced-emission NOx plus NMHC standard may not participate in any averaging, banking, or trading program set forth in the test procedures document incorporated by reference in subdivision (c) of this section. A manufacturer may certify to any standard between the values of 1.8 g/bhp-hr to 0.3 g/bhp-hr, by 0.3 g/bhp-hr NOx + NMHC increments.

Manufacturers certifying to this optional standard must also certify to a PM standard of 0.03, 0.02, or 0.01 g/bhp-hr.

(9) [No Change]

(10) *2004-2006* : – Except as provided in paragraph (11), below, the required standard shall be 2.4 g/bhp-hr NOx + NMHC measured as the arithmetic sum of exhaust component certification values for these pollutants, without restriction on individual component values, 15.5 g/bhp-hr CO, and 0.05 g/bhp-hr PM (0.07 g/bhp-hr PM in-use).

(A) Manufacturers may choose to certify to a 2.5 g/bhp-hr optional combined NOx + NMHC standard, provided that the NMHC exhaust component certification value shall not exceed 0.5 g/bhp-hr.

(B) Emissions averaging may be used to meet the combined NOx + NMHC standard, the optional combined NOx + NMHC standard set forth in paragraph (A), and the PM standard.

(C) The combined NOx + NMHC standard and the optional combined NOx + NMHC standard described in paragraph (A) may serve as the certification standard for the higher emitting fueling mode of an engine certified under the dual fueling mode certification process set forth in section 1956.8(a)(4), title 13, CCR.

(11) *2004-2006* – For diesel-fueled, or dual-fuel, and bi-fuel urban bus engines except for heavy-duty pilot ignition engines, the standards are 0.5 g/bhp-hr NOx, 0.01 g/bhp-hr PM, 0. 5 g/bhp-hr NMHC, 5.0 g/bhp-hr CO, and 0.01 g/bhp-hr formaldehyde. As an option, manufacturers may choose to meet the NOx and PM standards with a base engine that is certified to the standards in paragraph (10) above, equipped with an aftertreatment system that reduces NOx to 0.5 g/bhp-hr and PM to 0.01 g/bhp-hr standards. The NMHC, CO, and formaldehyde standards in this paragraph (11) shall still apply. Manufacturers shall be responsible for full certification, durability, testing, and warranty and other requirements for the base engine. For the aftertreatment system, manufacturers shall not be subject to the certification durability requirements, or in-use recall and enforcement provisions, but are subject to warranty provisions for functionality.

(A) Engine manufacturers may sell diesel-fueled, dual-fuel, or bi-fuel engines to any transit fleet exempted by the Executive Officer under paragraphs (c)(8) and (d)(7) of section 1956.2,

title 13, CCR, from the requirements of paragraphs (c)(5) and (d)(4) of section 1956.2, certified to the standards in either paragraphs (9) or (10) above, provided that engines certified to the standards in paragraph (10) must be certified to a 0.01 g/bhp-hr PM standard.

(B) Manufacturers may sell diesel-fueled hybrid-electric buses that are certified to a 1.8 g/bhp-hr NOx, 0.01 g/bhp-hr PM, 0.5 g/bhp-hr NMHC, and 15.5 g/bhp-hr CO standard to any transit agency that has received written authorization from the Executive Officer pursuant to paragraph (d)(9) of section 1956.2, title 13, CCR. The formaldehyde standard set forth in paragraph (11), above, shall not apply to the HEBs sold pursuant to this subparagraph.

~~(12) 2007 and subsequent – 0.2 g/bhp-hr NOx, 0.01 g/bhp-hr PM, 0.05 g/bhp-hr NMHC, 5.0 g/bhp-hr CO, and 0.01 g/bhp-hr formaldehyde.~~

(b) *2003-2006* *bi-fuel heavy-duty pilot ignition engines* – A bi-fuel engine meeting the definition of a heavy-duty pilot ignition engine set forth in section1956.2 (b)(4) may be certified to the standards in section1956.1 (a)(8) and (a)(10), provided that the engine is certified to an optional PM standard of 0.03, 0.02, or 0.01 g/bhp-hr.

(c) *Test Procedures.* The test procedures for determining compliance with standards applicable to 1985 ~~and subsequent~~ through 2006 model-year heavy-duty diesel cycle urban bus engines and vehicles and the requirements for participation in the averaging, banking and trading programs, are set forth in the "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles," adopted December 12, 2002, and the "California Interim Certification Procedures for 2004 and Subsequent Model Hybrid-Electric Vehicles, in the Urban Bus and Heavy-Duty Vehicle Classes," adopted October 24, 2002, which are incorporated by reference herein.

NOTE: Authority cited: Sections 39600, 39601, 43013, 43018, 43100, 43101, 43104 and 43806, Health and Safety Code; and section 28114, Vehicle Code. Reference: Sections 39002, 39003, 39017, 39033, 39500, 39650, 39657, 39667, 39701, 40000, 43000, 43000.5, 43009, 43013, 43018, 43102 and 43806, Health and Safety Code; and section 28114, Vehicle Code.

Amend section 1956.8 (a)(2)(A) to read as follows:

§ 1956.8. Exhaust Emissions Standards and Test Procedures – 1985 and Subsequent Model Heavy-Duty Engines and Vehicles.

(a)(1) [No Change]

(2)(A) The exhaust emissions from new 2004 and subsequent model heavy-duty diesel engines, heavy-duty natural gas-fueled and liquefied-petroleum-gas-fueled engines derived from diesel-cycle engines, and heavy-duty methanol-fueled diesel engines, and the optional, reduced-emission standards for 2002 and subsequent model engines produced beginning October 1, 2002, except in all cases engines used in medium-duty vehicles, shall not exceed:

Exhaust Emission Standards for 2004 and Subsequent Model Heavy-Duty Engines, and Optional, Reduced Emission Standards for 2002 and Subsequent Model Heavy-Duty Engines Produced Beginning October 1, 2002, Other than Urban Bus Model Year Engines October 1, 2002 through 2006[L] (grams per brake horsepower-hour [g/bhp-hr])

Model Year	*Oxides of Nitrogen Plus Non-methane Hydrocarbons*	*Optional Oxides of Nitrogen Plus Non-methane Hydrocarbons*	*Oxides of Nitrogen*	*Non-methane Hydrocarbons*	*Carbon Monoxide*	*Particulates*
2004-2006[H]	2.4 [A,C,E,J]	2.5 [B,C,E,J]	n/a	n/a	15.5	0.10 [C]
October 1, 2002-2006	n/a	1.8 to 0.3 [A,D,F]	n/a	n/a	15.5	0.03 to 0.01 [G]
2007 and subsequent	n/a	n/a	0.2 [I]	0.14	15.5	0.01 [K]

[A] This is the standard for the arithmetic sum of the oxides of nitrogen exhaust component certification value and the non-methane hydrocarbon exhaust component certification value, without individual restriction on the individual component values.

[B] This is the standard for the arithmetic sum of the oxides of nitrogen exhaust component certification value and the non-methane hydrocarbon exhaust component certification value, with the non-methane hydrocarbon individual component value not to exceed 0.5 g/bhp-hr.

[C] For 2004 through 2006 model years, emissions averaging may be used to meet this standard. Averaging must be based on the requirements of the averaging, banking and trading programs described in "California Exhaust Emission Standards and Test Procedures for 1985 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles" incorporated by reference in section 1956.8 (b), below.

D A manufacturer may elect to certify to an optional reduced-emission NOx+NMHC standard between the values, inclusive, by 0.3 grams per brake horsepower-hour increments. Engines certified to any of these optional reduced-emission NOx standards are not eligible for participation in any averaging, banking or trading programs described in "California Exhaust Emission Standards and Test Procedures for 1985 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles" incorporated by reference in section 1956.8 (b), below.

E May be used as the certification standard for the higher emitting fueling mode of an engine certified under the dual fueling mode certification process of section 1956.8 (a)(4), below.

F May be used as the certification standard for the lower emitting fueling mode of an engine certified under the dual fueling mode certification process of section 1956.8 (a)(4), below.

G A manufacturer may elect to certify to an optional reduced-emission PM standard between the specified values, inclusive, by 0.01 grams per brake horsepower-hour increments. Engines certified to any of these optional reduced-emission PM standards are not eligible for participation in any averaging, banking or trading programs described in "California Exhaust Emission Standards and Test Procedures for 1985 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles" incorporated by reference in section 1956.8 (b), below.

H Engine manufacturers subject to the Heavy-Duty Diesel Engine Settlement Agreements (Settlement Agreements)[1] must produce engines in compliance with the requirements contained in their respective Settlement Agreement. Most engine manufacturers subject to the Settlement Agreements are required to manufacture engines meeting the exhaust emission standards for 2004 and subsequent model years engines beginning October 1, 2002.

I A manufacturer may elect to include any or all of its heavy-duty diesel engine families in any or all of the NOx emissions averaging, banking, or trading programs for heavy-duty diesel engines, within the restrictions described in "California Exhaust Emission Standards and Test Procedures for 1985 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles" incorporated in section 1956.8 (b), below. If the manufacturer elects to include engine families in any of these programs, the NOx family emission limit (FEL) may not exceed the following FEL caps: 2.00 grams per

[1] Seven of the largest heavy-duty diesel engine manufacturers will be implementing measures to reduce emissions beginning October 1, 2002, to meet the requirements of the Heavy-Duty Diesel Engine Settlement Agreements reached with the ARB. The Heavy-Duty Diesel Engine Settlements were agreements reached in response to lawsuits brought by the United States Environmental Protection Agency and violations alleged by the ARB pertaining to excess in-use emissions caused by the use of defeat devices and unacceptable algorithms. Navistar signed its Settlement Agreement on October 22, 1998. Cummins, Detroit Diesel Corporation, Caterpillar, Volvo, Mack and Renault signed their Settlement Agreements on December 15, 1998.

brake horsepower-hour (0.75 grams per megajoule) for model years before 2010; 0.50 grams per brake horsepower-hour (0.19 grams per megajoule) for model years 2010 and later. The FEL cap applies whether credits for the engine family are derived from averaging, banking, or trading programs.

J For 2007 through 2009 model years, a manufacturer may use these emission standards in accordance with section 1956.8 (a)(2)(B). A manufacturer may elect to include any or all of its heavy-duty diesel engine families in any or all of the NOx plus NMHC emissions averaging, banking, or trading programs for heavy-duty diesel engines, within the restrictions described in "California Exhaust Emission Standards and Test Procedures for 1985 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles" incorporated in section 1956.8 (b), below. If the manufacturer elects to include engine families in any of these programs, the NOx family emission limit (FEL) may not exceed the following FEL caps: 2.00 grams per brake horsepower-hour (0.75 grams per megajoule) for model years. The FEL cap applies whether credits for the engine family are derived from averaging, banking, or trading programs.

K A manufacturer may elect to include any or all of its heavy-duty diesel engine families in any or all of the particulate averaging, banking, or trading programs for heavy-duty diesel engines, within the restrictions described in "California Exhaust Emission Standards and Test Procedures for 1985 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles" incorporated by reference in section 1956.8 (b), below. The particulate FEL for each engine family a manufacturer elects to include in any of these programs may not exceed an FEL cap of 0.02 grams per brake horsepower-hour (0.0075 grams per megajoule). The FEL cap applies whether credits for the engine family are derived from averaging, banking, or trading programs.

L For 2007 and subsequent model year urban bus engines, this section applies.

(B) *Phase-in Options.*

~~(i)~~ 1. *Early NOx compliant engines.* For model years 2007, 2008, and 2009, a manufacturer may, at their option, certify one or more of their engine families to the combined NOx plus NMHC standard or FEL applicable to model year 2006 engines under section 1956.8 (a)(2), in lieu of the separate NOx and NMHC standards or FELs applicable to the 2007 and subsequent model years, specified in section 1956.8 (a)(2). Each engine certified under this phase-in option must comply with all other emission requirements applicable to model year 2007 engines. To qualify for this option, a manufacturer must satisfy the U.S.-directed production requirement of certifying no more than 50 percent of engines to the NOx plus NMHC standards or FELs applicable to 2006 engines, as specified in 40 Code of Federal Regulations, part 86, section 86.007-11 (g)(1), as adopted January 18, 2001. In addition, a manufacturer may reduce the quantity of engines that are required to be

phased-in using the early certification credit program specified in 40 Code of Federal Regulations, part 86, section 86.007-11 (g)(2), as adopted January 18, 2001, and the "Blue Sky" engine program specified in 40 Code of Federal Regulations, part 86, section 86.007-11 (g)(4), as adopted January 18, 2001.

~~(ii)~~ 2. *Early PM compliant engines.* A manufacturer certifying engines to the 2007 and subsequent model year PM standard listed in section 1956.8 (a)(2) (without using credits, as determined in any averaging, banking, or trading program described in "California Exhaust Emission Standards and Test Procedures for 1985 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles," to comply with the standards) before model year 2007 may reduce the number of engines that are required to meet the 2007 and subsequent model year PM standard listed in section 1956.8 (a)(2) in model year 2007, 2008 and/or 2009. To qualify for this option, a manufacturer must satisfy the PM emission requirements pursuant to the methods detailed in 40 Code of Federal Regulations, part 86, section 86.007-11 (g)(2)(ii), as adopted January 18, 2001.

* * * * *

NOTE: Authority cited: Sections 39600, 39601, 43013, 43018, 43100, 43101, 43104, 43105, and 43806, Health and Safety Code, and section 28114, Vehicle Code. Reference: Sections 39002, 39003, 39500, 43000, 43013, 43018, 43100, 43101, 43102, 43104, 43106, 43202, 43204, 43206, 43210, 43211, 43212, 43213, and 43806, Health and Safety Code; and section 28114, Vehicle Code.

§ 2020. Purpose and Definitions of Diesel Particulate Matter Control Measures

(a) *Purpose*. Diesel particulate matter was identified in 1998 as a toxic air contaminant. According to California law, an airborne toxic control measure using the best available control technology shall, therefore, be employed to reduce the public's exposure to diesel particulate matter.

(b) *Definitions*. For the purposes of the rules specified in article 4, the following definitions apply:

"Alternative fuel" means natural gas, propane, ethanol, methanol, gasoline (when used in hybrid electric buses only), hydrogen, electricity, fuel cells, or advanced technologies that do not rely on diesel fuel. "Alternative fuel" also means any of these fuels used in combination with each other or in combination with other non-diesel fuels.

"Commercially available" means available for purchase and installation at a reasonable cost.

"Heavy-duty pilot ignition engine" means an engine designed to operate using an alternative fuel, except that diesel fuel is used for pilot ignition at an average ratio of no more than one part diesel fuel to ten parts total fuel on an energy equivalent basis. An engine that can operate or idle solely on diesel fuel at any time does not meet this definition.

"Level" means one of three categories of Air Resources Board-verified diesel emission control strategies: Level 1 means the strategy reduces engine diesel particulate matter emissions by between 25 and 49 percent, Level 2 means the strategy reduces engine diesel particulate matter emissions by between 50 and 84 percent, and Level 3 means the strategy reduces engine diesel particulate matter emissions by 85 percent or greater, or reduces engine emissions to less than or equal to 0.01 grams diesel particulate matter per brake horsepower-hour.

"Municipality" means a city, county, city and county, special district, or a public agency of the United States of America or the State of California, and any department, division, public corporation, or public agency of this State or of the United States, or two or more entities acting jointly, or the duly constituted body of an Indian reservation or rancheria.

"Owner" means the same as in title 13, California Code of Regulations, section 2180.1(a)(21).

~~*"Retirement" or "Retire" means an engine or vehicle will be withdrawn from an active fleet in California. The engine may be sold outside of California, scrapped, or used in a backup vehicle.*~~

"Transit agency" means a public entity responsible for administering and managing transit services. Public transit agencies can directly operate transit service or contract out for all or part of the total transit service provided.

"Terminal" means any place or places where a vehicle is regularly garaged or maintained, or from which it is operated or dispatched, which may include a private business or residence.

"Verified" means that a diesel emission control strategy or system has received approval from the Executive Officer according to the "Verification Procedure for In-Use Strategies to Control Emissions from Diesel Engines" in title 13, California Code of Regulations, commencing with section 2700, and incorporated by reference.

"Warranty Period" means the same as in title 13, California Code of Regulations, section 2707.

NOTE: Authority cited: Sections 39600 and 39601, Health and Safety Code. Reference: Sections 39002, 39003, 39650-39675, 43000, 43013, 43018, 43101, 43102, 43104, 43105 and 43700, Health and Safety Code.

Amend section 2023.1(a) to read as follows:

§ 2023.1. Fleet Rule for Transit Agencies – *Urban Bus Requirements*

(a) To encourage transit agencies that operate urban bus fleets to purchase or lease lower emission alternative-fuel buses, while also providing flexibility to such fleet operators to determine their optimal fleet mix in consideration of such factors as air quality benefits, service availability, cost, efficiency, safety, and convenience, two paths to compliance with this fleet rule are available: the alternative-fuel path and the diesel path.

(1) Transit agencies must choose their compliance path, and shall notify ARB of their intent to follow either the diesel or the alternative-fuel path, by January 31, 2001. Reporting requirements for that notification are set forth in subdivisions (a) and (b) of section ~~*1956.4*~~ *2023.4*, title 13, CCR.

(2) A transit agency within the jurisdiction of the South Coast Air Quality Management District may elect to change its compliance path from the diesel path to the alternative-fuel path, provided that the transit agency notifies the Executive Officer of the change by January 31, 2004, and provided that the transit agency is in compliance with all requirements of section ~~*1956.2*~~ *2023.1*, including specific requirements of the diesel path, on or before January 1, 2004. Reporting requirements for this notification are set forth in ~~paragraph (b)(3) of~~ section ~~*1956.4*~~ *2023.4*(b)(3), title 13, CCR.

(3) A new transit agency that is a successor to an existing transit agency or that has been created from a merger of two or more transit agencies or parts of two or more transit agencies must have the same compliance path as the transit agency or agencies out of which it is formed.

(4) A transit agency within the jurisdiction of the South Coast Air Quality Management District shall follow the alternative-fuel path. If the transit agency had previously stated its intent to follow the diesel path, the change to the alternative-fuel path shall be effective on [Insert effective date of subsection] .

* * * * *

NOTE: Authority cited: Sections 39600, 39601, 39667, 43013, 43018 and 43101(b), Health and Safety Code. Reference: Sections 39002, 39003, 39017, 39500, 39650, 39667, 40000, 43000, 43000.5, 43013, 43018, 43701(b), 43801 and 43806, Health and Safety Code; and sections 233 and 28114, Vehicle Code.

APPENDIX B

URBAN BUS SURVEY

Urban Bus Survey - Alternate Fuel Experience

Transit Agency:_____Date_____

Interviewer_____

As a transit agency on the alternative fuel path, we would like to ask you a few questions regarding the use of alternate fuels in your fleet.

1 What type of fuels are you using?
Diesel LNG Propane CNG Gasoline Hybrid Other:_____

2. What is the relative cost of the alternative fuel buses, compared to diesel buses (you can state the actual cost of the buses)?

3 Have you installed a fueling station? How much did it cost?

4. What other modifications were made to your facility in order to use the alternative fuel (changes due to space requirements or handling lighter than air fuels)? At what cost?

5. Which staff did you need to train and what type of training was required? At what cost or how much time (training may have been provided by the fuel provider)?

6. What has your overall experience been with the alternative fueled vehicles compared to diesel fuel?
Routine maintenance:

Breakdowns/Reliability:

Durability (how long the engine lasts before overhaul), longevity of bus:

Fuel use and storage:

Manufacturer Support:

Urban Bus Survey - Alternate Fuel Experience

Transit Agency:_____

7. What are the costs compared to diesel?
Routine maintenance (annual hours/bus or $/year/bus):

Costs related to reliability (increased spare ratio?):

Repowering or remanufacturing engines (engine components labor):

Fuel costs (per mile):

Have you received any waivers from SCAQMD to purchase diesel fuel buses? What was the reason? Have any requests for waivers been denied? (details).

8. Is there a specific reason why you chose the specific alternate fuel over others?

Is there anything else you would like to share regarding the experience with alternate fuel?

APPENDIX C

INVENTORY AND EMISSIONS MODELING

I. Methodology

The emissions inventory model EMFAC2002, which is used by the Air Resource Board (ARB) to estimate on-road motor vehicle emissions inventories, also calculates an inventory for urban buses. However, for a number of reasons staff believes that, without modification, the EMFAC model may not be suitable for developing regulations that address only urban transit buses. First, the population of the urban bus vehicle class in EMFAC is derived from the Department of Motor Vehicles (DMV) registration database and contains urban buses as well as other categories of buses (examples are Greyhound and tour buses). The urban bus population reported by transit agencies is much smaller than the urban bus population in EMFAC. Second, the urban bus fleet in EMFAC contains 45 model years of vehicles and buses of all ages are assumed to accrue 37,700 miles per year on average. Data reported for the years 2000-2002 by transit agency show that the transit bus fleet consists of only 23 model years and that mileage accrual rate is a function of vehicle age. Finally, the EMFAC model does not include alternative-fueled vehicles, but alternative-fueled buses have increasingly become an important part of every transit fleet.

In support of the ARB's amendments to the Fleet Rule for Transit Agencies, staff has constructed an inventory model specifically for diesel and alternative-fueled urban buses. The model uses the population and activity data reported by transit agencies, diesel bus emission rates from the EMFAC model, and alternative-fueled bus emission rates estimated from recent test data. The following sections discuss the urban bus activity and emission rate estimates and present an urban bus specific inventory.

II. Urban Bus Activity Data

The Fleet Rule for Transit Agencies, adopted in 2000, has required that transit agencies provide an annual report of their urban buses since 2001. The population data were, therefore, based on reported data.

The following urban transit bus activity data were obtained and analyzed:

- Annual mileage accrual rate;
- Population (POP) and age distribution;
- Total vehicle miles traveled (VMT).

The annual mileage accrual rate for urban buses was estimated from the annual mileage data provided by transit agencies. The average annual mileage data by model year was statistically fit to obtain a relationship between annual mileage accrual rate and vehicle age. Alternative-fueled urban buses were assumed to accrue the same annual miles as diesel urban buses at the same age.

A. Statewide

The statewide population of urban buses, based on the 2002 reports from transit agencies, was 10,142, or 6,476 diesel buses and 3,666 alternative-fuel buses. Staff calculated the age distributions (number of vehicles by age) for diesel and alternative-fueled urban buses using these data. For the statewide alignment analysis, only the diesel population was analyzed. Alternative fuel urban buses are assumed not to be affected by engine availability as described below.

Staff projected the population for future years for the statewide baseline emissions, alignment scenario emissions, and statewide alternative fuel scenario based on the following assumptions:

- For the baseline scenario, no growth between 2004 and 2009 and growth resuming starting 2010 at a 1.6 percent growth rate. As stated, in the Staff Report, no engine manufacturer plans to certify a diesel engine for urban buses during this time frame. Therefore, staff assumes that transit agencies on the diesel path will maintain their current fleets through repowering until 2010 when diesel engines become available. The slow down in turnover is reflected in the reported data.
- For the alignment scenario, no growth between 2004 and 2006 and growth resuming starting in 2007 at a 1.6 percent growth rate. Diesel engines will be available at 1.2 g/bhp-hr NOx for 2007 through 2009. Fleets will start buying diesel buses again at their usual rate in 2007, however, once the 2010 diesel buses are available at 0.2 g/bhp-hr NOx, it is expected there will be larger purchases made in 2010 and 2011 to catch up to their needed fleet sizes.
- For the statewide alternative fuel mandate, staff assumed the emissions would follow the same declining rate as was projected in the original rule since it followed the same engine standards path, i.e., 0.2 g/bhp-hr engines starting in 2007. However, the emissions starting points were adjusted to the 2006 emission values of 10.6 tons per day NOx and 420 pounds per day PM consistent with the baseline values. All purchases will be alternative fuel buses beginning in 2007 and continuing through 2015 when the alternative fuel path mandate expires, but all engines whether diesel or alternative fuel will meet the 0.2 g/bhp-hr NOx standard from 2010 on.

Staff estimated the populations of diesel urban buses for 2003 and later model years using reported 2002 populations as the base year. The projected populations for future years were adjusted using the survival rates (the fraction of the new vehicles that remains in the fleet after certain years) for urban diesel buses in EMFAC2002 and modified to reflect the reported urban bus population survival rate.

The urban bus daily vehicle miles traveled (VMT) for any given year was estimated from the population (POP) and accrual rate using the following equation:

$$VMT = \Sigma\,(POP_{age} \times \text{Accrual Rate}_i), \text{ where } age = 0 \text{ to } 22. \qquad (1)$$

The urban bus mileage accrual rate, survival rate, and population distribution for years 2002 and 2020 are found in Table 1.

Table 1. Statewide Urban Bus Accrual Rate, Survival Rate and Population Distribution

Age	Accrual Rate (mi/year)	Survival Rate	2002 Diesel Population[1]	2020 Diesel Population[2]
0	30,868	1.00000	501	647
1	31,679	1.00000	675	658
2	32,332	1.00000	796	670
3	32,824	0.99301	364	657
4	33,158	0.99301	438	637
5	33,332	0.99301	558	615
6	33,346	0.98943	237	588
7	33,201	0.98774	215	556
8	32,897	0.98399	154	496
9	32,434	0.97909	165	466
10	31,811	0.93291	610	461
11	31,028	0.93291	360	444
12	30,087	0.84530	355	392
13	28,986	0.71960	398	344
14	27,725	0.60220	336	287
15	26,305	0.49520	7	250
16	24,726	0.37055	59	182
17	22,987	0.24590	41	120
18	21,089	0.13950	161	70
19	19,032	0.07180	20	48
20	16,815	0.02960	25	24
21	14,439	0.00070	0	0
22	11,904	0.00070	1	0

1 Reported by transit agencies.
2 Projected from year 2002 original rule population.

B. South Coast Air Quality Management District (SCAQMD)

The SCAQMD urban bus population of 4,632 urban buses is based on data reported for 2004 by the 17 transit agencies located within the jurisdiction of SCAQMD, which reported populations of 1,865 diesel fuel and 2,767 alternative-fuel buses. Staff calculated the age distributions (number of vehicles by age) for diesel and alternative-fueled urban buses using the survival rates (the fraction of the new vehicles that remains in the fleet after certain years) based urban diesel buses in EMFAC2002. A 95

percent fleet turnover rate of the oldest diesel buses to be replaced with alternative-fuel buses was used, except for years 2005 to 2009.

For model years 2005 to 2009, staff conducted a telephone survey of the six diesel path transit agencies to obtain specific plans for purchasing, including replacement and growth vehicles (Table 2). All other assumptions regarding growth rate and VMT remain the same as in the statewide model. The population distribution for years 2005 and 2020 are given in Table 3.

Table 2. Reported Plans for Bus Purchases, SCAQMD Diesel Path Agencies

Year	GHEB[1]	CNG Bus[2]
2005	71	14
2006	23	
2007	55	9
2008	64	
2009	51	

[1]Gasoline Hybrid Electric Bus
[2]Compressed Natural Gas Bus

Table 3. SCAQMD Transit Bus Population Distribution

Age	2005 Diesel Population[1]	2020 Diesel Population[2]	2005 Alt Fuel Population[1]	2020 Alt Fuel Population[2]
0	2	394	63	402
1	90	63	122	72
2	135	103	210	87
3	112	105	1054	134
4	233	138	322	75
5	24	42	321	68
6	42	78	266	70
7	255	92	359	70
8	99	106	1	72
9	127	75	17	52
10	48	76	32	247
11	25	2		6
12	387	88		6
13	19	131		7
14	59	110		7
15	68	228		7
16	101	22		59
17	0	39		114
18	9	238		197
19	0	92		982
20	0	116		296
21	0	44		294
22	30	22		242

1 Reported by transit bus agencies.
2 Projected from year 2005 population.

III. Emission Rates of Diesel and Alternative-Fueled Urban Buses

The diesel urban bus emission rates used for this analysis are the same as those used in EMFAC2002 version 2.2 (Table 4). The emission rates are based on the currently adopted exhaust emission standards for urban bus engines and were adjusted for the modeled scenarios. Changes to the emission factors for the scenarios were calculated using a ratio between the adopted emission standard and the "projected" emission standard to determine the emission rate for that year.

Table 4. EMFAC2002 Diesel Urban Bus Emission Rates (g/mi)[1]

Model Year Group	HC	NOx	PM
Pre 1987	2.06	46.18	1.29
1987-1990	2.05	40.20	1.22
1991-93	2.02	25.49	1.16
1994-95	1.99	29.84	1.41
1996-98	1.98	39.17	1.69
1999-02	1.98	20.39	0.58
2003	0.84	10.20	0.12
2004-06	0.84	2.55	0.12
2007	0.84	1.02[2,3]	0.12
2008+	0.75	0.90[2,3]	0.10

1. Values assumed for baseline, if all engines were available.
2. The difference in the emission factors for 2007 and 2008+ is based on the implementation Zero Emission Bus purchasing requirements.
3. To model the alignment scenario, staff used emission factors of 6.14 for 2007 and 0.90 for 2010, to reflect certification values of 1.2 g/bhp-hr in 2007 and 0.2 g/bhp-hr (+ZEB) in 2010.

Emission rates for alternative-fueled transit buses were estimated from emission data collected by West Virginia University (WVU) (Table 5). The WVU data include emission data for 71 1991-1998 model year CNG-powered urban buses. The emission data were first divided into model year groups corresponding to the model year groups of diesel transit buses and the data in each group were then averaged. Emission rates for model years after 1998 were estimated using the ratio of the standards. As with the statewide analysis, changes to the emission factors for the scenarios were calculated using a ratio between the adopted emission standard and the "projected" emission standard to determine the emission rate for that year.

Table 5. Alternative-Fuel Urban Buses Emission Rates (g/mi)

Model Year Group	HC	NOx	PM
1991-93	14.6	25.4	0.02
1994-95	15.5	11.2	0.02
1996-98	20.7	20.0	0.02
1999-02	20.7	20.0	0.02
2003	7.96	10.0	0.004
2004-06	0.80	7.5[1]	0.004
2007	0.80	1.0	0.004
2008+	0.80	1.0	0.004

[1] The range of the certification values for alternative-fuel buses is 0.6 to 2.5 g NOx+NMHC/bhp-hr. For the Baseline calculation, staff used the average value of 1.5 g NOx/bhp-hr certification level to determine the emission factor of 7.5 g/mi. For the scenarios, staff used the emission factor of 2.5g/mi (0.5 g/bhp-hr) because the predominant urban bus purchased in these years is the gasoline hybrid certified at the 0.6 g NOx+NMHC level.

For comparison, Table 6 shows the currently adopted emission standards for urban buses.

Table 6. Urban Bus Standards (g/bhp-hr)

Model Year	HC	CO	NOX	PM	HC+NOx
1973-74	—	40.0	—	—	16.0
1975-76	—	30.0	—	—	10.0
1977-79	1.00	25.0	7.5	—	—
1980-83	1.00	25.0	—	—	6.0
1984-86	1.30	15.5	5.1	—	—
1987-90	1.30	15.5	6.0	0.60	—
1991-93	1.30	15.5	5.0	0.10	—
1994-95	1.30	15.5	5.0	0.07	—
1996-98	1.30	15.5	4.0	0.05	—
1999-02	1.30	15.5	4.0	0.05	—
10/2002-03	—	15.5	2.5 (NOx+NMHC)	0.01	—
2004-06		15.5	Diesel: 0.5 Alt Fuel:2.5 (NOx+NMHC)	0.01	—
2007		15.5	0.2	0.01	—
2008+			15% of new purchases are ZEBs for large fleets		

IV. Urban Bus Emission Inventory

Using the data presented above, staff calculated baseline inventories for the statewide and SCAQMD urban buses. Tables 7 and 8 show the diesel urban bus baseline inventories for selected calendar years for the statewide and SCAQMD inventories and Tables 9 presents the alternative-fueled urban buses for the SCAQMD inventories.

Table 7. Statewide Diesel Urban Bus Baseline Emissions (tons/day)

Pollutant	2000	2005	2010	2015	2020
HC	0.56	0.52	0.41	0.25	0.09
NOx	13.5	10.6	7.93	3.72	1.37
PM (lbs/day)	540	420	320	142	100

Table 8. Statewide Alignment Scenario Emissions (tons/day)

Pollutant	2000	2005	2010	2015	2020
HC	0.56	0.52	0.39	0.26	0.10
NOx	13.5	10.6	7.79	4.91	1.86
PM (lbs/day)	540	420	300	142	100

Table 9. Statewide Alternative Fuel Path Mandate Scenario Emissions (tons/day)

Pollutant	2000	2005	2010	2015	2020
HC	0.56	0.52	0.55	0.56	0.56
NOx	13.5	10.6	7.18	3.72	1.37
PM (lbs/day)	540	420	300	142	100

Table 10. SCAQMD Diesel Urban Bus Baseline Emissions (tons/day)

Pollutant	2000	2005	2010	2015	2020
HC	0.23	0.15	0.13	0.11	0.062
NOx	5.72	3.03	2.64	2.11	1.19
PM (lbs/day)	239	125	107	85.3	48.8

Table 11. SCAQMD Alternative-Fuel Urban Bus Baseline Emissions (tons/day)

Pollutant	2000	2005	2010	2015	2020
HC	2.61	5.42	5.19	4.17	2.38
NOx	2.50	5.27	5.06	4.09	2.38
PM (lbs/day)	5.1	10.5	10.3	8.6	5.6

APPENDIX D

COST ANALYSIS METHODOLOGY

I. Cost Analysis Methodology

This cost analysis addresses only two of the four options presented to the Air Resources Board (ARB) in this rule-making. As discussed in the Staff Report, there are two main options: 1) changing the statewide urban bus emission standards and 2) requiring all transit agencies in the South Coast Air Quality Management District (SCAQMD) to follow the alternative-fuel path for urban buses. Within option #1 there are three ways the ARB could choose to change the statewide standards, and only the third option (Alternative 1.3), of requiring all transit agencies statewide to follow the alternative-fuel path for urban buses, would require additional expenditures by transit agencies and hence entail a specific cost analysis. Alternative 2, where all transit agencies in the SCAQMD would be required to follow the alternative-fuel path for urban buses, would also entail additional costs for transit agencies.

California transit agencies provide the ARB with annual reports of the composition of their urban bus fleets, as required in the Fleet Rule for Transit Agencies. The complete inventory of urban buses operated by transit agencies is described in Appendix C. Alternative 1.3 would require all California transit agencies to convert to the alternative-fuel path in the next year or so, while Alternative 2 would only require that all transit agencies located in the SCAQMD that are on the diesel path switch to the alternative-fuel path. To determine the number of alternative-fuel buses which transit agencies would buy instead of diesel buses for Alternative 1.3, staff modeled the urban bus purchases which would be alternative-fuel rather than diesel (Table 1). For Alternative 2, staff surveyed the six transit fleets on the diesel path and requested their purchasing plans for 2005 to 2009. Estimated costs of Alternative 2 are based on these planned purchases (Table 2).

Table 1. Modeled Statewide Purchases of Alternative-Fuel Urban Bus Purchases

Year	CNG Bus[1]
2005	127
2006	84
2007	382
2008	400
2009	379
2010	992
2011	776
2012	189
2013	240
2014	273
2015	327

[1]Compressed Natural Gas Bus

Table 2. Reported Plans for Alternative-Fuel Urban Bus Purchases, SCAQMD Diesel Path Agencies Only

Year	GHEB[1]	CNG Bus[2]
2005	71	14
2006	23	-
2007	55	9
2008	64	-
2009	51	-

[1]Gasoline Hybrid Electric Bus
[2]Compressed Natural Gas Bus

A. Cost Calculations

The cost-effectiveness analysis is based on estimates of expected emissions reductions and of costs for implementation for Alternatives 1.3 and 2. Staff estimated the incremental cost of each Alternative by determining the difference between the capital and operations and maintenance costs of diesel urban buses and alternative-fuel urban buses.

Cost estimates were obtained from technicians and engineers in the field, as well as from published references. For the main cost categories, ARB staff determined typical or average costs based on the cost estimates obtained for each category. Alternate-fuel urban buses represent relatively new and still-evolving technology, and so there is a dearth of operating experience on which to base cost estimates.

As is explained below, natural gas buses entail a number of cost categories that are avoided when gasoline HEBs are used. Thus, although gasoline HEBs themselves are more expensive than natural gas buses, the auxiliary costs for the latter result in higher estimated lifetime costs for natural gas buses.

1. Capital Costs for Buses

For bus replacement costs, current prices of new buses were used to determine the premium of an alternative-fuel bus over a comparable diesel fuel bus (Table 2). The Federal Transportation Authority provides 80%-83% of the capital cost of new buses, so transit agencies see only a portion of the per-bus additional capital cost (FTA 2004). As a conservative estimate, staff assumed a 20 percent transit agency share (Table 3), although the cost to society is the full incremental difference. Staff did not subtract from the capital cost any incentive funds that may be available to offset the purchase of alternative-fuel buses. Staff has shown the two different types of buses that transit agencies in the SCAQMD are purchasing: gasoline hybrid-electric (HEB) and compressed natural gas (CNG) buses.

Table 3. Estimated Premiums for Alternative-Fuel Vehicles

Bus Type	100% Premium	20% Premium
Gasoline HEB	$122,700	$24,546
CNG Bus	$50,000	$10,000

2. Capital Costs for Fueling Stations and Maintenance Facilities

Staff expects that many transit agencies affected by Alternative 1.3 will have to construct new alternative-fueling facilities, while the six transit providers affected by Alternative 2 have already either built a fueling station or have one planned and financed, based on staff's survey of transit agencies. Thus, only the cost analysis for Alternative 1.3 includes the capital costs of new fueling facilities, although both Alternatives include operating and maintenance costs for fueling infrastructure. Staff assumed that half of the natural gas fueling facilities constructed pursuant to Alternative 1.3 would be L/CNG stations (gasification) and that half would be CNG (compression) stations.

In addition, transit agencies that are purchasing gasoline HEBs will use existing facilities. One transit agency, Long Beach Transit, has financed an upgraded gasoline fueling station already and thus those costs were also not attributed to this rule. Thus, no capital costs were accounted for constructing fueling facilities for Alternative 2.

In some cases transit agencies have upgraded maintenance facilities or constructed new ones, often in conjunction with onsite fueling stations, and in other cases they have been able to rearrange existing facilities to accommodate the additional safety requirements for working with natural gas engines. Since such upgrades are apparently optional, staff did not include capital costs for construction or upgrades of maintenance facilities in the estimated cost of the rule.

3. Maintenance Costs

Staff believes that maintenance costs for natural gas buses are likely to be somewhat higher than for diesel buses for a variety of reasons. Natural gas engines and fuel systems are somewhat more complex, and mechanics may not have had as much experience with them. In addition, spare parts are more expensive primarily because natural gas engines and their replacement parts are simply not manufactured in the same high volumes as diesel engines. Also, it appears that natural gas engines are much more sensitive to deferred maintenance than traditional diesel engines. On the other hand, diesel bus engines are becoming significantly more complex than they have been in the past, which tends to reduce the extra cost entailed in selecting alternative-fuel buses.

Based on transit agency staff estimates, extra maintenance costs range from $0.06 to $0.17 per mile, with an average of $0.10 per mile. Assuming 43,500 miles per year, per-bus extra maintenance costs are expected to be about $4,300 per year.

Extra maintenance costs for gasoline HEBs relative to diesel buses are quite uncertain, because gasoline HEBs are an even newer technology and are all still under warranty. Gasoline HEBs are expected to offer excellent fuel economy and thus lower fuel costs. Some preliminary data indicates that lifetime repair costs for gasoline HEBs may be lower than those for diesel buses because diesel buses typically require at least one engine and transmission replacement or major overhaul during the life of the bus, while the gasoline HEB has no transmission and a much less expensive engine. Gasoline HEBs may also have significantly lower costs on brake repair.

Transit agencies may find that extended warranties on new technologies, while likely more expensive per year than staff's maintenance estimates, greatly reduce downside risk and uncertainty. Also, it appears that there may be significant differences in natural gas bus maintenance costs among transit agencies. Transit operators with higher per-bus maintenance costs may well be able to learn from the practices of operators with lower per-bus maintenance costs. Of course, accurate comparison of these costs requires careful attention to operators' variations in internal accounting practices.

4. Operational Costs or Benefits

In the absence of published, verifiable data, staff made several assumptions regarding the costs of labor and fuel. The cost analyses are based on the incremental cost differences between diesel and alternative-fuel urban bus purchase and use. Labor costs for natural gas buses and gasoline HEBs are expected to increase modestly over typical diesel bus costs. Initial training costs, and ongoing training associated with regular recertification of technicians for natural gas maintenance, are primarily responsible for expected minor increases in labor costs.

Fuel costs are the primary and most uncertain operational cost. Staff assumed an annual mileage of 43,500 miles/year for urban buses. Natural gas engines are about 10 percent less efficient than diesel. Fuel cost differences in running buses on natural gas rather than diesel are therefore technologically precise, but, as is explained below, economically highly uncertain over the life of the regulation.

Although at present natural gas is less expensive than diesel, it is impossible to be certain about fossil fuel market conditions between now and 2020. In recent years CNG has been 15 - 20 percent more expensive (on a $/mile basis) than diesel. Thus, two cases were presented; one based on current fuel prices (D>NG) and another based on recent history (NG>D) (Tables 4 though 7). The current fuel prices were averages of retail and transit agency contract prices, and yielded a price difference of about $0.70/equivalent gallon. The recent historical prices were based on the past few years using California data from U.S. DOE EIA and South Coast agencies, which yielded a price difference of $0.10/gallon. Historically, natural gas prices have been between residual oil (#6) prices and heating oil (#2) prices. Diesel fuel is essentially the same as #2 oil. Thus, if market stability continues, natural gas may continue to be less expensive than diesel.

However, key parameters of the natural gas market appear to be changing. Canadian imports, which have met domestic demand growth in the past 10-15 years, are becoming insufficient. Knowledgeable observers expect liquefied natural gas (LNG) imports from Asia or the Mideast to meet demand growth for the foreseeable future, however there may be a period of turbulence as LNG terminals on the Pacific coast are still in the planning stages, and require at least 5 years to permit and construct. Natural gas prices are apparently now high enough to motivate investment in LNG import facilities. Also, it appears that LNG import terminals will be primarily designed to gasify LNG imports for pipeline distribution; it's unclear if sufficient LNG demand exists to also include dedicated LNG distribution which would avoid re-refrigeration costs. Staff estimates that transit agencies using LNG could realize noticeable if modest savings by avoiding these energy-based processing costs, given typical bus mileage and current and future energy prices.

At the same time, it is in the interests of oil producers to keep prices high enough to make as much money as they can, but low enough so users aren't really motivated to make changes which will reduce structural demand for oil and decrease their sales revenues.

In addition, environmental concerns continue to favor natural gas combustion over oil and coal, and demand for cleaner fuels may well continue to push up natural gas prices. However, it should be noted that imported LNG tends to include minor fractions of petroleum gases heavier than methane; if used as-is for transportation, these fractions would affect emissions slightly. The vast majority of natural gas is used for heating and other industrial processes; transportation is a minuscule portion of consumption. Thus, natural gas prices will be determined by forces largely unrelated to motor vehicle use.

Another aspect of infrastructure that may affect short-term prices would be the amount of natural gas storage in the South Coast region. Lack of sufficient storage may expose natural gas buyers to short-term price spikes, especially when demand equals or exceeds supply.

Historically, almost all LNG has been sold in long-term contracts with stable (though not necessarily unchanging) prices. Observers report that the market is diversifying, with short and medium term contracts becoming more available. Transit agencies that commit themselves to natural gas as a fuel would be well-advised to seriously consider medium or long-term contracts to ensure price stability for themselves, as well as to obtain the lower per-unit prices typical of larger contracts.

Lastly, reduced heating demand due to consistent weather changes such as global warming would tend to keep natural gas prices from rising as much as otherwise.

No extra fuel cost was included for gasoline HEBs, as HEB efficiencies and modest repair costs are expected to offset any price premium between gasoline HEBs and diesel.

5. Present-Value Cost Basis

All costs are presented in present value terms of 2005 dollars, where the "present" is defined as July 1, 2005. Capital costs are simply discounted at the annual real interest rate of 0.05, exclusive of inflation. Thus, current prices can be used for future purchases. Ongoing annual costs, such as maintenance and fuel, are also discounted at the real interest rate to put them in terms of 2005 dollars.

For converting future values (FV) to present values (PV), the standard formula PV/FV = 1/((1+r)^n) is used, where r is the real interest rate and n is the number of years in the future. The standard formula for converting present value to an equal amount (AV) spread over a certain number of years can also be used to evaluate how initial capital expenditures can be financed. AV/PV = ((r(1+r)^n)/((1+r)^n-1), where r is the real interest rate and n is the number of years for which equal (amortized) annual amounts are desired. These equations can be found in many standard references, such as the study guide for the professional engineering exam (NCEES 2003).

All these costs are predictions of future prices, so they could vary noticeably depending on demand, competition, and economic conditions, among other reasons.

6. Summary of Expected Costs

The most likely cost of complying with Alternative 1.3 is about $319,000,000, not including fuel surcharges or savings over the years. On an annualized basis, this is equivalent to about $29,400,000 per year over the 16 years from 2005 to 2021. These values are in 2005 dollars. As mentioned above, substituting CNG for diesel may turn out to yield either costs or savings, as predictions of future fuel prices are by far the most uncertain of the estimates used in the cost analysis of this regulation. Based on current market conditions where diesel is more expensive, average savings are estimated to be about $200,000,000 over the life of the regulation. Based on recent years when natural gas has been more expensive, additional costs of about $128,000,000 are estimated. Thus, estimated total costs are presented without fuel, and with estimates for both possible fuel savings and costs, for clarity.

The most likely cost of complying with Alternative 2 is about $7,676,000, not including fuel surcharges or savings over the years. On an annualized basis, this is equivalent about $708,000 per year over the 16 years from 2005 to 2021. These values are in 2005 dollars. As mentioned above, substituting CNG for diesel may turn out to yield either costs or savings, as predictions of future fuel prices are by far the most uncertain of the estimates used in the cost analysis of this regulation. Based on current market conditions where diesel is more expensive, average savings are estimated to be about $1,552,000 over the life of the regulation. Based on recent years when natural gas has been more expensive, additional costs of about $984,000 are estimated. As with Alternative 1.3, estimated total costs are presented without fuel, and with estimates for both possible fuel savings and costs, for clarity.

As mentioned above, overall total costs for natural gas buses are higher than for gasoline HEBs, so the per-bus costs for natural gas buses shown in Table 4 are higher than in Table 5 where most of the buses are gasoline HEBs.

Table 4. Total Typical Costs for Statewide Alternative-Fuel Case

Total	Typical
All But Fuel	**$319,000,125**
w/ Fuel NG>D	$446,670,798
w/ Fuel D>NG	$117,677,083
Total Per Bus	
All But Fuel	$76,517
w/ Fuel NG>D	$107,141
el D>NG	$28,227
Annualized	
All But Fuel	**$29,434,112**
w/ Fuel NG>D	$41,214,273
w/ Fuel D>NG	$10,858,054

Table 5. Total Typical Costs for SCAQMD Diesel Path Agencies Only

Total	Typical
All But Fuel	**$7,675,748**
w/ Fuel NG>D	$8,659,981
w/ Fuel D>NG	$6,123,718
Total Per Bus	
All But Fuel	$26,745
w/ Fuel NG>D	$30,174
el D>NG	$21,337
Annualized	
All But Fuel	**$708,241**
w/ Fuel NG>D	$799,056
w/ Fuel D>NG	$565,035

The overall costs of this scenario can also be presented on an actual expected annual basis. The averages of the cost estimates in 2005 dollars were used in Tables 6 and 7 below.

Table 6. Annual Expected Costs for Statewide Alternative-Fuel Case

Expected Annual Costs in $2005						
	Capital	Operations	Fuel D>NG	Total (D>NG)	Fuel NG>D	Total (NG>D)
2005	$5,188,703	$833,237	-$898,976	$5,122,965	$570,093	$6,592,033
2006	$3,268,475	$1,318,432	-$1,422,451	$3,164,456	$902,059	$5,488,966
2007	$14,155,979	$3,528,911	-$3,807,327	$13,877,562	$2,414,448	$20,099,338
2008	$14,117,156	$5,627,895	-$6,071,912	$13,673,139	$3,850,553	$23,595,605
2009	$12,739,053	$7,405,622	-$7,989,895	$12,154,781	$5,066,858	$25,211,533
2010	$31,755,599	$12,152,500	-$13,111,281	$30,796,818	$8,314,627	$52,222,726
2011	$23,658,165	$15,372,996	-$16,585,860	$22,445,301	$10,518,060	$49,549,221
2012	$5,487,719	$15,522,203	-$16,746,839	$4,263,083	$10,620,146	$31,630,068
2013	$6,636,697	$15,848,815	-$17,099,220	$5,386,292	$10,843,612	$33,329,124
2014	$7,189,755	$16,248,689	-$17,530,642	$5,907,802	$11,117,201	$34,555,645
2015	$8,201,814	$16,792,044	-$18,116,865	$6,876,992	$11,488,960	$36,482,817
2016		$15,992,423	-$17,254,157	-$1,261,734	$10,941,866	$26,934,289
2017		$14,766,901	-$15,931,947	-$1,165,046	$10,103,376	$24,870,277
2018		$13,771,446	-$14,857,955	-$1,086,509	$9,422,295	$23,193,741
2019		$11,849,826	-$12,784,727	-$934,901	$8,107,540	$19,957,366
2020		$10,023,183	-$10,813,970	-$790,787	$6,857,768	$16,880,951
2021		$9,545,889	-$10,299,019	-$753,130	$6,531,208	$16,077,096

Table 7. Annual Expected Costs for SCAQMD Diesel Path Agencies Only

Expected Annual Costs in $2005						
	Capital	Operations	Fuel D>NG	Total (D>NG)	Fuel NG>D	Total (NG>D)
2005	$1,882,737	$91,853	-$99,100	$1,875,491	$62,845	$2,037,435
2006	$537,665	$87,479	-$94,381	$530,764	$59,852	$684,997
2007	$1,306,129	$136,872	-$147,670	$1,295,331	$93,646	$1,536,648
2008	$1,357,018	$130,354	-$140,638	$1,346,734	$89,187	$1,576,559
2009	$1,029,880	$124,147	-$133,941	$1,020,085	$84,940	$1,238,967
2010		$118,235	-$127,563	-$9,328	$80,895	$199,130
2011		$112,605	-$121,489	-$8,884	$77,043	$189,648
2012		$107,243	-$115,704	-$8,461	$73,374	$180,617
2013		$102,136	-$110,194	-$8,058	$69,880	$172,016
2014		$97,272	-$104,947	-$7,674	$66,553	$163,825
2015		$92,640	-$99,949	-$7,309	$63,384	$156,024
2016		$88,229	-$95,190	-$6,961	$60,365	$148,594
2017		$66,528	-$35,474	$31,053	$22,496	$89,024
2018		$63,360	-$33,785	$29,575	$21,425	$84,785
2019		$50,139	-$32,176	$17,962	$20,405	$70,543
2020		$47,751	-$30,644	$17,107	$19,433	$67,184
2021		$45,477	-$29,185	$16,292	$18,508	$63,985

II. References

FTA 2004. U.S. Department of Transportation Federal Transit Administration10-01-98. Urbanized Area Formula Program: Grant Application Instructions. Number C 9030.1C http://www.fta.dot.gov/legal/guidance/circulars/9000/433_1152_ENG_HTML.htm

NCEES 2005. Fundamentals of Engineering Supplied-Reference Handbook, 7th Edition. National Council of Examiners for Engineering and Surveying. Pages 92-93. National Council of Examiners for Engineering and Surveying, Clemson, South Carolina 29631.
http://www.ncees.org/exams/study_materials/fe_handbook/fe_engineering_economics.pdf

Consulted for Background:

Avera, Dave. Personal Communication. April 13, 2004. Department of General Services. E-mail from Dave Avera to Kathleen Mead

Fujime, Kazuya. April 2002. LNG Market and Price Formation in East Asia. Institute of Energy Economics, Japan. http://eneken.ieej.or.jp/en/data/pdf/127.pdf

Mundy, Dan. Personal Communication. August 13, 2004. Telephone conversation with Muriel Strand, Project Manager, Transit and Procurement, Department of Transportation, Division of Mass Transportation, Sacramento, California.

Norton, Paul. The Right Way to Calculate Fuel Cost Conversions. Natural Gas Fuels, August 1996, p. 13-14.

Simmons & Co International. January 18, 2005. Outlook for Natural Gas: 2005 and Beyond. http://www.simmonsco-intl.com/files/011805.pdf via http://www.simmonsco-intl.com/research.aspx?Type=researchreports

U.S. DOE. World LNG Market Structure April, 19, 2004. Energy Information Administration, http://www.eia.doe.gov/oiaf/analysispaper/global/lngmarket.html

U.S. DOE. Annual Energy Outlook 2005. Energy Information Administration. http://www.eia.doe.gov/oiaf/aeo/overview.html

U.S. DOE, The Alternative Fuel Price Report. Energy Efficiency and Renewable Energy, Alternative Fuels Data Center. March 28, 2005 http://www.eere.energy.gov/afdc/resources/pricereport/pdfs/afpr_03_28_05.pdf

Vauthier, Max. LNG Trade: the 2006/2008 Horizon, LNG Journal, March/April 2004., Drewry House, 213 Marsh Wall, London, E14 9FJ, UK http://www.lngjournal.com/articleMarApr04p13-15.htm

Vaitheeswaran, Vijay. Oil in troubled waters. The Economist. April, 28, 2005 http://www.economist.com/displaystory.cfm?story_id=3884623

TITLE 13. CALIFORNIA AIR RESOURCES BOARD

NOTICE OF PUBLIC HEARING TO CONSIDER AMENDMENTS TO THE REGULATIONS FOR PORTABLE FUEL CONTAINERS

The Air Resources Board (the Board or ARB) will conduct a public hearing at the time and place noted below to consider adoption of amendments to the regulations and test procedures for portable fuel containers.

DATE: September 15-16, 2005

TIME: 9:00 a.m.

PLACE: South Coast Air Quality Management District
Auditorium
21865 E. Copley Dr.
Diamond Bar, CA 91765

This item will be considered at a two-day meeting of the Board, which will commence at 9:00 a.m., September 15, 2005, and will continue at 8:30 a.m., September 16, 2005. This item may not be considered until September 16, 2005. Please consult the agenda for the meeting, which will be available at least 10 days before September 15, 2005, to determine the day on which this item will be considered.

If you have a disability-related accommodation need, please go to http://www.arb.ca.gov/html/ada/ada.htm for assistance or contact the ADA Coordinator at (916) 323-4916. If you are a person who needs assistance in a language other than English, please contact the Bilingual Coordinator at (916) 324-5049. 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 amendments to title 13, California Code of Regulations, sections 2467, 2467.1, 2467.2, 2467.3, 2467.4, 2467.5, 2467.6, 2467.7; repeal of section 2467.8, and adoption of new sections 2467.8 and 2467.9. Proposed adoption of the incorporated "Certification Procedure, CP-501 for Portable Fuel Containers and Spill-Proof Spouts," "Test Procedures, TP-501 Determination of Integrity of Spill-Proof Spouts and Spill-Proof Systems," and "TP-502 Determination of Diurnal Emissions from Portable Fuel Containers." Proposed amendments to "Test Method 510, Automatic Shut-Off Test Procedure for Spill-Proof Systems and Spill-Proof Spouts," adopted July 6, 2000, and Repeal of "Test Method 512, Determination of Fuel Flow Rate for Spill Proof Systems and Spill Proof Spouts, adopted July 6, 2000."

Staff is proposing amendments to the regulations controlling emissions from portable fuel containers (PFC). The PFCs or "gas cans" are used to store and dispense fuel into on-road and off-road mobile sources.

The Board adopted regulations to control the emissions from PFCs in September 1999. The current regulations reduce emissions from three main processes: evaporation of fuel vapors through PFC openings, permeation of fuel through PFC container walls, and spillage during fueling events. The current PFC regulations were fully implemented in 2001 and are projected to result in a reduction of about 75 tons per day (tpd) of reactive organic gases (ROG) emissions statewide by 2007.

Shortly after implementation of the PFC regulations, consumers began to express complaints regarding spillage from the new PFCs. The ARB staff researched these complaints and learned that while the regulations have been successful in reducing emissions from evaporation and permeation, emissions from spillage continued to occur. Furthermore, ARB staff received complaints expressing dissatisfaction with the design and functionality of the PFC "spill-proof" spouts.

Other issues that have been identified during implementation of the regulations are poor production quality and the use of non-regulated containers for gasoline storage.

In response to the issues encountered with the current regulations, ARB staff is proposing the following amendments:

- Modify the existing spout regulations to improve spillage control;
- Include a voluntary Consumer Acceptance Program to support and encourage user-friendly PFC designs;
- Establish a certification program for PFCs to improve product quality;
- Clarify the definition of a PFC to include presently non-compliant containers;
- Combine the evaporation and permeation standards into a new diurnal standard to simplify certification and compliance testing; and,
- Adopt new PFC test procedures to streamline testing.

The ARB staff estimates that with the approval of the proposed amendments, ROG emissions will be reduced by 18.4 tpd by the year 2015. These emission reductions result from reducing emissions from spillage by removing the automatic shutoff requirement, adding kerosene containers into the regulations, clarifying the definition of a PFC to include utility jugs, and incorporating a diurnal standard.

The amendments are expected to have little effect on the cost of PFCs meeting current standards. However, ARB staff estimates that consumers will pay about $8.50 more when purchasing a compliant kerosene container or utility jug in lieu of a non-compliant substitute container. The total cost from the proposed amendments will be about $17 million over a five-year period, including costs associated with the proposed certification program and new test procedures. The estimated cost-effectiveness for this proposal is about $ .40 to $ .70 per pound of ROG reduced. This cost-effectiveness figure

compares favorably with values for the small off-road engines (SORE) regulations recently adopted by the Board that had a cost-effectiveness range of under $2.00 to over $6.00 per pound of hydrocarbons reduced.

The ARB staff conducted five public workshops and had over 60 meetings with manufacturers and other interested parties during development of the proposed amendments. In addition, ARB staff considered alternatives to the proposal including no action, retaining the current requirements and adding a consumer education program, imposing a diurnal standard and certification program, and the current proposal. The ARB staff determined that adopting the proposal is technologically feasible, cost-effective and provides the greatest benefits to the people of California.

COMPARABLE FEDERAL REGULATIONS

The U.S. EPA is considering national standards for portable fuel containers and has attended meetings and public workshops held by the ARB on this topic. Currently, no comparable federal regulations pertaining to portable fuel containers have been adopted.

AVAILABILITY OF DOCUMENTS AND AGENCY CONTACT PERSONS

The Board staff has prepared a Staff Report: Initial Statement of Reasons (ISOR) for the proposed regulatory action, which includes a summary of the economic and environmental impacts of the proposal. The report is entitled: Initial Statement of Reasons for Proposed Amendments to the Portable Fuel Container Regulations, and includes a summary of the economic and environmental impacts of the proposal.

Copies of the ISOR and the full text of the proposed regulatory language, in underline and strikeout format to allow for comparison with the existing regulations, may be accessed on 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, CA 95814, (916) 322-2990 at least 45 days prior to the scheduled hearing September 15, 2005.

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 ARB's web site listed below.

Inquiries concerning the substance of the proposed regulation may be directed to the designated agency contact person, Mr. Dennis Goodenow, at (916) 322-2886 or dgoodeno@arb.ca.gov.

Further, the agency representative and designated back-up contact persons to who non-substantive inquiries concerning the proposed administrative action may be directed are Artavia Edwards, Manager, Board Administration & Regulatory Coordination Unit, (916) 322-6070, or Amy Whiting, Regulations Coordinator,

(916) 322-6533. 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 contact persons.

This notice, the ISOR and all subsequent regulatory documents, including the FSOR, when completed, are available on the ARB Internet site for this rulemaking at www.arb.ca.gov/regact/pfc/2005/pfc2005.htm

COSTS TO PUBLIC AGENCIES AND TO BUSINESSES AND PERSONS AFFECTED

The determinations of the Board's 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 not create costs or savings to any state agency or 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, the ARB staff evaluated the potential economic impacts on representative private persons or businesses. Designing the automatic shutoff feature has been reported by PFC manufacturers to be one of the most costly aspects of the current PFC regulations. Removing this feature will most likely result in a cost savings. No costs have been attributed to this amendment. To estimate the cost of the proposed certification program ARB staff used data supplied by independent test companies and manufacturers' hourly labor rates. ARB staff estimates that it will cost a typical manufacturer $4,000 to comply with the program. There are currently eight manufacturers producing PFCs for the California market, thus the cost of adding the certification program is $32,000. Assuming that eight manufacturers sell about 1.9 million PFCs in the State each year, certification will cost about $.02 per PFC. These costs would likely be passed on to the consumer. The proposed amendments would potentially increase the cost of a kerosene container or utility jug by $6.00 to $11.00, or an average of about $8.50 per container. The increased cost is attributed to material and production costs associated with adding control technologies for evaporation, permeation, and spillage. In total, this will result in a cost of approximately $17 million (0.6 million kerosene containers plus 1.4 million utility jugs x $8.50 per container). This amounts to a price increase of about $1.70 per container per year over the estimated five-year useful life of the kerosene container. It is expected that the useful life of a utility jug is more than five years, thus the cost per year would be less. The cost of complying with the proposed diurnal emission standard is not expected to be substantially different from complying with the existing permeation standard in the PFC regulations. The total cost from the proposed amendments will be about $17 million over a five-year period including costs associated with the proposed certification program and new test procedures.

The Executive Officer has made an initial determination that the proposed regulatory action will not have a significant statewide adverse economic impact directly affecting businesses, including the ability of California businesses to compete with businesses in other states, or on representative private persons.

In accordance with Government Code section 11346.3, the Executive Officer has determined that the proposed regulatory action will not affect the creation or elimination of jobs within the State of California, the creation of new businesses or elimination of existing businesses within the State of California, or the expansion of businesses currently doing business within the State of California. A detailed assessment of the economic impacts of the proposed regulatory action can be found in the ISOR.

The Executive Officer has also determined, pursuant to title 1, CCR, section 4, that the proposed regulatory action will have some impact, although not significant, on small business that buy and sell kerosene containers. During the initial years of implementation, the increased cost may lead to a slight drop in demand that could result in lower profits for businesses.

In accordance with Government Code sections 11346.3(c) and 11346.5(a)(11), the Executive Officer has found that the reporting requirements of the regulation which apply to businesses are necessary for the health, safety, and welfare of the people of the State of California.

Before taking final action on the proposed regulatory action, the Board must determine that no reasonable alternative considered by the board or that has otherwise been identified and brought to the attention of the board 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.

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 **no later than 12:00 noon, September 14, 2005**, 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, CA 95814

Electronic mail is to be sent to: pfc2005@listserv.arb.ca.gov and received at the ARB **no later than 12:00 noon, September 14, 2005**.

Facsimile transmissions 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 September 14, 2005.** 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 board encourages members of the public to bring to the attention of 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 sections 39600, 39601, 43013, 43018, and 43101, of the Health and Safety Code, and *Western Oil and Gas Ass'n. V. Orange County Pollution Control District,* 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975). The action is proposed to implement, interpret and make specific sections 39000, 39001, 39003, 39500, 39515, 39516, 41511, 43000, 43013, 43016, 43017, and 43018 of the Health and Safety Code, and *Western Oil and Gas Ass'n. V. Orange County Pollution Control District,* 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975).

HEARING PROCEDURES

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 non substantial 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 ARB's Public Information Office, Air Resources Board, 1001 I Street, Visitors and Environmental Services Center, 1st Floor, Sacramento, CA 95814, (916) 322-2990.

CALIFORNIA AIR RESOURCES BOARD

Catherine Witherspoon
Executive Officer

Date: July 19, 2005

California Environmental Protection Agency

Air Resources Board

STAFF REPORT
INITIAL STATEMENT OF REASONS FOR PROPOSED AMENDMENTS TO THE PORTABLE FUEL CONTAINER REGULATIONS

Date of Release: July 29, 2005
Scheduled for Consideration: September 15, 2005

Location:
South Coast Air Quality Management District
21865 E. Copley Dr.
Diamond Bar, California

Air Resources Board
P.O. Box 2815
Sacramento, CA 95812

This report has been reviewed by the staff of the California Air Resources Board and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Air Resources Board, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

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Table of Contents

EXECUTIVE SUMMARY **4**

1. INTRODUCTION **6**

2. BACKGROUND **7**

2.1 LEGAL AUTHORITY 7
2.2 REGULATORY HISTORY 7
2.3 EMISSIONS INVENTORY 7
2.3.1 1999 Staff Report *7*
2.3.2 2004 Update *8*
2.4 RELATED FEDERAL REGULATIONS 10
2.5 PUBLIC PROCESS 11
2.6 WORKSHOPS 11
2.7 MEETINGS 11

3. NEED FOR REGULATORY CHANGES **12**

3.1 STATE IMPLEMENTATION PLAN (OZONE) 12
3.1.1 SIP Settlement *12*
3.2 ISSUES WITH THE CURRENT REGULATIONS 13
3.2.1 Low Consumer Acceptance and Spout Incompatibility *14*
3.2.2 Non-uniform Production Quality *15*
3.2.3 Use of Non-Regulated Containers with Gasoline *16*
3.2.4 Diurnal Standard and Incompatible Test Methods *16*

4. SUMMARY OF PROPOSAL **16**

4.1 MODIFY THE EXISTING SPOUT REGULATIONS 17
4.2 CONSUMER ACCEPTANCE AND ARB STAR RATING 18
4.3 ESTABLISH A CERTIFICATION PROGRAM FOR PFCS 19
4.4 AMENDMENT TO PFC DEFINITION 20
4.5 DIURNAL STANDARD 20
4.5.1 Sources of Diurnal Emissions *20*
4.5.2 Technology to Control Diurnal Emissions *21*
4.5.3 Development of Diurnal Test Procedure *21*
4.5.4 Feasibility of Diurnal Standard *21*
4.6 IMPROVED PFC TEST PROCEDURES 22
4.6.1 Spill-Proof Spout Test Procedure *22*
4.6.2 Diurnal Emission Test Procedure *23*
4.7 OTHER NON-SUBSTANTIVE MODIFICATIONS 23

5. ENVIRONMENTAL AND ECONOMIC IMPACTS **23**

5.1 ENVIRONMENTAL IMPACT 23
5.1.1 Emission Reductions *23*
5.1.2 Reduced Exposure to Toxic Air Pollutants *24*
5.1.3 Environmental Justice *24*
5.2 COST AND COST-EFFECTIVENESS 25
5.2.1 Cost Estimates to Reduce Emissions and Implement Certification *25*
5.2.2 Cost-Effectiveness of Proposed Amendments *26*
5.3 ECONOMIC IMPACT ON THE ECONOMY OF THE STATE 27
5.3.1 Legal Requirement *27*
5.3.2 Businesses Affected *28*
5.3.3 Impact on Small Businesses *28*
5.3.4 Potential Impact on Distributors and Dealers *29*

5.3.5 Potential Impact on Business Competitiveness *29*
5.3.6 Potential Impact on Employment *29*

6. ALTERNATIVES CONSIDERED **29**

6.1 NO ACTION 29
6.2 RETAIN CURRENT REGULATIONS AND ADD A CONSUMER EDUCATION PROGRAM 30
6.3 IMPOSE A DIURNAL STANDARD AND CERTIFICATION PROGRAM 30

7. ISSUES **30**

7.1 NOTICE TO DISTRIBUTORS AND RETAILERS FOR NEWLY REGULATED PFCS 30
7.2 OPPOSITION TO REMOVING THE AUTOMATIC SHUTOFF REQUIREMENT 31
7.3 COORDINATION WITH EPA CONCERNING PROPOSED DIURNAL TEST PROCEDURE 31

8. CONCLUSIONS AND RECOMMENDATIONS **32**

9. REFERENCES **32**

APPENDIX A: Proposed Amendments to the Portable Fuel Container Regulations

APPENDIX B: Proposed CP-501, Certification Procedure For Portable Fuel Containers And Spill-Proof Spouts

APPENDIX C: Proposed TP-501, Test Procedure for Determining Integrity of Spill-Proof Spouts and Spill-Proof Systems

APPENDIX D: Proposed Amendments to Test Method 510 Automatic Shut-Off Test Procedure for Spill-Proof Systems and Spill-Proof Spouts

APPENDIX E: Proposed Amendments to Test Method 511 Automatic Closure Test Procedure for Spill-Proof Systems and Spill-Proof Spouts

APPENDIX F: Proposed Amendments to Test Method 512 Determination of Fuel Flow Rate for Spill-Proof Systems and Spill-Proof Spouts

APPENDIX G: Proposed TP-502, Test Procedure for Determining Diurnal Emissions from Portable Fuel Containers

APPENDIX H: Proposed Amendments to Test Method 513 Determination of Permeation Rate for Spill-Proof Systems

EXECUTIVE SUMMARY

Staff proposes to amend existing regulations controlling emissions from portable fuel containers (PFCs). PFCs or "gas cans" are used to store and dispense fuel into on-road and off-road mobile sources. While the emissions from a single PFC may be small, Air Resources Board (ARB or Board) staff estimates that the uncontrolled emissions from the nearly 10 million PFCs in California in 1999 resulted in about 100 tons per day (tpd) of reactive organic gases (ROG). By comparison, all the lawn and garden equipment in California emits about the same amount of ROG as the gas cans that fuel them.

The Board adopted regulations to reduce these uncontrolled emissions from PFCs in September 1999. The current regulations reduce emissions from three main processes: evaporation of fuel vapors through PFC openings, permeation of fuel through PFC container walls, and spillage during fueling events. The current PFC regulations were fully implemented in 2001 and were projected to result in a reduction of about 75 tpd of ROG emissions statewide by 2007. However, after four years of implementation and a comprehensive assessment of the program, ARB staff has identified problems that are reducing the effectiveness of the current regulations.

Shortly after implementing the PFC regulations, consumers began to express complaints regarding spillage from the new PFCs. Specifically, ARB staff received complaints expressing dissatisfaction with the design and functionality of the PFC's "spill-proof" spouts. ARB staff researched these complaints and learned that while the regulations have been successful in reducing emissions from evaporation and permeation, emissions from spillage continued to occur. This is a direct result of the spout design.

Current PFC regulations include performance standards for PFCs. Standards exist for fill height, flow rate, pressure maintenance, automatic closure, and automatic shutoff. The automatic shutoff requirement was specifically designed to control spillage by ensuring the flow of gasoline stops when the fuel going into a target fuel tank reached a prescribed level. Consumers have expressed frustration concerning the automatic shutoff feature and generally find the feature difficult to use for the following reasons:

- Use of the automatic shutoff feature is not intuitive;
- Automatic shutoff designs have led to difficulties in fueling, therefore causing spillage; and,
- Non-uniform fuel tank designs and fuel tank openings have rendered the automatic shutoff feature incompatible with some equipment.

Other issues that have emerged from the implementation of the regulations are poor production quality and the use of non-regulated containers for gasoline storage. ARB compliance tests show that many PFCs fail to comply with the original regulations, and the failures commonly result from poor production quality. Also, kerosene containers

that are not subject to the current regulations have become inexpensive PFC substitutes. Additionally, uncontrolled utility jugs are being used to store and transfer gasoline.

ARB staff sponsored two statewide surveys and a consumer focus group to obtain information from consumers concerning their experiences using PFCs, as well as to obtain information relating to the number of PFCs used in California. These studies have provided ARB staff with information about the effectiveness of the current regulations, data to improve emission estimates, and insights to further identify problem areas with the regulations. In response to the issues identified with the current regulations, ARB staff is proposing the following amendments:

- Modify the existing spout regulations to improve spillage control;
- Include a voluntary Consumer Acceptance Program to support and encourage user-friendly PFC designs;
- Establish a certification program for PFCs to improve product quality;
- Expand the definition of a PFC to include presently non-compliant containers;
- Combine the evaporation and permeation standards into a new diurnal standard to simplify certification and compliance testing; and,
- Adopt new PFC test procedures to streamline testing.

Approval of the proposed amendments will reduce ROG emissions by more than 18 tons per day (tpd) by the year 2015. These emission reductions result from removing the automatic shutoff feature, thus reducing emissions from spillage, adding kerosene containers and utility jugs into the regulations, and adopting a more stringent diurnal standard.

These amendments are expected to have little effect on the cost of existing PFCs that meet current standards. However, ARB staff estimates that consumers will pay an additional $8.50 when purchasing a compliant kerosene container or utility jug in lieu of a non-compliant substitute container. The total cost from the proposed amendments will be about $17 million over a five-year period including costs associated with the proposed certification program and new test procedures. The estimated cost-effectiveness for this proposal is about $.40 to $.70 per pound of ROG reduced. This cost-effectiveness figure compares favorably with values for the small off-road engines (SORE) regulations recently adopted by the Board that had a cost-effectiveness range of under $2.00 to over $6.00 per pound of hydrocarbons reduced.

ARB staff conducted five public workshops and had over 60 meetings with manufacturers and other interested parties during development of the proposed amendments. In addition, ARB staff considered alternatives to the proposal including no action, retain the current requirements and add a consumer education program, impose a diurnal standard and certification program, and the current proposal. ARB staff believes the proposal is technologically feasible, cost-effective and provides the greatest benefits to the people of California.

1. INTRODUCTION

PFCs or "gas cans" are made of either high-density polyethylene (HDPE or plastic) or metal and are sold in a variety of shapes and sizes typically ranging from one to five gallons capacity. PFCs are used to store and dispense fuel into on-road and off-road mobile sources, including a broad range of small engines and equipment (e.g., lawnmowers, leaf blowers, personal watercraft, all-terrain vehicles, etc.).

Reactive Organic Gas (ROG) emissions from PFCs come from evaporation, permeation, and spillage of gasoline. Even though the emissions from a single PFC are small, over 10 million PFCs were in use in California in 1999, and emitted over 100 tons per day (tpd) of ROG. The primary source of PFC emissions (about 72 tpd) was associated with fuel evaporation from vents and other types of openings. Permeation contributed about 8 tpd of ROG emissions, as did spillage. Spillage from PFCs occurs when attempting to pour fuel, removing the spout from a target tank, or in some cases, when a tank is overfilled. About 12 tpd came from other sources.

In September 1999, the Board adopted the current PFC regulations to reduce PFC emissions. The regulations were implemented in January 2001. The regulations were expected to reduce over 75 tpd of ROG emissions in 2007, by controlling evaporation, permeation, and spillage from PFCs.

Shortly after implementing the PFC regulations consumers began to express complaints regarding spillage from the new PFCs "spill-proof" spouts and systems. ARB staff researched these complaints and learned that the regulations have been successful in reducing emissions from evaporation and permeation, however emissions from spillage continued to occur. Although, the new PFCs work well with some equipment, there are many instances where the spouts are too large or inflexible to fit into various types of non-standardized tanks. Consumers find some of the features helpful, but others difficult and impractical to use.

Other issues that have emerged from the implementation of the regulations are poor production quality of spouts, and the use of non-regulated containers for gasoline storage. ARB staff randomly tests PFCs for compliance. These tests show that many PFCs fail to comply with the original regulations and the failures commonly result from poor production quality. Also, kerosene containers that were not included in the original regulations have become inexpensive PFC substitutes. In addition, utility jugs that were intended to be included in the regulations are sold with no emission controls due to unclear regulatory language.

In response to the issues encountered with the current regulations, ARB staff is proposing the following amendments:

- Modify the existing spout regulations to improve spillage control;
- Include a voluntary Consumer Acceptance Program to support and encourage user-friendly PFC designs;

- Establish a certification program for PFCs to improve product quality;
- Expand the definition of a PFC to include presently non-compliant containers;
- Combine the evaporation and permeation standards into a new diurnal standard to simplify certification and compliance testing; and,
- Adopt new PFC test procedures to streamline testing.

The amendments included in this document are aimed at maximizing emission reductions from PFCs in a cost-effective manner while improving consumer acceptance of spill-proof systems. This document describes the need for the amendments, provides a summary of the ARB staff's proposal, identifies environmental and economic impacts, and discusses the alternatives that were considered and issues that have not been resolved.

2. BACKGROUND

The background portion of this report includes the legal authority, regulatory history, emissions inventory, related federal programs to control emissions from PFCs, and the public process used in these proceedings.

2.1 Legal Authority

In 1988, the California legislature enacted the California Clean Air Act (CCAA), which declared that attainment of State ambient air quality standards is necessary to promote and protect public health, particularly the health of children, older people, and those with respiratory diseases. The legislature also directed that these standards be attained by the earliest practicable date.

The CCAA as codified in the Health and Safety Code (HSC) Sections 43013 and 43018 grants the ARB authority to regulate off-road mobile sources of emissions and fuels. Such sources include jet skis, all-terrain vehicles, off-road motorcycles and small off-road engines. These sources are often refueled using PFCs, and ARB is therefore authorized to regulate PFCs as adjuncts to existing and proposed off-road engine regulations, as a separate off-road mobile source category, and as an emission source associated with motor vehicle fuel.

2.2 Regulatory History

The current PFC regulations were filed with the Secretary of State on September 11, 1999 and became fully applicable on January 1, 2001.

2.3 Emissions Inventory

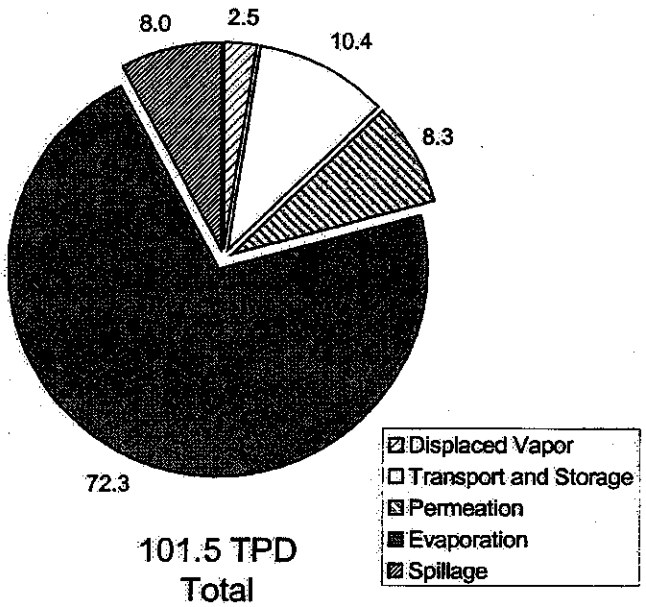
2.3.1 1999 Staff Report

In the1999 PFC rulemaking, ARB staff estimated that if left uncontrolled PFCs in California would emit 101.5 tpd of ROG by the year 2007. As a result of

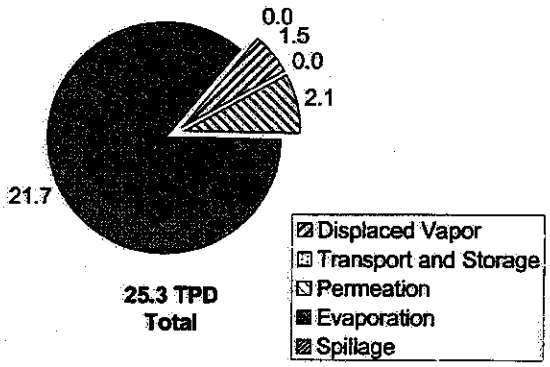
implementing the 1999 regulations, emissions were projected to be reduced to 25.3 tpd of ROG. Chart 2.1 summarizes the different emission categories and individual contributions as projected for 2007. As can be seen, the largest portion of the emissions comes from the evaporation category.

Chart 2.1
1999 Estimate of Emissions

Uncontrolled PFC Emissions - 2007



Controlled PFC Emissions - 2007



2.3.2 2004 Update

This Section discusses changes and adjustments to our estimate of emissions based on new information and an analysis of the effectiveness of the existing regulations. Between February and December 2004, ARB staff contracted with the California State University, Sacramento to conduct two PFC surveys. The main objective was to obtain information from residential and commercial users about their experiences using PFCs. A secondary objective was to gain information related to the number of kerosene containers and other types of containers used for gasoline but not controlled under the current regulations. In the two surveys, Analysis of 2004 California Household Portable Fuel Container Survey (September 2004) and Analysis of the 2004 California Commercial Portable Fuel Container Survey (January 2005) the results revealed changes in the estimated number of PFCs and the penetration rate of compliant PFCs. The penetration rate is

based on the number of compliant PFCs that have replaced the "old style", non-compliant PFCs. In addition, the surveys identified 590,000 uncontrolled kerosene containers, with 350,000 being used for storage and dispensing of gasoline in California, and 1.4 million uncontrolled utility jugs that are being inappropriately used to store gasoline. Table 2.1 describes the differences between the 1999 and 2004 population estimates.

Table 2.1

Comparison of 1999 and 2004 PFC Population Estimates For Year 2007				
1999 PFC Estimates			2004 PFC Estimates	
Residential	10,000,000		Residential	9,500,000
Commercial	630,000		Commercial	210,000
			Utility Jugs	1,400,000
			Kerosene	590,000
Total PFCs	10,630,000		Total PFCs	11,700,000

The PFC surveys show that more PFCs are used in California than expected based on the 1999 survey, and there are fewer commercial PFCs than originally estimated. Also, the number of metal PFCs compared to plastic PFCs has decreased, resulting in more emissions from permeation. This is because metal containers permeate less than plastic PFCs.

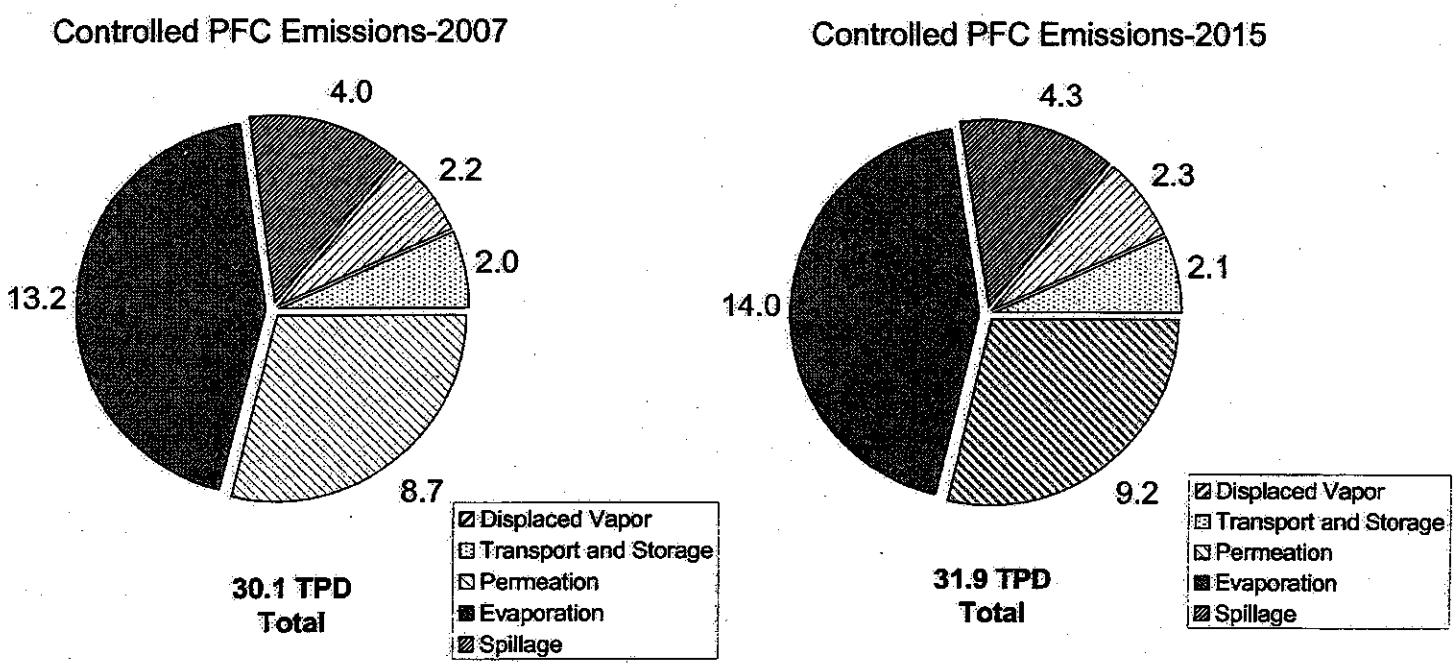
In addition, ARB staff quantified the emissions that occur when the PFCs are vented prior to fueling. The data are included in the report Quantification of Vent Emissions from Portable Fuel Containers Prior to Fueling (May 2005). The changes in population and data on emissions from venting were used to revise our emission estimates. Details regarding the proposed emissions adjustments can be found in the report Revised California's Portable Gasoline Container Emissions Inventory (May 2005). The effects of the changes to the 2007 controlled ROG emissions inventory are shown in Chart 2.2.

As a result of the ARB staff investigation into the numerous consumer complaints regarding spillage and the incompatibility issues resulting from the automatic shutoff feature, ARB staff realized that the 1999 regulations did not achieve all the emission reductions expected. ARB staff had estimated in 1999 that 8 tpd of ROG emissions due to spillage would be fully controlled in 2007. ARB staff now believes the ROG emissions from spillage will only be reduced by about half in 2007. Likewise, ARB staff had expected emissions from utility jugs to be controlled like any other PFC. However, because the definition of a PFC in the regulations was unclear, utility jugs have been sold for use with gasoline without controls. These emissions are estimated to be 14.5 tpd of ROG in 2007. Kerosene containers are also being used

to store gasoline, contributing another 3.4 tpd of ROG in 2007. Also, ARB staff had expected emissions from evaporation to be reduced from 72.3 tpd of ROG in 1999 to 21.7 tpd of ROG in 2007. In fact, ARB staff now believes that by including kerosene containers and utility jugs, evaporation emissions will be reduced to 9.2 tpd ROG in 2007.

The better than expected emission reductions from evaporation, the less than expected emission reductions from spillage, and the uncontrolled emissions from kerosene containers and utility jugs are included in our revised estimate of 2007 emissions. With no additional controls or amendments to these regulations, the effect of the major additions and adjustments to our estimate of ROG emissions will result in 30.1 tpd of ROG emissions in 2007 compared to our 1999 estimate of 23.5 tpd. In 2015 ROG emissions will be 31.9 tpd. The emissions for these two years are very similar. The growth in the number of PFCs and the controls in effect are offsetting. Both the 2007 and 2015 emission estimates are presented in Chart 2.2.

Chart 2.2
2004 Estimate of Emissions



2.4 Related Federal Regulations

There are currently no federal regulations pertaining to controlling emissions from PFCs. However, the U.S. Environmental Protection Agency (EPA) is considering adopting national standards for PFCs. In the prior PFC rulemaking, ARB staff reviewed federal regulations applicable to workers safety and to safety in transporting PFCs to avoid conflicts. The proposed amendments would not effect the federal requirements.

2.5 Public Process

The proposed amendments incorporate comments and suggestions from PFC manufacturers, consultants, consumer groups, the public, and the EPA. Public information concerning the development of this proposal was made available on ARB's web site at www.arb.ca.gov/pfc/pfc.htm. Announcements regarding workshops and the release of regulatory documents were provided to over 290 manufacturers, distributors, dealers and interested parties via email by the ARB Portable Fuel Container list server.

2.6 Workshops

ARB staff conducted five public workshops to aid in developing the proposed amendments. Workshop notices were mailed to over 600 affected stakeholders comprised of PFC and engine manufacturers, recreational marine manufacturers and dealers, trade associations, and other interested public parties. ARB staff carefully considered the verbal and written comments received during this process. As a result of these comments, ARB staff made significant changes to the proposed amendments and certification and test procedures. Many of those changes are reflected in this proposal.

2.7 Meetings

Numerous meetings were conducted with PFC manufacturers as summarized in Table 2.4.

Table 2.4
List of Meetings

Stakeholder	Date(s)
A.S.T.M	02/16/04
Blitz	04/14/04, 05/04/04, 08/25/04, 08/26/04, 09/13/04, 02/22/05
Chilton	09/26/03, 04/14/04
Dupont	01/07/04, 03/16/04, 04/15/04, 04/26/04, 04/29/04, 05/13/04
Flow 'N Go	05/19/04
Mid West Can Company	04/19/04, 05/04/04, 08/25/04, 08/26/04, 09/14/04
No-Spill Research	04/15/04, 05/04/04
Portable Fuel Container Trade Association	07/26/04, 08/25/04, 08/26/04, 9/10/04, 10/27/04, 11/8/04, 12/08/04
Sceptor	02/16/04, 04/16/04, 05/04/04, 08/25/04, 08/26/04, 09/14/04
Scribner	05/04/04, 05/11/04, 05/12/04, 05/13/04, 08/25/04, 08/26/04
Speedy Spout	12/1/03, 01/8/04, 05/04/04, 04/04/05, 04/16/04,

	05/04/05, 08/25/04, 08/26/04, 09/14/04,
EPA	01/20/04, 02/26/04, 03/16/04, 04/27/04, 09/15/04, 01/18/05, 06/06/05
VP Racing	08/25/04, 08/26/04
Wedco	01/13/04, 01/27/04, 04/15/04, 05/04/04, 08/25/04, 08/26/04, 09/22/04, 02/23/05

3. NEED FOR REGULATORY CHANGES

The need for regulatory changes includes a discussion of the State Implementation Plan requirements and issues with the current regulations.

3.1 State Implementation Plan (Ozone)

On November 15, 1994, the ARB adopted the State Implementation Plan (SIP) for ozone that was subsequently approved by the EPA on September 25, 1996. The SIP serves as California's overall strategy for achieving national air quality standards for ozone. The SIP seeks to reduce air pollution in the most cost-effective manner, using a combination of performance standards and market-based programs to promote the introduction of cleaner technologies and expand compliance with existing control strategies. The 1994 SIP includes State measures to control mobile sources (including passenger cars, heavy-duty trucks and off-road equipment), local measures for stationary and area sources, and federal measures for sources under exclusive or practical federal control (such as planes and locomotives). California's SIPs for carbon monoxide and inhalable particulate matter also rely on controlling these sources. In addition, many areas in California still exceed the more stringent State ambient air quality standards for ozone and particulate matter.

Portable fuel containers are a significant source of ROG emissions in California. Reducing ROG emissions from PFCs will help improve California's air quality and are needed to achieve the State and federal air quality standards throughout California.

3.1.1 SIP Settlement

On January 28, 1999, the Board approved a settlement with three Los Angeles based environmental groups regarding the 1994 State Implementation Plan for Ozone (SIP) litigation (Coalition for Clean Air v. South Coast Air Quality Management District). The lawsuit was filed against the South Coast Air Quality Management District, the ARB, and the EPA for failure to implement specific measures contained in the 1994 SIP.

The settlement addressed emission reduction shortfalls in the South Coast Air Basin in 2010. Under the terms of the settlement, ARB is obligated to make up these shortfalls. The PFC control measure adopted in 1999 played a major role in making

up the emission reduction shortfalls in the South Coast Air Basin. This proposal will help assure these anticipated reductions are fully achieved.

3.2 Issues with the Current Regulations

Recognizing the significant ROG emissions from uncontrolled PFCs, the Board adopted regulations to control these emissions in September 1999. The current regulations include requirements to reduce emissions from three main processes: evaporation and permeation (which in this report are considered diurnal emissions) and spillage. The current regulations were fully implemented in 2001, although it will be many years before the controlled PFCs replace all of the non-controlled cans.

Based on our experiences in implementing and enforcing the current regulations, ARB staff has identified several issues relating to spillage and consumer acceptance. One issue is a direct result of the automatic shutoff feature included in the regulations. The automatic shutoff feature is designed to reduce spillage by stopping the flow of gasoline when the target fuel tank reaches a prescribed fill level. Manufacturers designed spouts that met the requirements of ARB regulations, but often the spouts were incompatible with many types of equipment fuel tanks. Consumers have become frustrated because of these incompatibilities. They claim the PFCs are difficult to use.

A second issue is that the current regulations do not impose production line testing or certification requirements on the PFC manufacturers. This has resulted in a high degree of variability with the production parts. As demonstrated through compliance testing, nearly half of the products tested fail to meet the regulations, largely due to poor quality control. Consequently, by the time ARB enforcement staff has identified non-complying PFCs, those PFCs have already been introduced for sale, and measures to recall non-compliant PFCs already in consumer hands are largely ineffective.

A third issue is the sale of non-compliant PFCs. Several manufacturers have been marketing containers used for carrying water and other fluids. These containers are nearly identical to the old, non-compliant PFCs, except in color. They are being sold adjacent to compliant PFCs on the shelves of retail stores. Some consumers are purchasing these non-compliant containers and filling them with gasoline. This slows down the turnover to low emission PFCs.

A final issue involves combining the evaporation and permeation controls into a diurnal standard, and changing the PFC test methods to be consistent with the proposed amendments. Changing the requirements and test methods for permeation and evaporation will simplify and reduce the costs associated with certification and enforcement procedures.

In summary, issues with the current regulations are:

- Low consumer acceptance and spout incompatibility;
- Non-uniform production quality;
- Use of non-regulated containers with gasoline; and,
- Diurnal standard and incompatible test methods.

3.2.1 Low Consumer Acceptance and Spout Incompatibility

Current PFCs are designed to comply with the regulation's automatic closure and automatic shutoff features, as well as fill height, flow rate, pressure and permeation standards. The automatic closure feature is designed to reduce emissions from evaporation and spillage. The automatic shutoff feature is also designed to reduce emissions from spillage. The fill height and flow rate standards are designed to ensure the tank fills fully and at a rate acceptable to consumers. The pressure standard is designed to reduce emissions due to evaporation. The permeation standard is designed to reduce emissions due to permeation.

Some of these features and standards have resulted in significant emission reductions, especially the automatic closure feature. However, ARB staff has learned that other features and standards have indirectly led manufacturers to design PFCs that are difficult to operate or incompatible with many types of equipment fuel tanks. Although the PFCs work well with some equipment, many other types of equipment, such as line trimmers and leaf blowers, cannot be effectively fueled from compliant PFCs. Spillage from compliant PFCs may even occur from users attempting to fuel equipment by manually holding the spout open and attempting to pour fuel. In many instances of incompatible equipment design, this is the only option for a consumer to fuel the equipment.

In other cases, a fuel tank is overfilled due to failures of the PFC automatic shutoff feature. This is usually the result of fuel tanks that are too small to allow sufficient fuel to be dispensed to achieve a vacuum and actuate the automatic shutoff feature.

In the survey, Analysis of 2004 California Household Portable Fuel Container Survey (September 2004, page 4, Table 7), 32 percent of all respondents expressed frustration with using compliant PFCs and reported problems with spillage or usage. ARB staff finds the following features and standard have contributed to the consumer acceptance issues:

- Automatic shutoff;
- Fill height and flow rate; and,
- Pressure standard.

3.2.2.1 Automatic Shutoff

The automatic shutoff feature required by the PFC regulations stops the flow of fuel when a specified fill height is reached in the target tank. In many designs, automatic shutoff is actuated via a vacuum line contained in the spout. This design has resulted in rigid, large diameter spouts that are incompatible with many types of equipment with hard to reach, small diameter fuel necks. In addition, many consumers are unable to understand how the feature works and thus use the PFCs incorrectly, possibly causing more spillage than before the regulations, as reported by consumer complaints. Most PFC manufacturers and ARB staff have concluded that removing the automatic shutoff feature will improve consumer acceptance and reduce spillage.

3.2.2.2 Fill Height and Flow Rate

The fill height and flow rate standards were intended to require manufacturers to design PFCs that would flow and fill in such a way that consumers would find acceptable. These measures were purely consumer acceptance measures included in the previous rulemaking, and no emissions benefits were identified for them. After testing the PFCs and conducting a consumer focus group, ARB staff learned that most consumers were not concerned about these features, and that they cause manufacturers difficulty in designing spouts that meet the other emissions related regulations. Overall, ARB staff has concluded that these standards are unnecessary.

3.2.2.3 Pressure Requirement

The pressure standard in the regulations is intended to control emissions from evaporation while a PFC is stored with gasoline. The current standard is 10 psig. Research conducted by ARB staff revealed that PFCs designed to hold pressure up to 10 psig are difficult to operate. As reported by consumers, an unusually large amount of physical force is required to dispense fuel. The force involved is often enough to tip over equipment, which can result in spillage. ARB staff has shown that reducing the pressure standard will have no effect on emissions and will make it easier for consumers to dispense fuel by requiring less physical force to be applied to the target fuel tank.

3.2.2 Non-uniform Production Quality

ARB staff has conducted compliance testing on over 950 PFCs. Nearly half failed. The test results identify considerable production variability, even among individual product lines leading to non-compliance. In addition, some PFCs are poorly designed and use inferior materials. This is inconsistent with a superior PFC design ARB staff evaluated in the late 1990's while developing the initial regulations. The superior design did not make it into production.

3.2.3 Use of Non-Regulated Containers with Gasoline

Non-regulated containers are being sold that hold fluids other than gasoline. These containers are similar in size, shape and appearance to PFCs. Kerosene containers and utility jugs are examples of such containers. These containers are offered for sale at a number of retail stores and use conventional spouts that do not control evaporation, permeation, or spillage. Since 2001, manufacturers began reporting record sales of non-regulated containers, as they are typically sold adjacent to regulated PFCs, often at a discounted price.

In a usage survey titled Analysis of 2004 California Household Portable Fuel Container Survey (September 2004 page 10, Table 17), it was shown that approximately 350,000 kerosene containers and 1.4 million utility jugs are being used for gasoline in California. Use of these containers decreases the emission reductions provided by the PFC regulations. To a significant extent the compliance by retailers and distributors of PFCs is key to ensuring the emission reductions are achieved.

3.2.4 Diurnal Standard and Incompatible Test Methods

The current regulations include requirements for evaporation and a separate standard for permeation. This approach requires additional testing for manufacturers and ARB staff, adding complexity and cost to testing and enforcement procedures. By combining the evaporation requirements and the permeation standard into a single diurnal standard, certification and enforcement testing will be simplified, testing costs will be reduced, and testing will be consistent with routine use.

The proposed changes related to automatic shutoff, fill height, flow rate, pressure, and the diurnal standard require the need for updated and new test procedures for PFCs. These test procedures and standards are needed to measure and enforce the proposed amendments.

4. SUMMARY OF PROPOSAL

This chapter outlines ARB staff's proposed amendments. This report identifies the major provision of each proposed amendment, explains the rationale for each provision, and discusses its feasibility.

The proposed amendments in this section are ARB staff's response to the issues identified with the current regulations. The following are discussed:

- Modify the existing spout regulations to improve spillage control;
- Include a voluntary Consumer Acceptance Program to support and encourage user-friendly PFC designs;

- Establish a certification program for PFCs to improve product quality;
- Expand the definition of a PFC to include presently non-compliant containers;
- Combine the evaporation and permeation standards into a new diurnal standard to simplify certification and compliance testing; and,
- Adopt new PFC test procedures to streamline testing.

The proposed amendments would apply to PFCs offered for sale after July 1, 2007. Exceptions to this implementation date are the elimination of the fill height and flow rate standards and the new regulatory definition of a PFC. These three amendments are proposed to take effect 30 days from the date of filing these amendments with the Secretary of State.

4.1 Modify the Existing Spout Regulations

The current PFC regulations were designed to eliminate spillage when transferring fuel to a variety of gasoline-powered equipment. In the development of this proposal, ARB staff contracted surveys, performed research, and funded a focus group in an attempt to fully understand consumer usage of PFCs. In the residential survey, Analysis of 2004 Household Portable Fuel Container Survey (September 2004, page 4, Table 7), 32 percent of all respondents reported problems with spillage. In the commercial user survey, Analysis of the 2004 Commercial Portable Fuel Container Survey, (January 2005, page 13, Table 3.6), an average of 17 percent of users also reported problems with filling equipment. The consumer focus group titled State of California Air Resources Board Gas Can Focus Group (August 2004, page 5) and ARB staff's internal studies revealed similar results.

To address these issues, ARB staff is proposing to eliminate the current automatic shutoff feature and the fill height and flow rate standards. This will provide manufacturers with greater design flexibility to produce PFCs that are easier to use and more compatible with many types of vehicles and off-road equipment. The automatic closure feature will remain in effect as it has been shown to effectively reduce emissions from evaporation. ARB staff is proposing to remove the fill height and flow rate standards from the regulations 30 days after the date of filing these amendments with the Secretary of State. ARB staff is also proposing to eliminate the automatic shutoff requirement for newly certified PFCs, to take effect by July 1, 2007. Manufacturers are expected to certify new designs by July 1, 2007.

Because the fill height and flow rate standards are purely consumer acceptance related, no emissions consequences will result from their elimination. The amendments in this proposal also eliminate the automatic shutoff requirement. ARB staff expects manufacturers will redesign spouts so consumers have greater visibility and control of the refueling event. Increased visibility and control includes making the spouts clear and smaller in size so consumers can see into the equipment fuel tanks, and by providing a trigger, lever, or push button that actuates and shuts off the flow of fuel. These features are prohibited in the current regulations due to the automatic shutoff requirement. PFC manufacturers are committed to design spouts that provide

more visibility and control of the fueling event, in order to improve consumer acceptance. ARB staff believes this will reduce the spillage of fuel that is occurring as a result of the automatic shutoff requirement. Because the current automatic shutoff feature often results in spillage, ARB staff estimates that by replacing the feature with increased visibility and control this amendment will reduce ROG emissions from spillage. Some spillage will still occur, but less frequently than with the automatic shutoff feature.

The pressure standard in the current regulations was adopted to ensure PFCs contain emissions from evaporation while PFCs are stored with gasoline. While implementing the current regulations, manufacturers reported that the 10 psig design criteria limited their ability to produce easy-to-use PFCs.

ARB staff preformed research to investigate the actual vapor pressure that develops in a PFC under normal conditions. Actual vapor pressure measurements taken from PFCs exposed to a summertime temperature profile showed that the vapor pressure does not exceed 4.0 psig. These observations are further substantiated by vapor pressure curves for 7 Reid Vapor Pressure (RVP) fuel. The curves predict that the partial pressure of hydrocarbon vapors will rise by no more than 3.9 psig when the fuel temperature rises from 65 to 105 degrees Fahrenheit. This information shows that the design criteria can be lowered while still effectively controlling emissions from evaporation. As a result, ARB staff is proposing to reduce the PFC pressure standard from 10 psig to 5 psig on all PFCs to be certified on or after July 1, 2007.

4.2 Consumer Acceptance and ARB Star Rating

In order to improve PFC usability and consumer acceptance, ARB staff is proposing a voluntary consumer acceptance-labeling program that uses an ARB Star Rating system. This purely optional program is designed to improve existing PFCs by allowing manufacturers to label PFCs rated superior by consumers. The labeling program will enable consumers to easily recognize and purchase PFCs that other users have rated as easy to use. Market competition should lead manufacturers to design quality products that are compatible and easy to use.

Under this program, manufacturers may submit consumer acceptance criteria to ARB staff for approval prior to certification. If ARB staff approves the criteria, the manufacturer would have at least ten consumers evaluate their product on a percentage scale, with 100 percent being the highest possible score. ARB staff would then assign the product one to three stars based upon a minimum evaluation rating of 70 percent or more for one star, 80 percent or more for two stars, or 90 percent or more for three stars. ARB staff may reproduce the evaluation to verify the designated consumer rating.

The consumer acceptance-labeling program would authorize a manufacturer to use the ARB Star Rating to market their product(s). The program would be voluntary but

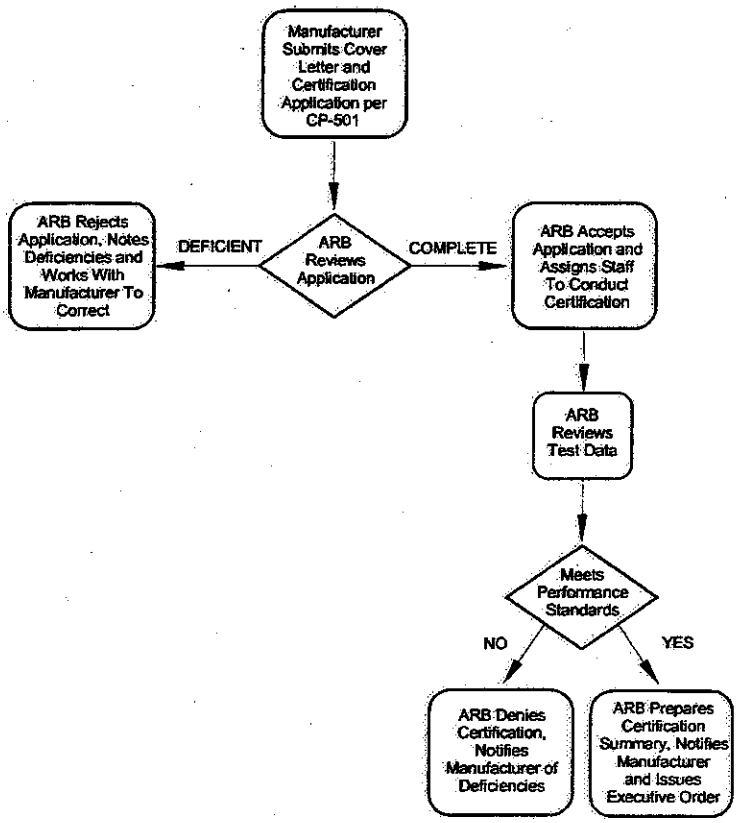
strongly encouraged for all manufacturers, as ARB staff believes this will greatly improve consumer acceptance and public education.

4.3 Establish a Certification Program for PFCs

In order to ensure that PFCs sold in California comply with the PFC regulations prior to their sale in the State, ARB staff is proposing to establish a certification program. The proposed regulations (Appendix A) reference the proposed Certification Procedure "CP-501" (Appendix B).

The proposed certification program requires PFC manufacturers to submit a formal application that includes test data documenting compliance with the specified performance standards, as well as information pertaining to PFC design. An ARB Executive Order certifying PFCs for sale in California will be issued if all of the applicable certification requirements are met. Figure 4.1 describes the certification process.

Figure 4.1
Certification Process for Portable Fuel Containers



4.4 Amendment to PFC Definition

The ARB staff proposes to amend the definition of a PFC to include kerosene containers and make it clear that utility jugs that are sold, advertised, or offered for sale as a PFC are subject to the applicable PFC regulations. The new definition would take effect 30 days from the date of filling the amendments with the Secretary of State. As proposed, all containers labeled or embossed for use with gasoline, diesel, or kerosene are subject to these regulations. Also, all containers that are labeled or embossed for use with some other fluid, such as water, are not subject to these regulations. For those containers that are not labeled or embossed, the marketing strategy of the manufacturers, distributors, and retailers determine if the regulations apply.

4.5 Diurnal Standard

The current regulations include separate standards and test methods to determine evaporation and permeation emissions. This approach requires additional testing for manufacturers and ARB staff, adding complexity and cost to testing and enforcement procedures. By combining the evaporation requirements and the permeation standard into a single diurnal standard and test method, certification and enforcement testing will be simplified, testing costs will be reduced, and testing will be consistent with in-use practices. ARB staff is proposing to combine the evaporation and permeation standards into a single diurnal standard and test method. The implementation schedule is shown in Table 4.1.

Table 4.1
Diurnal Standards and Implementation Schedule

Effective Dates	Diurnal Standards
Initial Std. July 1, 2007	0.4 grams ROG/gallon-day
Final Std. January 1, 2009	0.3 grams ROG/gallon-day

The following subsections describe the sources of diurnal emissions from PFCs, technology to control diurnal emissions, development of a diurnal test procedure, and the testing performed by ARB staff that shows the feasibility of the proposal.

4.5.1 Sources of Diurnal Emissions

Diurnal emissions from PFCs are comprised of two sources, evaporation and permeation. Evaporation occurs as a result of daily temperature fluctuations that cause vapors to expand and escape through openings in the PFC. Permeation occurs when gasoline saturates the walls of a plastic PFC and escapes to the atmosphere.

4.5.2 Technology to Control Diurnal Emissions

4.5.2.1 Evaporative Emissions

The automatic closure feature has been effective in controlling emissions from evaporation. The pressure standard also contributes to reduced emissions from evaporation.

4.5.2.2 Permeation Emissions

Manufacturers have used a variety of technologies to comply with the PFC permeation regulations. Barrier technologies including co-extrusion, special polymers and resins, and surface treatments have been verified to effectively control permeation through ARB staff compliance testing and development of both the PFC and small off-road engine (SORE) regulations.

4.5.3 Development of Diurnal Test Procedure

During development of this proposal, ARB staff developed and validated a new diurnal test that measures both evaporation and permeation emissions. ARB staff test report Quantification of Permeation and Evaporative Losses from Portable Fuel Containers (June 2004, page 3, Figure 1) present the results. ARB staff believes this will not only simplify testing and reduce testing costs, but will also replicate the types of durability encountered during routine use.

4.5.4 Feasibility of Diurnal Standard

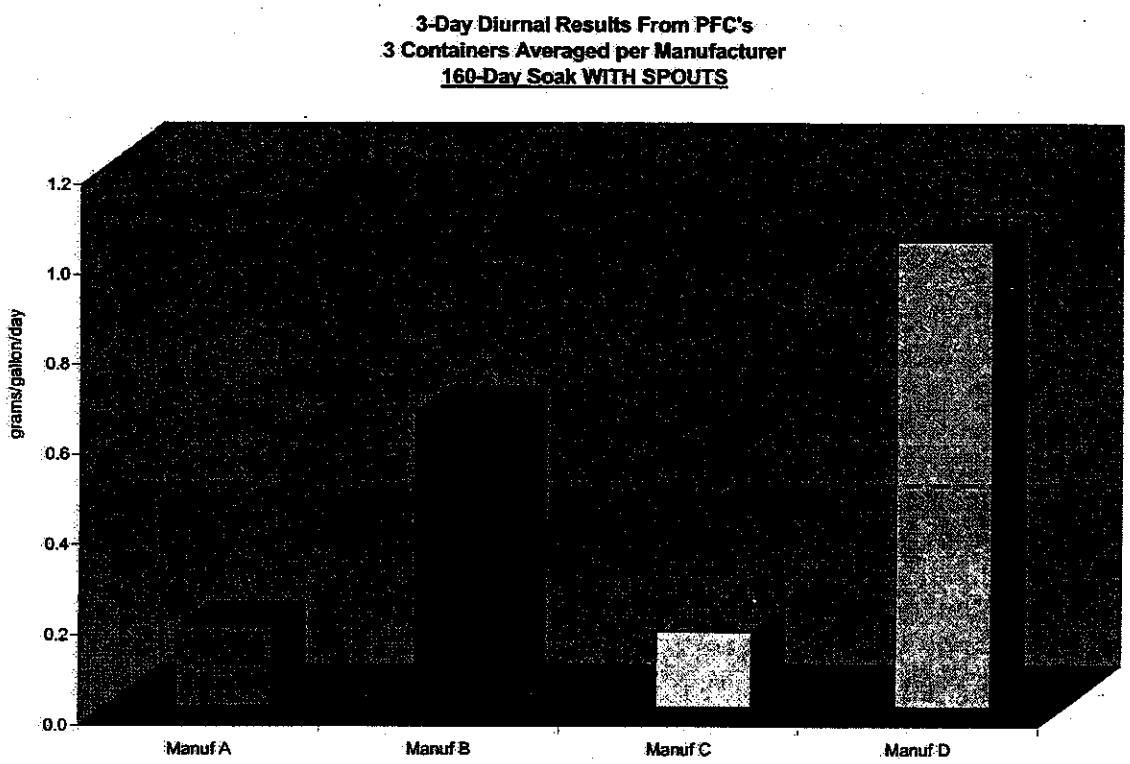
In order to evaluate the feasibility of implementing a combined evaporation and permeation emissions test method, ARB staff tested PFCs using a Sealed Housing for Evaporative Determination (SHED) enclosure. Testing involved an initial preconditioning and durability test period followed by diurnal testing. The durability portion involved repeatedly actuating (500 times) and removing the spouts to simulate in use conditions. After the durability test period, the PFCs were placed in the SHED and subjected to three consecutive California summertime temperature profiles to quantify the diurnal emissions that resulted.

4.5.4.1 Diurnal Results

The diurnal test results (average of three containers per manufacturer) presented in Figure 4.2 show that two manufacturers' PFCs easily met the proposed 2007 and 2009 diurnal standard of 0.4 and 0.3 grams/gal-day, respectfully, and two manufacturers' PFCs failed. One of the manufacturer's PFCs that failed to meet the criteria (manufacturer B) did so because of one problem spout and poor production quality that can be remedied. The other manufacturer's containers that failed (manufacturer D) were utility jugs with no controls. Based on these results,

ARB staff is proposing to establish a 0.4 gram/gal-day standard in 2007, and lower it to 0.3 grams/gal-day in 2009.

Figure 4.2



4.6 Improved PFC Test Procedures

4.6.1 Spill-Proof Spout Test Procedure

ARB staff has conducted extensive compliance testing on a large variety of PFCs. The testing has suggested improvements to the test requirements. The proposed improvements would include removing the test criteria for fill height, flow rate, and automatic shutoff, modify the test criteria for pressure, and impose a new test procedure for diurnal testing. Based on their experiences with testing, ARB staff proposes to replace existing Test Methods 510, 511 and 512 with Test Procedure TP-501 (Appendix C). This change would take effect for PFCs certified by July 1, 2007.

In the interim period prior to July 1, 2007, ARB staff is proposing to amend Test Method 510 and remove Test Method 512, to be effective 30 days after the date of filing of these amendments with the Secretary of State. This will immediately provide manufacturers with greater flexibility related to the fill height and flow rate

standards. The proposed interim amendments to Test Method 510 are in strikeout and underline format in Appendix D of this staff report. The existing Test Method 511 can be found in Appendix E. Appendix F includes the proposed amendments to Test Method 512, also in strikeout format.

4.6.2 Diurnal Emission Test Procedure

ARB staff is proposing to replace existing Test Method 513, the test method for permeation, with a new diurnal test procedure TP-502. This change would take effect for PFCs certified by July 1, 2007. TP-502 includes a durability demonstration. This procedure will measure all PFC emissions except for spillage using one procedure. The results generated from the test would be similar to the emissions from a PFC stored in a garage on a hot summer day. The proposed test procedure, TP-502 can be found in Appendix G of this staff report and Appendix H includes Test Method 513.

4.7 Other Non-Substantive Modifications

ARB staff is proposing to make other non-substantive modifications to the regulations. Some examples are:

- Amend the regulations to allow for secondary openings to allow for technology changes that may reduce the pressure in a PFC;
- Remove the automatic closure by physical force requirement to allow fueling control using a trigger, lever, or push button; and,
- Include an exemption for model airplanes, boats, cars and trucks that use a closed loop fueling system.

5. ENVIRONMENTAL AND ECONOMIC IMPACTS

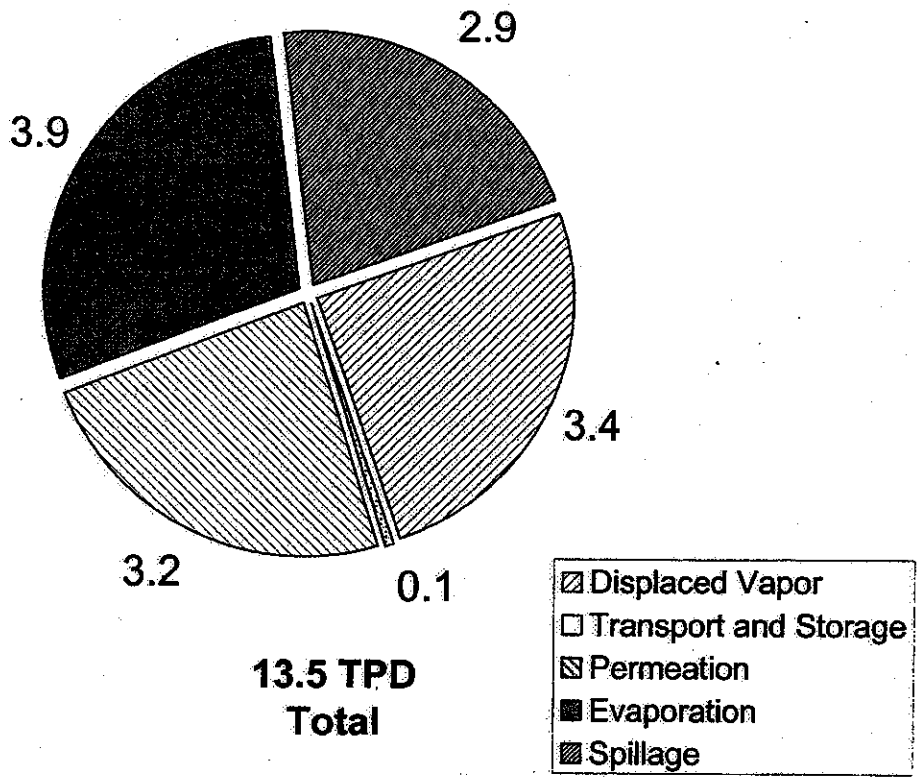
This portion of the ARB staff report discusses environmental and economic impacts.

5.1 Environmental Impact

5.1.1 Emission Reductions

The proposed amendments will reduce ROG emissions from PFCs by 18.4 tpd in 2015 compared to the current regulations. The emission reductions include 1.4 tpd due to reduced spillage, 3.2 tpd due to regulating kerosene containers, 13.3 tpd from assuring utility jugs comply, and 0.5 tpd from the new combined diurnal standard. Chart 5.1 shows the resulting controlled emissions by source for 2015.

Chart 5.1
Expected Emissions in 2015



5.1.2 Reduced Exposure to Toxic Air Pollutants

Benzene, a toxic air contaminant, is present in the emissions associated with evaporation from PFCs. Because the proposed amendments will reduce ROG emissions, they will also reduce the public's exposure to toxic compounds found in gasoline, such as benzene.

5.1.3 Environmental Justice

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

cumulative impacts of air pollution from multiple mobile, commercial, industrial, area wide, and other sources. Over the past twenty years, the ARB, local air districts, and federal air pollution control programs have made substantial progress towards improving the air quality in California. However, some communities continue to experience higher exposures than others as a result of the cumulative impacts of air pollution from multiple mobile and stationary sources and thus may suffer a disproportionate level of adverse health effects. Since the same ambient air quality standards apply to all regions of the State, all communities, including environmental justice communities, will benefit from the air quality benefits associated with the proposal. Alternatives to the proposed recommendations, such as recommending no change to the automatic shutoff requirement, would affect all communities throughout the State. As additional relevant scientific evidence becomes available, the PFC standards will be reviewed again to ensure that the public's health is protected with an adequate margin of safety.

To ensure that everyone has an opportunity to stay informed and participate fully in the development of the amendments to the PFC regulations, ARB staff conducted five public workshops in Sacramento. Information was also distributed by mail and via the Internet, as described in Section 2.5 of this staff report.

5.2 Cost and Cost-Effectiveness

ARB staff evaluated cost information supplied by PFC manufacturers and obtained through two statewide surveys to determine the economic impacts of the proposed amendments. ARB staff relied upon the costs cited in the 1999 PFC Initial Statement of Reasons (ISOR) to estimate the increased retail price for kerosene containers and utility jugs due to the proposed amendments.

5.2.1 Cost Estimates to Reduce Emissions and Implement Certification

5.2.1.1 Cost of Removing the Automatic Shutoff Feature

Designing the automatic shutoff feature has been reported by PFC manufacturers to be one of the most costly aspects of the current PFC regulations. Removing this feature will most likely result in a cost savings. No costs have been attributed to this amendment.

5.2.1.2 Cost of Implementing the Certification Program

To estimate the cost of the proposed certification program ARB staff used data supplied by independent test companies and manufacturers' hourly labor rates. ARB staff estimates that it will cost a typical manufacturer $4,000 to comply with the program. There are currently eight manufacturers producing PFCs for the California market, thus the cost of adding the certification program is $32,000. Assuming that eight manufacturers sell about 1.9 million PFCs in the State each year, certification will cost about $.02 per PFC. These costs would likely be passed on to the consumer.

5.2.1.3 Cost of Regulating Kerosene Containers and Utility Jugs

The proposed amendments would potentially increase the cost of a kerosene container or utility jug by $6.00 to $11.00, or an average of about $8.50 per container. The increased cost is attributed to material and production costs associated with adding control technologies for evaporation, permeation, and spillage. In total, this will result in a cost of approximately $17 million (0.6 million kerosene containers plus 1.4 million utility jugs x $8.50 per container). This amounts to a price increase of about $1.70 per container per year over the estimated five-year useful life of the kerosene container. It is expected that the useful life of a utility jug is more than five years, thus the cost per year would be less.

5.2.1.4 Cost of Implementing the New Diurnal Standard

The cost of complying with the proposed diurnal emission standard is not expected to be substantially different from complying with the existing permeation standard in the PFC regulations. Currently, manufacturers are using control technologies that are capable of reducing emissions sufficiently to meet the proposed diurnal standards. Better engineering and quality control are expected to allow those PFCs that currently exceed the proposed standards to comply. Thus, compliance costs are expected to be minimal, and we have included no additional costs in our assessment.

5.2.2 Cost-Effectiveness of Proposed Amendments

ARB staff used cost information obtained from the 1999 PFC ISOR, manufacturers, and test companies to calculate the cost-effectiveness of this proposal. ARB staff included certification costs and assumed a five-year useful life of PFCs when calculating cost-effectiveness. The certification cost ($32,000) is estimated assuming eight manufacturers producing PFCs for the California market at a testing and processing cost of $4,000 each. The cost for a kerosene container or utility jug is estimated assuming 0.6 million kerosene containers and 1.4 million utility jugs at a per container cost of $8.50 or a total of $17 million. The estimated reductions are 3.2 tpd or nearly 7 million lbs. over five years from kerosene containers and 13.3 tpd or 29 million lbs. from utility jugs. The emission reductions and costs associated with producing compliant PFCs over their useful life are shown in Table 5.1. The other proposed amendments to the PFC regulations are not expected to result in increased costs compared to the existing regulations.

Table 5.1

Cost-Effectiveness of Proposed Amendments			
Category	**Costs Over 5 Years**	**Emission Reductions lbs. Over 5 Years**	**Cost-Effectiveness**
Kerosene Container	$5 million	7 million	$.70 per lb.
Utility Jugs	$12 million	29 million	$.40 per lb.
Spillage	$0	3 million	N/A
Certification	$32,000	N/A	N/A
Diurnal	$0	1 million	N/A
Total	$17 million	60 million	$.40 to $.70 per lb.

5.3 Economic Impact on the Economy of the State

The proposed amendments would have no noticeable impact on the status of California PFC manufacturers. The amendments would potentially increase the cost of kerosene containers and utility jugs by about $6.00 to $11.00 per container. In total, this will result in a total cost of compliance of approximately $17 million. This amounts to a price increase of about $1.70 per year over the five-year useful life of a kerosene container. Utility jugs are expected to have a useful life greater than a PFC, so the annual costs will be less. As mentioned above, the cost of certification is negligible. Consumers are unlikely to alter their purchasing behavior for such a price increase. Also, this price increase accounts for only a small portion of an annual household income.

5.3.1 Legal Requirement

Section 11346.3 of the Government Code requires State agencies to assess the potential for adverse economic impacts on California business enterprises and individuals when proposing to adopt or amend any administrative regulations. The assessment shall include a consideration of the impact of the proposed amendments on California jobs, business expansion, elimination or creation, and the ability of California business to compete.

Also, Section 11346.5 of the Government Code requires State agencies to estimate the cost or savings to any State agency, local agency or school district in accordance with instructions adopted by the Department of Finance. The estimate shall include any non-discretionary cost or savings to local agencies and the cost or savings in federal funding to the State.

5.3.2 Businesses Affected

Any business involved in the manufacturing of PFCs and equipment will potentially be affected by the proposed amendments. However, the focus of this analysis will be on the PFC manufacturers because these businesses would be most directly affected by the proposed amendments.

5.3.2.1 Portable Fuel Container Manufacturers

There are currently eight manufacturers that market PFCs in California; most of them do not meet the definition of a "Small Business" as defined in Government Code Section 11342.610. The majority of PFCs are manufactured outside of California.

The affected manufacturers fall into different industry classifications. A list of the industries that ARB staff has been able to identify is provided in Table 5.2.

Table 5.2
Industries with Potentially Affected Manufacturers

SIC Code	Industry
3053	Gaskets, Packing, and Sealing Devices
3087	Custom Compounding of Purchased Plastic Resins
3089	Plastic Products
5261	Lawn and Garden Supply Stores

5.3.3 Impact on Small Businesses

The proposed amendments will have some impact, although not significant, on small businesses that currently buy and sell kerosene containers and utility jugs. For small retailers, during the initial years of implementation, the increased cost of PFCs may lead to a slight drop in demand that could result in lower profits. For example, a small retailer that currently sells 50 containers and utility jugs per year might sell 10 percent fewer or five fewer PFCs during the first year of implementation. Assuming a 20 percent profit on an $11 PFC, the regulations would cost the retailer $11 in profit the first year. In this instance, the retailer would carry over unsold stock to the next year, possibly incurring less profit on the sale of these units.

5.3.4 Potential Impact on Distributors and Dealers

Most PFC manufacturers sell their products through distributors and dealers. Many independently owned dealers are small businesses. The distributors and dealers sell about 1.9 million PFCs per year in California. Although they are not directly affected by the proposed amendments, the amendments may affect them indirectly if an increase in the price of kerosene containers and utility jugs reduces sales volume.

5.3.5 Potential Impact on Business Competitiveness

The proposed amendments would not significantly impact the ability of California PFC manufacturers to compete with manufacturers of similar products in other states. This is because all manufacturers that offer products for sale in California are subject to the proposed amendments, regardless of their location. Furthermore, nearly all of the PFC manufacturers are located outside of California.

5.3.6 Potential Impact on Employment

The proposed amendments are not expected to cause a noticeable reduction in California employment because California accounts for only a small share of the manufacturing employment involving PFCs. However, some small businesses operating outside of California may leave the California market due to cost increases, which may result in a few jobs being eliminated.

6. ALTERNATIVES CONSIDERED

ARB staff evaluated three alternatives to this proposal:

- No action;
- Retain current requirements and add a consumer education program; and,
- Impose a diurnal standard and certification program.

6.1 No Action

The first alternative evaluated was to take no action. Under this alternative, it is unlikely that any PFC manufacturers would voluntarily incorporate consumer acceptance designs or manufacturer products that would be more acceptable to a consumer than the current PFCs. Consumers would continue to spill fuel when fueling equipment and the PFCs would continue to be incompatible with many equipment fuel tanks. Also, no emission reductions associated with non-complying containers would be achieved. ARB staff rejected this alternative, as it provides no benefits and does not address the existing problems.

6.2 Retain Current Regulations and add a Consumer Education Program

The second alternative evaluated was to retain the current requirements, but institute a consumer education program to improve consumer awareness and instruct consumers on proper usage of PFCs. Kerosene containers and utility jugs would not be regulated under this proposal. Under this alternative, it is unlikely that any manufacturers will alter their designs to improve consumer acceptance and compatibility. Also, PFC manufacturers are unlikely to solve spillage issues without regulatory action. The few manufacturers that may elect to redesign their PFCs would be at a competitive disadvantage compared to manufacturers electing not to redesign their PFCs. ARB staff rejected this alternative because it believes that simply educating the public on proper use of PFCs is not sufficient to address the consumer acceptance, non-regulated PFCs, and poor production quality issues.

6.3 Impose a Diurnal Standard and Certification Program

The third alternative evaluated was a proposal to implement a certification program and new diurnal standard. Kerosene containers and utility jugs would not be regulated under this proposal. Under this alternative, PFC manufacturers would only be required to certify their existing PFCs but would not be able to implement changes to further improve issues related to usability or spillage.

This alternative would have a minimal impact on manufacturers and may improve the overall compliance rate for PFCs sold in California. However, manufacturers would still be hampered by the current design requirements for PFCs, including automatic shutoff, fill height, flow rate, and the higher pressure standard. Retaining these regulations would not lead to design changes aimed at improving usability and spillage. Because one of ARB staff's goals was to improve consumer acceptance and reduce spillage, ARB staff rejected this alternative.

7. ISSUES

ARB staff has identified three issues that have not been resolved. These are discussed below.

7.1 Notice to Distributors and Retailers for Newly Regulated PFCs

In the current PFC regulations, utility jugs were intended to be included in the definition of PFCs used for the transport and storage of gasoline. ARB staff has routinely observed utility jugs being used to refuel personal watercraft (Jet Ski's, etc.), off-road motorcycles, and all terrain vehicles. Furthermore, utility jugs are often sold adjacent to PFCs at off-road and small equipment retailer outlets.

The proposed amendments call for the definition of a PFC to include utility jugs, to take effect 30 days after filling with the Secretary of State. Some manufacturers have suggested that the ARB staff needs to notify distributors and retailers of this amendment to ensure no utility jugs are sold for use with gasoline. Accordingly, ARB staff intends to work with industry to provide advisories to distributors, retailers, and consumers.

7.2 Opposition to Removing the Automatic Shutoff Requirement

The automatic shutoff feature was developed to stop the dispensing of fuel when a particular fill height is reached in the target fuel tank. This was intended to reduce emissions associated with spillage.

One manufacturer feels strongly that removing the automatic shutoff feature may seriously jeopardize the safety of consumers and result in increased emissions from spillage. This manufacturer has produced test data concerning the automatic shutoff feature. ARB staff has thoroughly reviewed the data and finds them inconsistent with the other findings included in the surveys, focus group, and ARB staff testing and research. A video made of the consumer focus group study clearly shows that consumers find the automatic shutoff feature difficult to use. Furthermore, other manufacturers believe that removing the automatic shutoff feature will reduce spillage and improve consumer acceptance. ARB staff believes that removing the automatic shutoff feature will improve consumer acceptance and result in greater fuel tank compatibility.

7.3 Coordination with EPA Concerning Proposed Diurnal Test Procedure

Throughout the development of this proposal, ARB staff worked closely with the EPA concerning the regulations and test procedures. The EPA is currently working on national regulations for PFCs and is considering a diurnal standard and test procedure modeled after the proposed regulations and test procedures contained in this staff report. However, there may be some differences between the durability portions of the two regulations and the fuel used for testing. Table 7.1 lists the potential differences. EPA has not yet announced a firm schedule to initiate rulemaking.

Table 7.1
Potential Differences between ARB and EPA Diurnal Regulations

ARB Requirements	Possible EPA Requirements
Non-Alcohol Based Certification Fuel	Alcohol Based Certification Fuel (CE10)
No Pressure/Vacuum Test	Pressure/Vacuum Test Required
No Slosh Test Required	Slosh Test Required
65°F-105°F Temperature Profile	72°F-96°F Temperature Profile

The effect of these differences are that the ARB regulations would be slightly more restrictive with regards to the temperature profile, where the EPA version would be slightly more restrictive in regards to the pressure, slosh, and fuel regulations. ARB staff is continuing to work with the EPA to ensure the differences between the two regulations are minimal.

8. CONCLUSIONS AND RECOMMENDATIONS

The ARB staff proposes amendments to the existing PFC regulations as discussed in this staff report:

- Modify the existing spout regulations to improve spillage control;
- Include a voluntary Consumer Acceptance Program to support and encourage user-friendly PFC designs;
- Establish a certification program for PFCs to improve product quality;
- Expand the definition of a PFC to include presently non-compliant containers;
- Combine the evaporation and permeation standards into a new diurnal standard to simplify certification and compliance testing; and,
- Adopt new PFC test procedures to streamline testing.

In developing this proposal, it has been ARB staff's goal to improve consumer acceptance and achieve the greatest possible emission reductions. The proposed amendments to the existing PFC regulations and test procedures are achievable using existing technology and manufacturing processes. The emission reductions are cost-effective when compared to recent control measures adopted by the Board. The proposed amendments are necessary to meet emission reduction goals and achieve health based ambient air quality standards.

No alternatives considered by the Board would be more effective in achieving the goals of this proposal, nor would be less burdensome to manufacturers or affected private persons.

ARB staff recommends the Board approve its proposal to amend Sections 2467 to 2467.9 of Title 13, California Code of regulations, Test Methods 510, 511, 512 and 513, and adopt Certification Procedure 501 and Test Procedures TP-501 and TP-502 incorporated by reference therein and provided in Appendices A through H of this report.

9. REFERENCES

Abell Hobby, "Model Airplane Exemption", June 2004

Air Resources Board, California Exhaust Emission Standards and Test Procedures for 2201 and Subsequent Model Passenger Cars, Light Duty Trucks, and Medium Duty Vehicles, May 28, 2004

Air Resources Board, California's Portable-Gasoline Container Emissions Inventory, May 2005

Air Resources Board, "Policies and Actions for Environmental Justice," December 2001.

Air Resources Board, "Staff report, Initial Statement of Reasons for Proposed Rulemaking, Public Hearing to Consider the Adoption of Exhaust and Evaporative Emission Control Requirements for Small Off-Road Equipment and Engines Less Than or Equal to 19 Kilowatts", August 2003

Air Resources Board, "Technical Report: Quantification of Permeation and Evaporative Losses from Portable Fuel Containers, (June 2004)," April 2005

Air Resources Board, "Technical Report: Quantification of Vent Emissions from Portable Fuel Container Prior to Fueling, (May 2005)," May 2005

ASTM F 2234-03 Standard Specification for Portable Gasoline and Kerosene Spill Resistant Fueling Systems for Consumer Use, July 2003

ASTM F852-99e1 Standard Specification for Portable Gasoline Containers for Consumer Use

ASTM F976-02 Standard Specification for Portable Kerosene Containers for Consumer Use

California State University Sacramento, Department for Social Research, "Analysis of the 2004 Commercial Portable Fuel Container Survey," January 2005

California State University Sacramento, Department for Social Research, "Analysis of 2004 Household Portable Fuel Container Survey," September 2004

Chevron USA, "California P-II Cert Fuel Vapor Pressure Curve Estimation & Latent Heat of Vaporization Estimation"

Dupont, "Materials Options to Reduce Evaporative Emissions", September 25, 2003

Eval Company of America, "EVOH and the Plastic Fuel Tank (PFT) or the Plastic Fuel Can (PFC)", September 25, 2003

Kathios, D., Ziff, R., Petrulis, A., and Bonczyk, J., "Permeation of Gasoline-Alcohol Fuel Blends Through High-Density Polyethylene Fuel Tanks with Different Barrier Technologies". Society of Automotive Engineers Technical Paper Series 920164, Presented at the International Congress & Exposition, Detroit, Michigan, February 24-28, 1992.

Opinions of Sacramento, "State of California Air Resources Board Gas Can Focus Group" August 2004

United State Environmental Protection Agency, Appendix A, Test Methods, Method 301 Field Validation of Pollutant Measurement Methods from Various Waste Media, December 1992

49 CFR, Chapter 1, Research and Special Programs Administration, Department of Transportation, Subpart E Labeling, Section 172.407

APPENDIX A

PROPOSED AMENDMENTS TO THE PORTABLE FUEL CONTAINER REGULATION

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Proposed Regulation Order
Portable Fuel Container Regulation

NOTE: Regulatory amendments to existing language are shown in underline to indicate additions to the text and ~~strikeout~~ to indicate deletions.

Amend title 13, California Code of Regulations, sections 2467, 2467.1, 2467.2, 2467.3, 2467.4, 2467.5, 2467.6, 2467.7; repeal of section 2467.8, and adoption of new sections 2467.8 and 2467.9 to read as follows

Article 6 Portable Fuel Containers and Spouts

2467. Applicability

(a) Except as provided in Section 2467.3, this article applies to any person who sells, supplies, offers for sale, advertises or manufactures for sale in California portable fuel containers or spouts, or both portable fuel containers and spouts for use in California.

(b) Except as provided by Section 2467.3, no person shall sell, supply, offer for sale, advertise, or manufacture for sale in California a portable fuel container or spout or both portable fuel container and spout after July 1, 2007 unless said portable fuel container or spout or both portable fuel container and spout is covered by an Executive Order issued pursuant to this article.

NOTE:
Authority cited: Sections 39600, 39601, 43013, 43018, and 43101, of the Health and Safety Code, and *Western Oil and Gas Ass'n. V. Orange County Pollution Control District,* 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975). Reference: Sections 39000, 39001, 39003, 39500, 39515, 39516, 41511, 43000, 43013, 43016, 43017, and 43018, of the Health and Safety Code, and *Western Oil and Gas Ass'n. V. Orange County Pollution Control District,* 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975).

2467.1. Definitions

(a) The definitions in Section 1900(b), Title 13 of the California Code of Regulations apply with the following additions:

(1) "ASTM" means the American Society for Testing and Materials.

(2) "Consumer" means the first person who in good faith purchases a new portable fuel container or spout or both portable fuel container and spout for purposes other than resale, including but not limited to personal, family, household, or institutional use.

(3) "Distributor" means any person to whom a portable fuel container or spout or both portable fuel container and spout is sold or supplied for the purposes of resale or distribution in commerce. Manufacturers, retailers, and consumers are not distributors.

(4) "Executive Officer" means the Executive Officer of the Air Resources Board, or his or her designee.

(5) "Fuel" means all fuels subject to any provision of Title 13, California Code of Regulations, Chapter 5, Standards for Motor Vehicle Fuels, Sections 2250 - 2298, except for Sections 2292.5, 2292.6, and 2292.7.

(6) "Kerosene" means any light petroleum distillate that is commonly or commercially known, sold or represented as kerosene, that is used in space heating, cook stoves, and water heaters, and is suitable for use as a light source when burned in wick-fed lamps.

(7) ~~(6)~~"Manufacturer" means any person who imports, manufactures, assembles, packages, repackages, or re-labels a portable fuel container or spout or both portable fuel container and spout.

(8) ~~(7)~~"Nominal Capacity" means the volume indicated by the manufacturer that represents the maximum recommended filling level.

(9) ~~(8)~~"Outboard Engine" means a spark-ignition marine engine that, when properly mounted on a marine watercraft in the position to operate, houses the engine and drive unit external to the hull of the marine watercraft.

(10) ~~(9)~~"Permeation" means the process by which individual fuel molecules may penetrate the walls and various assembly components of a portable fuel container directly to the outside ambient air.

(11) ~~(10)~~"Person" has the same meaning as defined in Health and Safety Code Section 39047.

(12) ~~(11)~~"Portable Fuel Container" means any container or vessel with a nominal capacity of ten gallons or less intended for reuse that is designed, ~~or~~ used, sold, advertised or offered for sale ~~primarily~~ for receiving, transporting, storing, and dispensing fuel or kerosene. Portable fuel containers do not include containers or vessels permanently embossed or permanently labeled, as defined in 49 Code of Federal Regulation Section 172.407, with language indicating said containers or vessels are solely intended for use with non-fuel or non-kerosene products.

(13) ~~(12)~~"Product Category" means the applicable category that best describes the product with respect to its nominal capacity, material construction, fuel flow rate, and permeation rate, as applicable, as determined by the Executive Officer.

(14) ~~(13)~~"Retailer" means any person who owns, leases, operates, controls, or supervises a retail outlet.

(15) ~~(14)~~"Retail Outlet" means any establishment at which portable fuel containers or spouts or both portable fuel containers and spouts are sold, supplied, or offered for sale.

(16) ~~(15)~~"ROG" (Reactive Organic Gas) means a reactive chemical gas, composed of hydrocarbons that may contribute to the formation of smog. ROG is sometimes referred to as Non-Methane Organic Compounds (NMOC's).

(17) ~~(16)~~"Spill-Proof Spout" means any spout that complies with all of the performance standards specified in Section 2467.2(b) and with the requirements in Section 2467.5.

(18) ~~(17)~~"Spill-Proof System" means any configuration of portable fuel container and firmly attached spout that complies with all of the performance standards in Section 2467.2(a) and with the requirements in Section 2467.5.

(19) ~~(18)~~"Spout" means any device that can be firmly attached to a portable fuel container for conducting pouring through which the contents of a portable fuel container can be dispensed.

(20) ~~(19)~~"Target Fuel Tank" means any receptacle that receives fuel from a portable fuel container.

NOTE:

Authority: Sections 39600, 39601, 43013, 43018, and 43101, of the Health and Safety Code, and *Western Oil and Gas Ass'n. V. Orange County Pollution Control District,* 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975). Reference: Sections 39000, 39001, 39003, 39500, 39515, 39516, 41511, 43000, 43013, 43016, 43017, and 43018, of the Health and Safety Code, and *Western Oil and Gas Ass'n. V. Orange County Pollution Control District,* 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975).

2467.2. Performance Standards and Test Procedures for Portable Fuel Containers and Spill-Proof Spouts.

(a) Except as provided in Section 2467.3, during the time period beginning 30 days after the date of filing of this subsection with the Secretary of State, and ending June 30, 2007, no person shall sell, supply, offer for sale, or manufacture for sale in California ~~on or after January 1, 2001,~~ any portable fuel container or any portable fuel container and spout which, at the time of sale or manufacture, does not meet all of the following Performance Standards for Spill-Proof Systems:

(1) An automatic shut-off stops the fuel flow before the target fuel tank overflows.

(2) Automatically closes and seals when removed from the target fuel tank and remains completely closed when not dispensing fuel.

(3) Has only one opening for both filling and pouring.

~~(4) Provides a fuel flow rate and fill level of:~~

~~(A) not less than one-half gallon per minute for portable fuel containers with a nominal capacity of:~~

~~1. less than or equal to 1.5 gallons and fills to a level less than or equal to 1 inch below the top of the target fuel tank opening; or~~

~~2. greater than 1.5 gallons but less than or equal to 2.5 gallons and fills to a level less than or equal to one inch below the top of the target fuel tank opening if the spill-proof system clearly displays the phrase "Low Flow Rate" in type of 34 point or greater on each spill-proof system or label affixed thereto, and on the accompanying package, if any; or~~

~~(B) not less than one gallon per minute for portable fuel containers with a nominal capacity greater than 1.5 gallons but less than or equal to 2.5 gallons and fills to a level less than or equal to 1.25 inches below the top of the target fuel tank opening; or~~

~~(C) not less than two gallons per minute for portable fuel containers with a nominal capacity greater than 2.5 gallons.~~

~~(5)~~ (4) Does not exceed a permeation rate of 0.4 grams per gallon per day.

~~(6)~~ (5) Warranted for a period of not less than one year against defects in materials and workmanship.

(b) Except as provided in Section 2467.3, during the time period beginning 30 days after the date of filing of this subsection with the Secretary of State, and ending June 30, 2007, no person shall sell, supply, offer for sale, or manufacture for sale in California ~~on or after January 1, 2001,~~ any spout which, at the time of sale or manufacture, does not meet all of the following Performance Standards for Spill-Proof Spouts:

(1) An automatic shut-off stops the fuel flow before the target fuel tank overflows.

(2) Automatically closes and seals when removed from the target fuel tank and remains completely closed when not dispensing fuel.

~~(3) Provides a fuel flow rate and fill level of:~~

~~(A) not less than one-half gallon per minute for portable fuel containers with a nominal capacity of:~~

~~1. less than or equal to 1.5 gallons and fills to a level less than or equal to 1 inch below the top of the target fuel tank opening; or~~

~~2. greater than 1.5 gallons but less than or equal to 2.5 gallons and fills to a level less than or equal to one inch below the top of the target fuel tank opening if the spill-proof spout clearly displays the phrase "Low Flow Rate" in type of 34 point or greater on the accompanying package, or for spill-proof spouts sold without packaging, on either the spill-proof spout or a label affixed thereto; or~~

~~(B) not less than one gallon per minute for portable fuel containers with a nominal capacity greater than 1.5 gallons but less than or equal to 2.5 gallons and fills to a level less than or equal to 1.25 inches below the top of the target fuel tank opening; or~~

~~(C) not less than two gallons per minute for portable fuel containers with a nominal capacity greater than 2.5 gallons.~~

~~(4)~~ (3) Warranted for a period of not less than one year against defects in materials and workmanship.

(~~3~~c) ~~The test procedures for determining compliance with the performance standards in this section are set forth in Section 2467.7~~

Except as provided in Section 2467.3, every portable fuel container, spout, or portable fuel container and spout produced on or after July 1, 2007 that is manufactured for sale, advertised for sale, sold, or offered for sale in California or that is introduced, delivered or imported into California for introduction into commerce and that is subject to any of the standards prescribed in this article and documents incorporated by reference therein, must be certified for use and sale by the manufacturer through the Air Resources Board and covered by an Executive Order issued pursuant to Chapter 9, Article 6, Section 2467.2(d).

(d) ~~The Executive Officer shall coordinate compliance procedures with these Performance Standards with:~~

~~(1) California State Fire Marshal (SFM)~~

~~(2) California Department of Industrial Relations, Division of Occupational Safety and Health (DOSH)~~

The criteria for obtaining certification, including all test procedures for determining certification and compliance with the standards applicable to portable fuel containers, spouts, or portable fuel containers and spouts produced on or after July 1, 2007 that are manufactured for sale, advertised for sale, sold, or offered for sale in California, or that are introduced, delivered or imported into California for introduction into commerce and that are subject to any of the standards prescribed in this article and documents incorporated by reference therein are set forth in "CP-501, Certification Procedure for Portable Fuel Containers and Spill-Proof Spouts," adopted (INSERT DATE.)

(e) ~~Compliance with the Performance Standards in this Section does not exempt spill-proof systems or spill-proof spouts from compliance with other applicable federal and state statutes and regulations such as state fire codes, safety codes, and other safety regulations, nor will the Air Resources Board test for or determine compliance with such other statutes or regulations.~~

The Executive Officer shall coordinate compliance procedures with these Performance and Certification and Compliance Standards with:

(1) California State Fire Marshal (SFM)

(2) California Department of Industrial Relations, Division of Occupational Safety and Health (DOSH)

(f) ~~Notwithstanding the provisions of subsections 2467.2(a) and (b), a portable fuel container or spout or both portable fuel container and spout manufactured before January 1, 2001, may be sold, supplied, or offered for sale until January 1, 2002 if the date of manufacture or representative date is clearly displayed on the portable fuel container or spout. An explanation of the date code shall be filed with the Executive Officer no later than the later of three months after the effective date of this article or within three months of production, and within three months after any change in coding.~~

Compliance with the Performance Certification or Compliance Standards in this Section does not exempt spill-proof systems or spill-proof spouts from compliance with other applicable federal and state statutes and regulations such as state fire codes, safety codes, and other safety regulations, nor will the Air Resources Board test for or determine compliance with such other statutes or regulations.

~~(g) If the Executive Officer finds any manufacturer distributor, or retailer offering for sale in the State of California a portable fuel container or spout or both portable fuel container and spout that does not substantially comply with the requirements set forth in this article, the manufacturer, distributor, or retailer will be subject to being enjoined from any further sales or distribution of such noncompliant portable fuel containers or spouts or both portable fuel containers and spouts, in the State of California pursuant to Section 43017 of the Health and Safety Code. Penalties may be assessed to the extent permissible under Part 5, Division 26 of the Health and Safety Code. Before seeking remedial action against any manufacturer, distributor, or retailer the Executive Officer will consider any information provided by the manufacturer, distributor, or retailer.~~

NOTE:

Authority: Sections 39600, 39601, 43013, 43018, and 43101, of the Health and Safety Code, and *Western Oil and Gas Ass'n. V. Orange County Pollution Control District,* 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975). Reference: Sections 39000, 39001, 39003, 39500, 39515, 39516, 41511, 43000, 43013, 43016, 43017, and 43018, of the Health and Safety Code, and *Western Oil and Gas Ass'n. V. Orange County Pollution Control District,* 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975).

2467.3. Exemptions.

(a) This Article does not apply to any portable fuel container or spout or both portable fuel container and spout manufactured in California for shipment, sale, and use outside of California.

(b) This Article does not apply to a manufacturer or distributor who sells, supplies, or offers for sale in California a portable fuel container or spout or both portable fuel container and spout that does not comply with the Performance Standards specified in Sections 2467.2(a) or (b), or the Certification and Compliance Standards specified in Section 2467.2(d), as long as the manufacturer or distributor can demonstrate that: (1) the portable fuel container or spout or both portable fuel container and spout is intended for shipment and use outside of California; and (2) that the manufacturer or distributor has taken reasonable prudent precautions to assure that the portable fuel container or spout or both portable fuel container and spout is not distributed to California.

This subsection (b) does not apply to portable fuel containers or spouts or both portable fuel containers and spouts that are sold, supplied, or offered for sale by any person to retail outlets in California.

(c) This Article does not apply to safety cans meeting the requirements of Chapter 17, Title 29, Subpart F, of the Code of Federal Regulations (§ 1926.150 et. seq.).

(d) This Article does not apply to portable fuel containers with a nominal capacity less than or equal to one quart.

(e) This Article does not apply to rapid refueling devices with nominal capacities greater than or equal to four gallons, provided such devices are designed for use in officially sanctioned off-highway motor sports such as car racing or motorcycle competitions and either create a leak-proof seal against a stock target fuel tank or are designed to operate in conjunction with a receiver permanently installed on the target fuel tank.

(f) This Article does not apply to portable fuel tanks manufactured specifically to deliver fuel through a hose attached between the portable fuel tank and the outboard engine for the purpose of operating the outboard engine.

(g) This Article does not apply to closed-system portable fuel containers that are used exclusively for fueling remote control model airplanes.

NOTE:

Authority: Sections 39600, 39601, 43013, 43018, and 43101, of the Health and Safety Code, and *Western Oil and Gas Ass'n. V. Orange County Pollution Control District,* 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975). Reference: Sections 39000, 39001, 39003, 39500, 39515, 39516, 41511, 43000, 43013, 43016, 43017, and 43018, of the Health and Safety Code, and *Western Oil and Gas Ass'n. V. Orange County Pollution Control District,* 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975).

2467.4. Innovative Products.

(a) The Executive Officer may exempt a portable fuel container or spout or both portable fuel container and spout from one or more of the requirements of Section 2467.2 if a manufacturer demonstrates by clear and convincing evidence that, due to the product's design, delivery system, or other factors, the use of the product will result in cumulative ROG emissions below the highest emitting representative spill-proof system or representative spill-proof spout in its product category as determined from applicable testing.

(b) For the purposes of this Section, "representative spill-proof system" or a "representative spill-proof spout" means a portable fuel container or spout or both portable fuel container and spout which, at the time of application in (c) of this Section, meets the Performance Standards specified in Sections 2467.2 (a) or (b) or the Certification Requirements specified in "CP-501, Certification Procedure for Portable Fuel Containers and Spill-Proof Spouts, adopted [INSERT DATE]."

(c) A manufacturer (applicant) must apply in writing to the Executive Officer for an innovative product exemption claimed under subsection (a). The application must include the supporting documentation that quantifies the emissions from the innovative product, including the actual physical test methods used to generate the data. In addition, the applicant must provide any information necessary to enable the Executive Officer to establish enforceable conditions for granting the exemption. All information including proprietary data submitted by a manufacturer pursuant to this section shall be handled in

accordance with the procedures specified in Title 17, California Code of Regulations, Sections 91000-91022.

(d) Within 30 days of receipt of the exemption application the Executive Officer shall determine whether an application is complete as provided in section 60030(a), Title 17, California Code of Regulations.

(e) Within 90 days after an application has been deemed complete, the Executive Officer will determine whether, under what conditions, and to what extent, an exemption from the requirements of Sections 2467.2 will be permitted. The applicant and the Executive Officer may mutually agree to a longer time period for reaching a decision. An applicant may submit additional supporting documentation before a decision has been reached. The Executive Officer will notify the applicant of the decision in writing and specify such terms and conditions that are necessary to ensure that emissions from use of the product will meet the emissions reductions specified in subsection (a), and that such emissions reductions can be enforced.

(f) In granting an innovative product exemption for a portable fuel container or spout or both portable fuel container and spout, the Executive Officer shall specify the test methods for determining conformance to the conditions established. The test methods may include criteria for reproducibility, accuracy, and sampling and laboratory procedures.

(g) For any portable fuel container or spout or both portable fuel container and spout for which an innovative product exemption has been granted pursuant to this section, the manufacturer shall notify the Executive Officer in writing at least 30 days before the manufacturer changes a product's design, delivery system, or other factors that may effect the ROG emissions during recommended usage. The manufacturer must also notify the Executive Officer within 30 days after the manufacturer learns of any information that would alter the emissions estimates submitted to the Executive Officer in support of the exemption application.

(h) If the Performance Standards specified in Section 2467.2 are amended for a product category, all innovative product exemptions granted for products in the product category, except as provided in this subsection (i), have no force and effect as of the effective date of the amended Performance Standards.

(i) If the Executive Officer believes that a portable fuel container or spout or both portable fuel container and spout for which an exemption has been granted no longer meets the criteria for an innovative product specified in subsection (a), the Executive Officer may hold a public hearing in accordance with the procedures specified in Title 17, California Code of Regulations, Subchapter 1.25, to determine if the exemption should be modified or revoked.

NOTE:

Authority: Sections 39600, 39601, 43013, 43018, and 43101, of the Health and Safety Code, and *Western Oil and Gas Ass'n. V. Orange County Pollution Control District,* 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975). Reference: Sections 39000, 39001, 39003, 39500, 39515, 39516, 41511, 43000, 43013, 43016, 43017, and 43018, of the Health and Safety Code, and *Western Oil and Gas Ass'n. V. Orange County Pollution Control District,* 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975).

2467.5. Administrative Requirements.

(a) Each manufacturer of a portable fuel container or portable fuel container and spout subject to and complying with Section 2467.2(a) must clearly display on each spill-proof system:

(1) the phrase "Spill-Proof System";

(2) a date of manufacture or representative date; and

(3) a representative code identifying the portable fuel container or portable fuel container and spout as subject to and complying with Section 2467.2(a).

(b) Each manufacturer of a spout subject to and complying with Section 2467.2(b) must clearly display on the accompanying package, or for spill-proof spouts sold without packaging, on either the spill-proof spout or a label affixed thereto:

(1) the phrase "Spill-Proof Spout";

(2) a date of manufacture or representative date; and

(3) a representative code identifying the spout as subject to and complying with Section 2467.2(b).

(c) Each manufacturer of a portable fuel container or portable fuel container and spout subject to and complying with Section 2467.2(c) must clearly display on each spill-proof system:

(1) the phrase "Spill-Proof System";

(2) a date of manufacture or representative date; and

(3) a representative code identifying the Executive Order Number issued by ARB for the portable fuel container or portable fuel container and spout.

~~(c)~~ (d) Each manufacturer subject to subsection (a), ~~or~~ (b), or (c) must file an explanation of both the date code and representative code with the Executive Officer no later than the later of three months after the effective date of this article or within three months of production, and within three months after any change in coding.

~~(d) Each manufacturer subject to subsection (a) or (b) must clearly display a fuel flow rate on each spill-proof system or spill-proof spout, or label affixed thereto, and on any accompanying package.~~

~~(e)~~ (d) Each manufacturer of a spout subject to subsection (b) or (c) must clearly display the make, model number, and size of only those portable fuel container(s) the spout is designed to accommodate and can demonstrate compliance with Section 2467.2(a) or 2467.2(c) on the accompanying package, or for spill-proof spouts sold without packaging, on either the spill-proof spout, or a label affixed thereto.

~~(f)~~ (e) Manufacturers of portable fuel containers or portable fuel containers and spouts not subject to or not in compliance with Section 2467.2 may not display the phrase "Spill-Proof System" or "Spill-Proof Spout" on the portable fuel container or spout, respectively, on any sticker or label affixed thereto, or on any accompanying package.

~~(g)~~ (f) Each manufacturer of a portable fuel container or spout or both portable fuel container and spout subject to and complying with Section 2467.2 that due to its design or other features cannot be used to refuel one or more on-road motor vehicles must clearly display the phrase "Not Intended For Refueling On-Road Motor Vehicles" in type of 34 point or greater on each:

(1) Spill-proof system or label affixed thereto, and on the accompanying package, if any; and

(2) package accompanying a spill-proof spout sold separately from a spill-proof system, or for spill-proof spouts sold without packaging, on either the spill-proof spout, or a label affixed thereto.

NOTE:

Authority: Sections 39600, 39601, 43013, 43018, and 43101, of the Health and Safety Code, and *Western Oil and Gas Ass'n. V. Orange County Pollution Control District,* 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975). Reference: Sections 39000, 39001, 39003, 39500, 39515, 39516, 41511, 43000, 43013, 43016, 43017, and 43018, of the Health and Safety Code, and *Western Oil and Gas Ass'n. V. Orange County Air Pollution Control District,* 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975).

2467.6. Variances.

(a) Any person or manufacturer who cannot comply with the requirements set forth in Section 2467.2 due to extraordinary reasons beyond the person's reasonable control, may apply in writing to the Executive Officer for a variance. The variance application must set forth:

(1) the specific grounds upon which the variance is sought;

(2) the proposed date(s) by which compliance with the provisions of Section 2467.2 will be achieved; and

(3) a compliance report reasonably detailing the method(s) by which compliance will be achieved.

(b) Upon ~~receipt of~~ receiving a complete variance application containing the information required in subsection (a), the Executive Officer shall hold a public hearing to determine whether, under what conditions, and to what extent, a variance from the requirements in Section 2467.2 is necessary and will be permitted. A hearing will be initiated no later than 75 days after receipt of a complete variance application. Notice of the time and place of the hearing must be sent to the applicant by certified mail not less than 30 days before the hearing. Notice of the hearing must also be submitted for publication in the California Regulatory Notice Register and sent to every person who requests such a notice, not less than 30 days before the hearing. The notice must state that the parties may, but not need ~~to~~ be, represented by counsel at the hearing. At least 30 days before the hearing, the variance application must be made available to the public for inspection.

Interested members of the public must be allowed a reasonable opportunity to testify at the hearing and their testimony must be considered.

(c) No variance may be granted unless all of the following findings are made:

(1) that, due to reasons beyond the reasonable control of the applicant, required compliance with Section 2467.2 would result in extraordinary economic hardship;

(2) that the public interest in mitigating the extraordinary hardship to the applicant by issuing the variance outweighs the public interest in avoiding any increased emissions of air contaminants that would result from issuing the variance; and

(3) that the compliance report proposed by the applicant can reasonably be implemented, and will achieve compliance as expeditiously as possible.

(d) Any variance order shall specify a final compliance date by which the requirements of Section 2467.2 will be achieved. Any variance order shall contain a condition that specifies increments of progress necessary to assure timely compliance, and such other conditions that the Executive Officer, in consideration of the testimony received at the hearing, finds necessary to carry out the purposes of Division 26 of the Health and Safety Code.

(e) A variance shall cease to be effective upon failure of the party to whom the variance was granted to comply with any term or condition of the variance.

(f) Upon the application of any person, the Executive Officer may review, and for good cause, modify or revoke a variance from requirements of Section 2467.2, after holding a public hearing in accordance with the provisions of subsection (b).

NOTE:

Authority: Sections 39600, 39601, 43013, 43018, and 43101, of the Health and Safety Code, and *Western Oil and Gas Ass'n. V. Orange County Pollution Control District,* 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975). Reference: Sections 39000, 39001, 39003, 39500, 39515, 39516, 41511, 43000, 43013, 43016, 43017, and 43018, of the Health and Safety Code, and *Western Oil and Gas Ass'n. V. Orange County Pollution Control District,* 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975).

2467.7. <u>Performance Standard</u> Test Procedures.

(a) Testing to determine compliance with Section 2467.2(b) of this article shall be performed by using the following test procedures:

(1) "Test Method 510, Automatic Shut-Off Test Procedure For Spill-Proof Systems And Spill-Proof Spouts," adopted July 6, 2000, (section numbers corrected September 13, 2000), <u>(amended INSERT DATE)</u> which ~~are~~ <u>is</u> incorporated by reference herein.

(2) "Test Method 511, Automatic Closure Test Procedure For Spill-Proof Systems And Spill-Proof Spouts," adopted July 6, 2000, (section numbers corrected September 13, 2000), which ~~are~~ <u>is</u> incorporated by reference herein.

~~(3) "Test Method 512, Determination of Fuel Flow Rate for Spill-Proof Systems and Spill-Proof Spouts,""adopted July 6, 2000, (section numbers corrected September 13, 2000), which are incorporate by reference herein.~~

(b) Testing to determine compliance with Section 2467.2(a) of this article shall be performed by using all test procedures in (a) above and the following test procedure:

(1) "Test Method 513, Determination Of Permeation Rate For Spill-Proof Systems," adopted July 6, 2000, (section numbers corrected September 13, 2000), which ~~are~~ is incorporated by reference herein.

(c) Alternative methods that are shown to be accurate, precise, and appropriate may be used upon written approval of the Executive Officer.

(d) Test procedures referred to in this Article can be obtained from the California Air Resources Board, and may be available at http://www.arb.ca.gov.

NOTE:

Authority: Sections 39600, 39601, 43013, 43018, and 43101, of the Health and Safety Code, and *Western Oil and Gas Ass'n. V. Orange County Pollution Control District,* 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975). Reference: Sections 39000, 39001, 39003, 39500, 39515, 39516, 41511, 43000, 43013, 43016, 43017, and 43018, of the Health and Safety Code, and *Western Oil and Gas Ass'n. V. Orange County Pollution Control District,* 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975).

~~**2467.8 Severability.**~~

~~(a) Each part of this article is severable, and in the event that any part of this article is held to be invalid, the remainder of this article continues in full force and effect.~~

~~NOTE:~~

~~Authority: Sections 39600, 39601, 43013, 43018, and 43101, of the Health and Safety Code, and *Western Oil and Gas Ass'n. V. Orange County Pollution Control District,* 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975). Reference: Sections 39000, 39001, 39003, 39500, 39515, 39516, 41511, 43000, 43013, 43016, 43017, and 43018, of the Health and Safety Code, and *Western Oil and Gas Ass'n. V. Orange County Pollution Control District,* 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975).~~

2467.8. Certification and Compliance Test Procedures.

(a) Testing to determine compliance with Section 2467.2(c) of this article shall be performed by using the test procedures specified in "CP-501, Certification Procedure for Portable Fuel Containers and Spill-Proof Spouts, adopted [ADOPTION DATE], which is incorporated by reference herein.

(b) Alternative methods that are shown to be accurate, precise, and appropriate may be used upon written approval of the Executive Officer.

(c) Test procedures referred to in this Article can be obtained from the California Air Resources Board, and may be available at http://www.arb.ca.gov.

NOTE:
Authority: Sections 39600, 39601, 43013, 43018, and 43101, of the Health and Safety Code, and *Western Oil and Gas Ass'n. V. Orange County Pollution Control District,* 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975). Reference: Sections 39000, 39001, 39003, 39500, 39515, 39516, 41511, 43000, 43013, 43016, 43017, and 43018, of the Health and Safety Code, and *Western Oil and Gas Ass'n. V. Orange County Pollution Control District,* 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975).

2467.9. Enforcement.

(a) If the Executive Officer finds any manufacturer, distributor, or retailer manufacturing for sale, advertising for sale, selling, or offering for sale in the State of California a portable fuel container or spout or both portable fuel container and spout that does not comply with the requirements set forth in this article, he or she may enjoin said manufacturer, distributor, or retailer from any further manufacture, advertisement, sales, offers for sale, or distribution of such noncompliant portable fuel containers or spouts or both portable fuel containers and spouts, in the State of California pursuant to Section 43017 of the Health and Safety Code. The Executive Officer may also assess penalties to the extent permissible under Part 5, Division 26 of the Health and Safety Code and/or revoke any Executive Order(s) issued for the non-compliant portable fuel container, spout or both portable fuel container and spout.

(b) Before seeking remedial action against any manufacturer, distributor, or retailer the Executive Officer will consider any information provided by the manufacturer, distributor, or retailer.

NOTE:
Authority: Sections 39600, 39601, 43013, 43018, and 43101, of the Health and Safety Code, and *Western Oil and Gas Ass'n. V. Orange County Pollution Control District,* 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975). Reference: Sections 39000, 39001, 39003, 39500, 39515, 39516, 41511, 43000, 43013, 43016, 43017, and 43018, of the Health and Safety Code, and *Western Oil and Gas Ass'n. V. Orange County Pollution Control District,* 14 Cal.3d 411, 121 Cal.Rptr. 249 (1975).

APPENDIX B

PROPOSED CP-501, CERTIFICATION PROCEDURE FOR PORTABLE FUEL CONTAINERS AND SPILL-PROOF SPOUTS

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California Environmental Protection Agency

Air Resources Board

Certification Procedure 501
For Portable Fuel Containers And
Spill-Proof Spouts

CP-501

Adoption Date: [To be determined]

TABLE OF CONTENTS

1. GENERAL INFORMATION AND APPLICABILITY 2

1.1 Legislative and Regulatory Requirements of Other State Agencies 2

1.2 Requirement to Comply with All Other Applicable Codes and Regulations 2

2. CERTIFICATION REQUIREMENTS 2

2.1 Openings 3

2.2 Color 3

2.3 Diurnal Emissions Standard 3

2.4 Durability 4

2.5 Leakage 4

2.6 Automatic Closure 4

2.7 Warranty 4

2.8 Operating and Maintenance Instructions 5

2.9 Materials Compatibility with Fuels 5

2.10 Optional Consumer Acceptance Program 5

3. SUBMITTING AN APPLICATION 7

4. APPLICATION REVIEW AND ACCEPTANCE 9

5. ENGINEERING EVALUATION 9

6. ALTERNATE TEST AND INSPECTION PROCEDURES 10

California Environmental Protection Agency
Air Resources Board

CP-501

Certification Procedure For Portable Fuel Containers and Spill-Proof Spouts

The definitions in Section 2467.1, Title 13 of the California Code of Regulations (CCR) apply to this Certification Procedure. For purposes of this Procedure, the term "ARB" refers to the California Air Resources Board.

1. GENERAL INFORMATION AND APPLICABILITY

This document specifies the criteria and procedures used by ARB to evaluate and certify portable fuel containers, spouts, or both portable fuel container and spouts manufactured for sale, advertised for sale, sold, or offered for sale in California or that are introduced, delivered or imported into California for introduction into commerce. An Executive Order will only be issued for a portable fuel container, spout, or both portable fuel container and spout that demonstrates compliance with all applicable certification requirements.

1.1 Legislative and Regulatory Requirements of Other State Agencies

The Executive Officer shall coordinate these Certification and Compliance Procedures with:

a) California State Fire Marshal (SFM); and

b) California Department of Industrial Relations, Division of Occupational Safety and Health (DOSH).

1.2 Requirement to Comply with All Other Applicable Codes and Regulations

Compliance with the Performance, Certification or Compliance Standards in this Section does not exempt spill-proof systems or spill-proof spouts from compliance with other applicable federal and state statutes and regulations such as state fire codes, safety codes, and other safety regulations, nor will the Air Resources Board test for or determine compliance with such other statutes or regulations.

2. CERTIFICATION REQUIREMENTS

The application for certification shall include the results for each test specified in Air Resources Board Test Procedure TP-501, Test Procedure for Determining Integrity of Spill-Proof Spouts and Spill-Proof Systems (Date) and Air Resources Board Test Procedure TP-502, Test Procedure for Determining Diurnal Emissions from

Portable Fuel Containers (Date), which are incorporated by reference herein. The tests shall be conducted using six (6) spill-proof systems, or spill-proof spouts of the same product family. An accredited independent test laboratory shall conduct all tests specified in this Certification Procedure. For purposes of this requirement, an accredited independent test laboratory is one that is not owned, operated or affiliated with the applicant seeking an Executive Order. The certification requirements are included in Table 2-1.

2.1 Openings

A portable fuel container may incorporate a secondary opening or vent hole (i.e. an opening other than the opening needed for the spout) provided the secondary opening or vent hole is not easily tampered by a consumer, and it does not emit hydrocarbon vapors in excess of the amounts specified in these requirements during fueling, storage, transportation or handling events.

2.2 Color

Portable fuel containers shall be color coded for specific fuels:

a) Gasoline – red;

b) Diesel – yellow; and

c) Kerosene – blue.

Each portable fuel container must have identification markings on the container and on the spill-proof spout.

a) Red containers shall be permanently identified with the embossed language, or permanent durable label "GASOLINE" in minimum 34-point Arial font or a font of equivalent proportions.

b) Yellow containers shall be permanently identified with the embossed language, or permanent durable label "DIESEL" in minimum 34-point Arial font or a font of equivalent proportions.

c) Blue containers shall be permanently identified with the embossed language, or permanent durable label "KEROSENE" in minimum 34-point Arial font or a font of equivalent proportions.

2.3 Diurnal Emissions Standard

a) Portable fuel containers produced on or after July 1, 2007 that are equipped with an intended spill-proof spout must emit no more than 0.4 grams per gallon per-day as determined by Air Resources Board Test Procedure TP-502, Test Procedure for Determining Diurnal Emissions from Portable Fuel Containers (Date), which is incorporated by reference

herein.

b) Portable fuel containers produced on or after January 1, 2009 that are equipped with an intended spill-proof spout must emit no more than 0.3 grams per gallon per-day as determined by Air Resources Board Test Procedure TP-502 Test Procedure for Determining Diurnal Emissions from Portable Fuel Containers (Date), which is incorporated by reference herein.

c) Portable fuel containers that share similar designs, are constructed of identical materials, and that are manufactured using identical processes, but vary only in size may be considered for certification as a product family.

2.4 Durability

Portable fuel containers, spouts, or both portable fuel containers and spouts must comply with the specifications for durability in Air Resources Board Test Procedure TP-501, Test Procedure for Determining Integrity of Spill-Proof Spouts and Spill-Proof Systems (Date) and Air Resources Board Test Procedure TP-502, Test Procedure for Determining Diurnal Emissions from Portable Fuel Containers (Date) for containers and spouts, which are incorporated by reference herein.

2.5 Leakage

There shall be no fluid leakage from any point in the spill-proof system or spill-proof spout as specified in Air Resources Board Test Procedure TP-501, Test Procedure for Determining Integrity of Spill-Proof Spouts and Spill-Proof Systems (Date) and Air Resources Board Test Procedure TP-502, Test Procedure for Determining Diurnal Emissions from Portable Fuel Containers (Date), which are incorporated by reference herein.

2.6 Automatic Closure

The spill-proof system or spill-proof spout shall automatically close when the spill-proof spout is removed from the target tank, seal and remain completely closed when not dispensing fuel, as specified in Air Resources Board Test Procedure TP-501, Test Procedure for Determining Integrity of Spill-Proof Spouts and Spill-Proof Systems (Date), which is incorporated by reference herein. Also, no liquid, beyond wetted surfaces, shall be retained in the spill-proof spout after fueling that may evaporate into the atmosphere.

2.7 Warranty

a) An applicant seeking an Executive Order pursuant to this article must warrant that its spill-proof system or spill-proof spout is free from defects in materials and workmanship that cause such systems or spill-proof

spouts to fail to conform with each of the certification and compliance standards specified in "CP-501, Certification Procedure for Portable Fuel Containers and Spill-Proof Spouts, adopted (Date)" for a period of one year from the date of sale.

b) An applicant must supply a copy of the warranty language specified in section a) above in the packaging for each spill-proof system or spill-proof spout at the time of sale identifying the following minimum requirements:

1) A statement of the terms and length of the warranty period;

2) An unconditional statement that the spill-proof system or spill-proof spout is certified to California requirements; and

3) A listing of the specific certification requirements or limitations to which it was certified.

2.8 Operating and Maintenance Instructions

An applicant must supply a copy of the operating instructions intended for each spill-proof system or spill-proof spout, and fueling application. These instructions shall include, at a minimum, the following specifications:

a) The designed intent of the spill-proof system or spill-proof spout, and the types of equipment with which it may be used to refuel; and

b) Other instructions, such as the recommended fueling angle(s) or special instructions such as venting prior to use.

2.9 Materials Compatibility with Fuels

Spill-proof systems, spill-proof spouts and all components incorporated therein, such as gaskets, seals, or O-rings must demonstrate compliance with the requirements of ASTM F-852-99 (March 10, 1999), and ASTM F-976-02 (May 10, 2002) which is incorporated by reference herein.

Applicants may request limited certification for use with only specified fuel blends. Such fuel-specific certifications shall clearly specify the limits and restrictions of the certification.

2.10 Optional Consumer Acceptance Program

An applicant may elect to participate in an optional consumer acceptance program for any or all of spill-proof systems or spill-proof spouts. Under this program, an applicant may supply a "consumer acceptance plan" as part of its certification program for consideration by the ARB Executive Officer. At a

minimum, a consumer acceptance plan must include the following minimum criteria:

a) At least 10 persons will evaluate no more than 3 of the applicant's specific spill-proof systems or spill proof spouts;
b) Each person must have only limited experience with said spill-proof systems or spill-proof spouts;
c) Each person will be provided no more than 5 minutes to read the instructions provided with the spill-proof system or spill-proof spout, and to assemble the product for use;
d) Each person shall fill an evaluation matrix of spill-proof systems or spill-proof spouts independently, out of view of other evaluators. The evaluation matrix, PFC Consumer Acceptance Matrix dated March 9, 2005 is attached.
e) Each person must dispense liquid from a specific spill-proof system or spill-proof spout into the matrix tanks;
f) After dispensing liquid from each specific spill-proof system or spill-proof spout, each person must document his or her opinion regarding the ease of use of said product on the evaluation matrix using a two category scoring system, not acceptable and acceptable; and
g) A minimum score equivalent to 70% acceptable shall be authorized one consumer acceptance star. A minimum score equivalent to 80% acceptable shall be authorized two consumer acceptance stars. A minimum score equivalent to 90% acceptable shall be authorized three consumer acceptance stars. Any manufacturer that elects to add the words "think safety" on the container in minimum 34-point Arial font in Spanish shall be awarded 5 bonus points to the total consumer acceptance score.

The ARB Executive Officer may elect to conduct duplicate consumer acceptance testing to verify the results submitted by participating applicants and may modify these criteria.

Table 2-1
Certification Requirements

Performance Type	Requirement				Sec	**Test Method**
Openings	Minimum release of hydrocarbon vapors				2.1	
Color	Fuel	Gasoline	Diesel	Kerosene	2.2	
	Color	Red	Yellow	Blue		

Diurnal	≤ 0.4 grams per gallon-day, July 1, 2007 ≤ 0.3 grams per gallon-day, January 1, 2009	2.3	ARB TP-502
Durability	Spout and container durability	2.4	ARB TP-501& TP-502
Leakage	No leakage	2.5	ARB TP-501& TP-502
Automatic Closure	Spout automatically closes and seals when removed from tank	2.6	ARB TP-501
Warranty	One year warranty, packaging requirements	2.7	
Instructions Operating & maintenance	Equipment and fueling specific instructions	2.8	
Materials Compatibility with Fuels	Must be compatible with fuels	2.9	ASTM F-852, & F976
Optional Consumer Acceptance Program	Optional Consumer Acceptance Criteria	2.10	

3. SUBMITTING AN APPLICATION

An applicant must submit the following information in its application for certification:

3.1 Model number(s) and size(s) of spill-proof systems or spill-proof spouts for which certification is requested. The applicant must supply test data that demonstrates the spill-proof systems or spill-proof spouts comply with each of the certification requirements identified in Table 2-1.

3.2 Engineering drawings of the spill-proof system or spill-proof spout detailing dimensions specific to each component. If an application is submitted for a spill-proof system (i.e., container and spout), separate dimensioned drawings for the portable fuel container and for the spill-proof spout are required. If more than one type or size of portable fuel container or more than one type of spill-proof spout is included in the application, separate dimensioned drawings are required for each component.

3.3 A sample of the spill-proof system or spill-proof spout.

3.4 Test data from each of the test procedures specified in Air Resources Board Test Procedure TP-501, Test Procedure for Determining Integrity of Spill-Proof Spouts and Spill-Proof Systems (Date) and Air Resources Board Test

Procedure TP-502, Test Procedure for Determining Diurnal Emissions from Portable Fuel Containers (Date) demonstrating that the spill-proof system, spill-proof spout, or component meets the applicable criteria.

3.5 Any other test data that supports the requirements in 3.4 above and that would assist in the determination of certification.

3.6 The language, symbols, or patterns that will actually be permanently embossed on the spill-proof system or spill-proof spout. This shall include examples of date code wheels as well as all other permanent markings and their locations on the container and/or spill-proof spout. Once an executive order is issued for a spill-proof system or spill-proof spout, these permanent markings cannot be altered or modified in any way without first obtaining the approval of the ARB Executive Officer.

3.7 The language or label(s) that may be affixed to the spill-proof system or spill-proof spout at the time of sale.

3.8 The manufacturer's recommended instructions, instruction decals, or any other type of placard attached to the spill-proof system or spill-proof spout at the time of sale. Include examples of actual decals or placards if available. Proposed placards or decals are sufficient if actual samples are not available. Once an executive order is issued for a spill-proof system or spill-proof spout, these decals or placards cannot be altered or modified in any way without first obtaining the approval of the ARB Executive Officer.

3.9 The manufacturer warranty(s) as defined in section 2.7.

3.10 A description of the materials used in the construction of the spill-proof system or spill-proof spout. Material compositions of gaskets, O-rings and seals must be described.

3.11 If the applicant is not the manufacturer of all system components incorporated in a spill-proof system or spill-proof spout, the applicant must include evidence that the component manufacturer(s) have been notified of the applicant's intended use of the manufacturers' components in the spill-proof system or spill-proof spout for which the application is being made.

a) If the applicant is requesting inclusion of one or more components not manufactured by it on the applicable spill-proof system or spill-proof spout, the applicant shall notify the component manufacturer(s) and obtain the information required of the application as specified in section 3.1 through 3.11.

b) If the component(s) requested for inclusion in the certification have not been previously incorporated in a spill-proof system or spill-proof spout

that has been issued an executive order pursuant to these procedures, each of the component(s) shall be subject to each of the application and test requirements specified herein.

4. APPLICATION REVIEW AND ACCEPTANCE

4.1 If the application for certification contains all of the information required by these procedures, it will be deemed to be complete and will be processed for certification. The application shall not be deemed complete until each of the minimum requirements listed in this Certification Procedure is completed.

4.2 The Executive Officer may find it necessary to request additional information of the applicant in order to complete the application and/or evaluate specific spill-proof systems or spill-proof spouts.

4.3 Applications will be processed in accordance with the procedures and time periods set forth in 17 CCR section 60030 et seq. The time periods may be extended by the Executive Officer as deemed reasonable.

4.4 The application shall be signed by the applicant or by their authorized delegate.

5. ENGINEERING EVALUATION

The ARB Executive Officer shall evaluate each application for certification of a spill-proof system or spill-proof spout to determine if the spill-proof system or spill-proof spout complies with the criteria for issuance of an executive order.

5.1 Any spill-proof system or spill-proof spout that does not comply with the requirements of this Certification Procedure shall be denied certification, and the application shall be returned to the applicant with reason(s) for denial. ARB will not evaluate an applicant's re-submittal of a spill-proof system or spill-proof spout application for certification unless the applicant can demonstrate that it has addressed and/or corrected deficiencies identified by ARB during the initial evaluation. The applicant must supply a written notification to the Executive Officer to identify the deficiency(s) and remedy(s).

5.2 The spill-proof system or spill-proof spout certification requirements submitted by the applicant shall be reviewed to ensure that they conform to the certification requirements in Section 2 of this Procedure.

5.3 The procedures for, and results of, any bench test or operational test results contained in the application shall be reviewed to determine if such procedures comply with the required test methodology, and to ensure that the results comply with the certification requirements described in this Procedure.

6. ALTERNATE TEST AND INSPECTION PROCEDURES

Test procedures other than those specified in this Certification Procedure may be used only if prior written approval is obtained from the Executive Officer. For purposes of this procedure, a test procedure is a methodology used to determine, with a high degree of accuracy, precision, and reproducibility, the value of a specified parameter. Once the test procedure is utilized to generate test data, the results are compared to the applicable certification requirements.

6.1 An applicant may request advance ARB Executive Officer approval to utilize an alternative test procedure. This request shall describe the proposed alternative test procedure, including equipment specifications necessary to conduct the test. If training is required to properly perform a test, a proposed training program shall be included.

6.2 The Executive Officer shall respond within sixty (60) days of receipt of a request and indicate that a formal response will be sent within one hundred twenty (120) days. This time period will allow for a detailed analysis of the proposed test procedure. If the Executive Officer determines that he or she cannot adequately evaluate the request within the specified time periods, he or she shall notify the applicant of said determination along with a projected date that a decision will be made.

6.3 All testing to determine the acceptability of the procedure shall be conducted by ARB staff, or by an independent test laboratory under the direction of ARB. Testing shall be conducted in accordance with good engineering judgement.

6.4 Test Procedure approval shall be granted on a case-by-case basis, only after all necessary comparison testing has been conducted. Because of the evolving nature of technology and test procedures, such approval may or may not be granted in subsequent cases without a new request for approval and additional testing to determine equivalency. If, after approval is granted, subsequent information demonstrates that equivalency between the two methods no longer meet the USEPA Method 301 requirements (Date), which is incorporated by reference herein, the Executive Officer may revoke the alternate status of the procedure.

6.5 Any approvals to use alternate test procedures, and the supporting evaluation test results shall be maintained by the Executive Officer.

APPENDIX C

PROPOSED TP-501, TEST PROCEDURE FOR DETERMING INTEGRITY OF SPILL-PROOF SPOUTS AND SPILL-PROOF SYSTEMS

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California Environmental Protection Agency

Air Resources Board

Test Procedure for Determining Integrity of Spill-Proof Spouts and Spill-Proof Systems

TP - 501

Adoption Date:[to be determined]

TABLE OF CONTENTS

Page

1. APPLICABILITY 3
2. PRINCIPAL AND SUMMARY OF TEST PROCEDURE 3
3. BIASES AND INTERFERENCES 3
4. SENSITIVITY, RANGE, AND PRECISION 3
5. EQUIPMENT 4
6. CALIBRATION PROCEDURE 4
7. TEST PROCEDURE 4
   - 7.1 System Preparation 4
   - 7.2 Verify Leak Free System 4
   - 7.3 Verify Automatic Closure 4
   - 7.4 Pressurized Leak Check 5
8. QUALITY ASSURANCE / QUALITY CONTROL (QA/QC) 5
9. RECORDING DATA 5
10. CALCULATING RESULTS 5
11. ALTERNATIVE TEST PROCEDURES 5
12. REFERENCES 6
13. FIGURES 6
    - *Figure 1. Field Data Sheet* 6
    - *Figure 2. Test Fixture* 6
    - *Figure 3. Elevated Pressure Test Setup* 6

California Environmental Protection Agency
Air Resources Board

Test Procedure for Determining Integrity of Spill-Proof Spouts and Spill-Proof Systems

The definitions in Section 2467.1, Article 6, Chapter 9 of Title 13, California Code of Regulations (CCR) applies to this test procedure.

For the purpose of this procedure, the term "ARB" refers to the California Air Resources Board, and the term "Executive Officer" refers to the ARB Executive Officer or his or her authorized representative or designate.

1. APPLICABILITY

This Test Procedure is used to verify the performance of the automatic closure and leak free features of spill-proof systems or spill-proof spouts. It is applicable in all cases where portable fuel containers, spouts or both portable fuel containers and spouts are manufactured for sale, sold, advertised for sale, or offered for sale in California or that are introduced, delivered or imported into California for introduction into commerce.

2. PRINCIPAL AND SUMMARY OF TEST PROCEDURE

This procedure is used to verify the performance of the automatic closure and leak free features of a spill-proof spout when installed on a portable fuel container (spill-proof system). Using water, the portable fuel container is filled to its rated capacity and inverted for a period of time for an initial check for leaks. The liquid is then dispensed through the spill-proof spout into a test fixture. The spill-proof spout is allowed to close when approximately 25% of the container rated capacity has been dispensed to verify the automatic closure feature is operational and checked for leaks and liquid retention in any open parts of the spout. This procedure is repeated twice more without refilling the container to check the performance at three different fill levels. The spill-proof system is then pressurized to 5.0 pounds per square inch (psig) with compressed air and immersed in a water bath for five minutes to test for high-pressure leaks.

3. BIASES AND INTERFERENCES

This section is reserved for future specifications.

4. SENSITIVITY, RANGE, AND PRECISION

This section is reserved for future specifications.

5. EQUIPMENT

5.1 Test fixture as shown in Figure 2.

5.2 Pressure gauge, 0-15 psig, 0.2 psig graduation, Grade 2A accuracy or better.

5.3 Pressure gauge adapter and container pressurization assembly as shown in Figure 3.

6. CALIBRATION PROCEDURE

This section is reserved for future specifications.

7. TEST PROCEDURE

7.1 System Preparation

Fill the portable fuel container to its rated capacity with water and attach the spill-proof spout per manufacturer instructions. For spill-proof spouts that are not part of a spill-proof system, select the largest portable fuel container specified for use by the spill-proof spout manufacturer for the test procedure. Fill the selected portable fuel container to its rated capacity with water and attach the spill-proof spout per manufacturer instructions. This assembly is now considered a spill-proof system.

7.2 Verify Leak Free System

Invert the spill-proof system with the spout in a vertical axis position for a period of five minutes to ensure that there are no leaks. Record the outcome on the field data sheet (see Figure 1). If the spill-proof system is observed leaking, place the spill-proof system in the upright position and ensure that the spill-proof spout is correctly and firmly attached. Invert the container again for a period of five minutes and check for leaks. Record the outcome on the field data sheet.

7.3 Verify Automatic Closure

Pre-fill the test fixture with 0.25 multiplied by (5.0 gallons--minus the container's rated capacity) gallons of water as shown in the following equation:

$$\text{Pre} - \text{fill Volume} = 0.25 * (5 \text{ gallons} - \text{capacity in gallons})$$

Following the manufacturers instructions, carefully insert the spill-proof spout into the opening on top of the test fixture (see Figure 2) and dispense water until the

tip of the spout is immersed in water. Lift the container to engage the automatic closure feature and gently tap the spout against the opening of the test fixture to remove any water that may adhere to the exterior surface of the spout. Verify that the spout remains closed and sealed by observing the spout for any water leakage while still in the inverted position for 10 seconds. Return the system to the normal upright position and check for leaks and liquid retention while repositioning and for 10 seconds after repositioning. Record observations on the field data sheet.

Empty test fixture and repeat test procedure two more times in sequence without refilling the fuel container.

7.4 Pressurized Leak Check

Remove the spill-proof spout and modify the portable fuel container as detailed in figure 3. Fill the portable fuel container to its rated capacity with water and attach the spill-proof spout per manufacturer's instructions. Using a sufficient ballast, place the modified spill-proof system upright in a water bath large enough to completely cover the portable fuel container and at least six inches. Using a compressed air source, slowly pressurize the spill-proof system to 5.0 psig and record the pressure at which any leaks (i.e., bubbles) may appear. After reaching 5.0 psig, observe the system for any leaks for a period of five minutes. Leaks are determined through the evidence of any bubbles coming from the portable fuel container or spout. Record observations on the field data sheet.

8. QUALITY ASSURANCE / QUALITY CONTROL (QA/QC)

This section is reserved for future specification.

9. RECORDING DATA

Record data on a form similar to the one shown in Figure 1.

10. CALCULATING RESULTS

This section is reserved for future specifications.

11. ALTERNATIVE TEST PROCEDURES

Test procedures, other than specified above, shall only be used if prior written approval is obtained from the ARB Executive Officer. In order to secure the ARB Executive Officer's approval of an alternative test procedure, the applicant is responsible for demonstrating to the ARB Executive Officer's satisfaction that the alternative test procedure is equivalent to this test procedure.

Such approval shall be granted on a case-by-case basis only.

Documentation of any such approvals, demonstrations, and approvals shall be maintained by the ARB Executive Officer and shall be made available upon request.

12. REFERENCES

This section is reserved for future specification.

13. FIGURES

Figure 1. Field Data Sheet

Figure 2. Test Fixture

Figure 3. Elevated Pressure Test Setup

Figure 1

Field Data Sheet

Portable Fuel Container Compliance Tests

I.D. Number _____ **Container Volume (gallons)** _____

System Mfg. _____ **Spout Model** _____
Container Model _____

Initial Leak Check __P__ __F__ **Tested By:** _____ **Test Date:** _____

Automatic Closure Test

Tested By: _____ **Test Date:** _____

Automatic Closure Test Results (pass / fail).			Comments
Trial 1	Trial 2	Trial 3	

Elevated Pressure Test

Tested By: _____ **Test Date:** _____

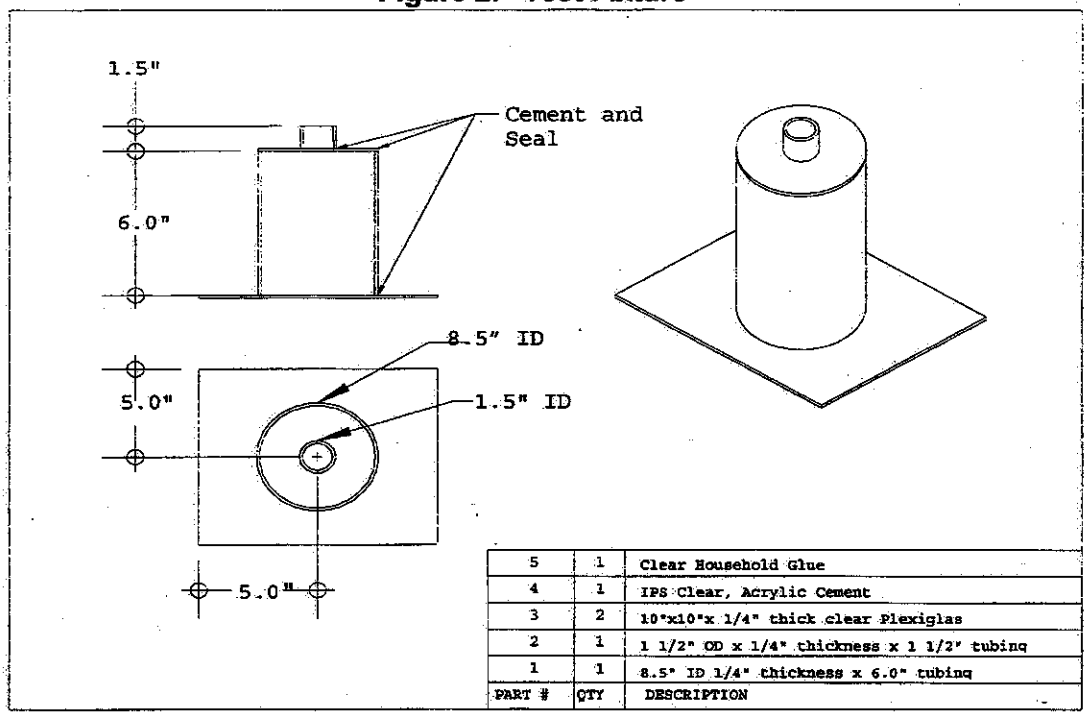
Pressure Test Results				Comments
Start Time	Stop Time	Total (minutes)	Results (pass/fail)	

I.D. # of Container Used _____

Additional Comments:

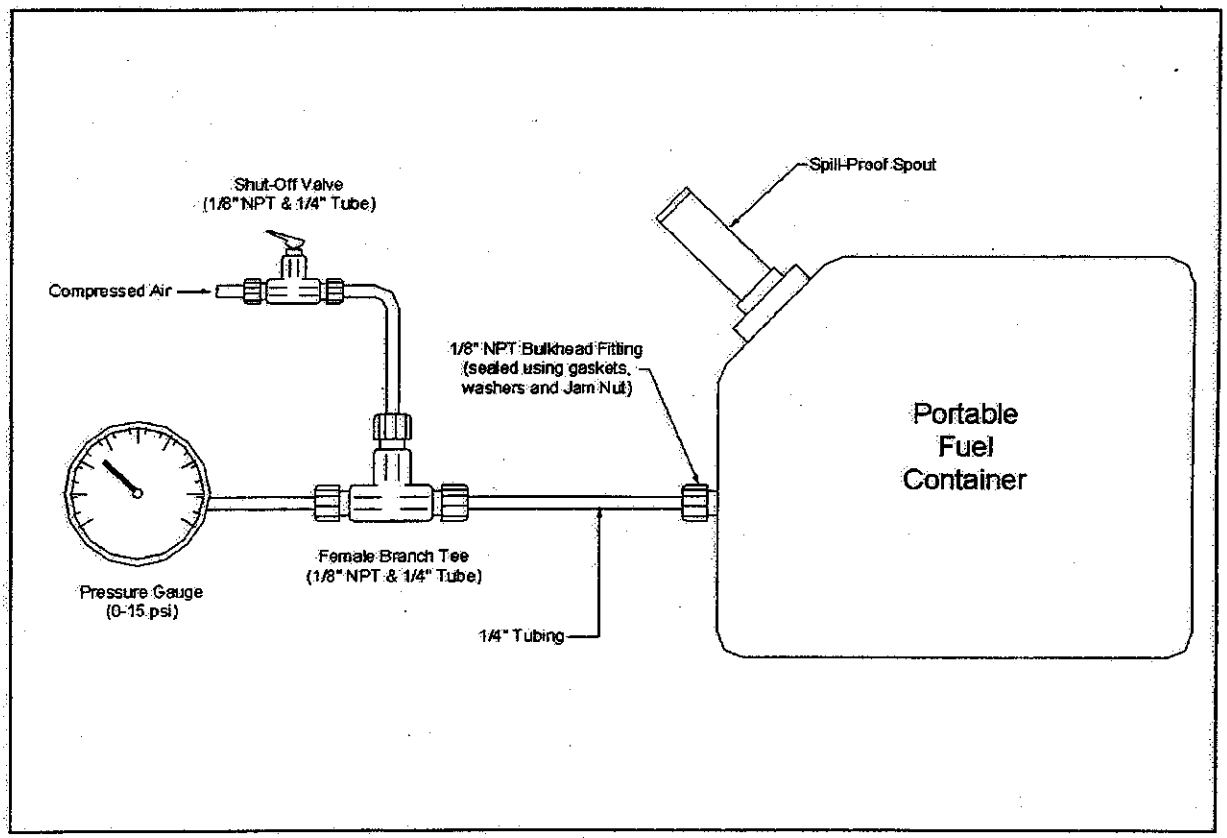
_____

Figure 2. Test Fixture



PART #	QTY	DESCRIPTION
5	1	Clear Household Glue
4	1	IPS Clear, Acrylic Cement
3	2	10"x10"x 1/4" thick clear Plexiglas
2	1	1 1/2" OD x 1/4" thickness x 1 1/2" tubing
1	1	8.5" ID 1/4" thickness x 6.0" tubing

Figure 3. Pressurized Leak Check Assembly



APPENDIX D

PROPOSED AMENDMENTS TO TEST METHOD 510, AUTOMATIC SHUT-OFF TEST PROCEDURE FOR SPILL-PROOF SYSTEMS AND SPILL-PROOF SPOUTS

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California Environmental Protection Agency

Air Resources Board

Spill-Proof System and Spill-Proof Spout Test Procedure

Test Method 510

AUTOMATIC SHUT-OFF TEST PROCEDURE FOR SPILL-PROOF SYSTEMS AND SPILL-PROOF SPOUTS

Adopted: July 6, 2000
(section numbers corrected September 13, 2000)
Revised 05/13/05

NOTE: Language to be added is <u>underlined</u> and language to be removed is shown in ~~strikeout~~.

Table of Content

		Page
1.	APPLICABILITY	1
2	PRINCIPAL AND SUMMARY OF TEST PROCEDURE	1
3	BIASES AND INTERFERENCES	1
4	SENSITIVITY, RANGE, AND PRECISION	1
5	EQUIPMENT	1
6	CALIBRATION PROCEDURE	1
7	TEST PROCEDURE	2
8	QUALITY ASSURANCE / QUALITY CONTROL (QA/QC)	2
9	RECORDING DATA	2
10	CALCULATING RESULTS	3
11	REPORTING RESULTS	3
12	ALTERNATIVE TEST PROCEDURES	3
13	REFERENCES	3
14	FIGURES	4

Test Method 510
Automatic Shut-Off Test Procedure For Spill-Proof Systems and Spill-Proof Spouts

1. APPLICABILITY

For the purpose of this procedure, the term "ARB" refers to the State of California Air Resources Board, and the term "ARB Executive Officer" refers to the Executive Officer of the ARB or his or her authorized representative or designate. Terms used in this test method are defined in Section 2467.1, Article 6, Chapter 9, Title 13 of the California Code of Regulations.

This procedure is used to verify the operation of the automatic shut-off feature of spill-proof systems or portable fuel containers and spill-proof spouts. It is applicable in all cases where a spill-proof system or a spill-proof spout is sold, supplied, offered for sale, or manufactured for use in the State of California

2 PRINCIPAL AND SUMMARY OF TEST PROCEDURE

Using water in place of gasoline, the portable fuel container is filled to its nominal capacity and inverted for a period of time to test for leaks. Water is then dispensed through the spill-proof spout into a test fixture. The test fixture is filled to a specified level to verify the performance of the automatic shut-off feature.

3 BIASES AND INTERFERENCES

The spill-proof system must be free of leaks for the correct operation of the automatic shut-off feature.

4 SENSITIVITY, RANGE, AND PRECISION

This section is reserved for future specification.

5 EQUIPMENT

5.1 0.5 gallon test fixture (see Figure 1)

~~5.2 Twelve inch ruler accurate to within 1/8 inch.~~

6 CALIBRATION PROCEDURE

This section is reserved for future specification.

7 TEST PROCEDURE

(1) Fill the portable fuel container of the spill-proof system to its nominal capacity with water and attach the spill-proof spout per manufacturer recommendations. For spill-proof spouts that are not part of a spill-proof system, select the largest portable fuel container specified for use by the spill-proof spout manufacturer for the test procedure. Fill the selected portable fuel container to its nominal capacity with water and attach the spill-proof spout per manufacturer recommendations. This assembly is now considered a spill-proof system.

(2) Invert the spill-proof system with the spout in a vertical axis position for a period of five minutes to ensure that there are no leaks. If the spill-proof system is observed leaking, place in the upright position and ensure that the spill-proof spout is correctly and firmly attached. Invert the container again for a period of five minutes. If any leakage of water is observed the spill-proof system is not in compliance with the automatic closure requirements of Section 2467.2, (a), (2), Article 6, Chapter 9, Title 13 of the California Code of Regulations.

(3) Prepare the spill-proof system for dispensing per manufacturers recommendations. Following the manufacturers recommendations carefully insert the spill-proof spout into the opening on top of the test fixture (see Figure 1) and begin dispensing water into the test fixture.

(4) Continue dispensing water until the flow stops or until the test fixture overflows. Remove the spill-proof spout from the test fixture and record the outcome on the field data sheet (see figure 2).

~~(5) For spill-proof systems with a fuel flow rate of less than two gallons per minute use a ruler to measure the distance between the water height in the test fixture and the top of the test fixture opening. Record this measurement on the field data sheet.~~

(6) Repeat steps (3) ~~through (5)~~ <u>and (4)</u> three times for each spill-proof system tested. If the spill-proof system is refilled during this test, the leak test procedure specified in step (2) must be completed before continuing with steps (3) through (5).

8 QUALITY ASSURANCE / QUALITY CONTROL (QA/QC)

This section is reserved for future specification.

9 RECORDING DATA

Record data on a form similar to the one shown in Figure 2.

10 CALCULATING RESULTS

This section is reserved for future specification.

11 REPORTING RESULTS

Compliance with the automatic shut-off requirements of Section 2467.2, Article 6, Chapter 9, Title 13 of the California Code of Regulations is achieved if:

~~(a)~~ the spill-proof system stops the fuel flow before the test fixture overflows on all three trials.

~~Compliance with the fill level requirements of Section 2467.2, Article 6, Chapter 9, Title 13 of the California Code of Regulations is achieved if:~~

~~(a) the spill-proof system fills the test fixture to a level less than or equal to 1 inch below the top of the opening on all three trials for spill-proof systems with fuel flow rates less than one gallon per minute.~~

~~(b) the spill-proof system fills the test fixture to a level less than or equal to 1.25 inches below the top of the opening on all three trials for spill-proof systems with fuel flow rates less than two gallons per minute but not less than one gallon per minute.~~

12 ALTERNATIVE TEST PROCEDURES

Test procedures, other than specified above, shall only be used if prior written approval is obtained from the ARB Executive Officer. In order to secure the ARB Executive Officer's approval of an alternative test procedure, the applicant is responsible for demonstrating to the ARB Executive Officer's satisfaction that the alternative test procedure is equivalent to this test procedure.

(1) Such approval shall be granted on a case-by-case basis only.

(2) Documentation of any such approvals, demonstrations, and approvals shall be maintained by the ARB Executive Officer and shall be made available

upon request.

13 REFERENCES

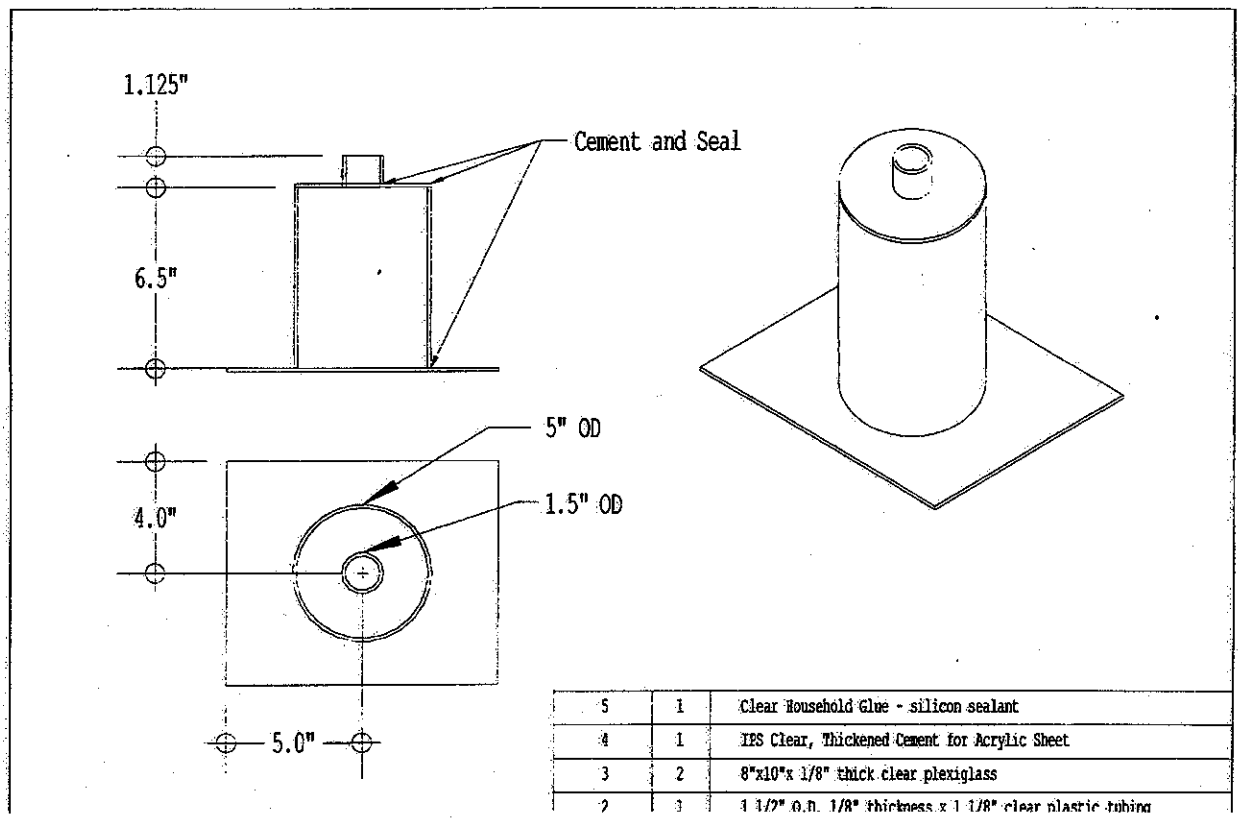
This section is reserved for future specification.

14 FIGURES

Figure 1. Test Fixture

Figure 2. Field Data Sheet

Figure 1. Test Fixture



5	1	Clear Household Glue - silicon sealant
4	1	IPS Clear, Thickened Cement for Acrylic Sheet
3	2	8"x10"x 1/8" thick clear plexiglass
2	3	1 1/2" O.D. 1/8" thickness x 1 1/8" clear plastic tubing

Figure 2. Field Data Sheet

Spill-Proof System Manufacturer:_____

OR

Spill-Proof Spout Manufacturer: _____ **AND**

Portable Fuel Container Manufacturer: _____

Container Volume: _____

Tested By:_____ **Date:**_____

Time:_____

TEST NUMBER	AUTO SHUT-OFF	~~FILL HEIGHT (inches)~~	COMMENTS

APPENDIX E

PROPOSED AMENDMENTS TO TEST METHOD 511 AUTOMATIC CLOSURE TEST PROCEDURE FOR SPILL-PROOF SYSTEMS AND SPILL-PROOF SPOUTS

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California Environmental Protection Agency

Air Resources Board

Spill-Proof System and Spill-Proof Spout Test Procedure

Test Method 511

AUTOMATIC CLOSURE TEST PROCEDURE FOR SPILL-PROOF SYSTEMS AND SPILL-PROOF SPOUTS

Adopted: July 6, 2000

TABLE OF CONTENT

		Page
1	APPLICABILITY	1
2	PRINCIPAL AND SUMMARY OF TEST PROCEDURE	1
3	BIASES AND INTERFERENCES	1
4	SENSITIVITY, RANGE, AND PRECISION	1
5	EQUIPMENT	1
6	CALIBRATION PROCEDURE	2
7	TEST PROCEDURE	2
8	QUALITY ASSURANCE / QUALITY CONTROL (QA/QC)	3
9	RECORDING DATA	3
10	CALCULATING RESULTS	3
11.	REPORTING RESULTS	3
12	ALTERNATIVE TEST PROCEDURES	3
13	REFERENCES	4
14	FIGURES	4

Test Method 511
Automatic Closure Test Procedure For Spill-Proof Systems and Spill-Proof Spouts

1 APPLICABILITY

For the purpose of this procedure, the term "ARB" refers to the State of California Air Resources Board, and the term "ARB Executive Officer" refers to the Executive Officer of the ARB or his or her authorized representative or designate. Terms used in this test method are defined in Section 2467.1, Article 6, Chapter 9, Title 13 of the California Code of Regulations.

This procedure is used to verify the performance of the automatic closure feature of spill-proof systems or portable fuel containers and spill-proof spouts. It is applicable in all cases where a spill-proof system or a spill-proof spout is sold, supplied, offered for sale, or manufactured for use in the State of California.

2 PRINCIPAL AND SUMMARY OF TEST PROCEDURE

Using water in place of gasoline, the portable fuel container is filled to its nominal capacity and inverted for a period of time to test for leaks. Water is then dispensed through the spill-proof spout into a test fixture. The spill-proof spout is quickly removed when the test fixture is approximately 50 % full to verify the automatic closure feature is operational. Finally, the spill-proof system is pressurized to 10 pounds per square inch (psi) with compressed air and immersed in a water bath for ten minutes to test for leaks.

3 BIASES AND INTERFERENCES

This section is reserved for future specifications.

4 SENSITIVITY, RANGE, AND PRECISION

This section is reserved for future specifications.

5 EQUIPMENT

5.1 Stopwatch accurate to within 0.2 seconds.

5.2 0.5 gallon test fixture (see Figure 2).

5.3 Modified portable fuel container (see Figure 3).

5.4 Pressure gauge, 0-15 psig, 0.2 psi graduation, Grade 2A accuracy or better

5.5 Pressure gauge adapter assembly as shown in Figure 3

6 CALIBRATION PROCEDURE

This section is reserved for future specifications.

7 TEST PROCEDURE

(1) Fill the portable fuel container of the spill-proof system to its nominal capacity with water and attach the spill-proof spout per manufacturer recommendations. For spill-proof spouts that are not part of a spill-proof system, select the largest portable fuel container specified for use by the spill-proof spout manufacturer for the test procedure. Fill the selected portable fuel container to its nominal capacity with water and attach the spill-proof spout per manufacturer recommendations. This assembly is now considered a spill-proof system.

(2) Invert the spill-proof system with the spout in a vertical axis position for a period of five minutes to ensure that there are no leaks. Record the outcome on the field data sheet (see figure 1). If the spill-proof system is observed leaking, place the spill-proof system in the upright position and ensure that the spill-proof spout is correctly and firmly attached. Invert the container again for a period of five minutes. Record the outcome on the field data sheet.

(3) Prepare the spill-proof system for dispensing per manufacturers recommendations. Following the manufacturers recommendations carefully insert the spill-proof spout into the opening on top of the test fixture (see figure 2) and begin dispensing water into the test fixture. Stop dispensing water when the test fixture is approximately 50 % full. Gently tap the spill-proof spout against the opening of the test fixture to remove any water which may adhere to the exterior surface of the spout. Verify that the spill-proof spout remains closed and sealed by removing from the test fixture and observing the spill-proof spout for any water leakage while still in the inverted position for one minute. Record observations on the field data sheet. Drain the test fixture and repeat this process three times.

(4) Remove the spill-proof spout and modify the portable fuel container as detailed in figure 3. Fill the portable fuel container to its nominal capacity with water and attach the spill-proof spout per manufacturers recommendations. Using a sufficient ballast, place the modified spill-proof system upright in a water bath large enough to completely cover the portable fuel container and spout plus six inches. Using a compressed air source, pressurize the spill-proof system to 10 psi. Observe the spill-proof system for evidence of leakage for ten minutes. Leakage shall be detected by the evidence of bubbles from the portable fuel container or the spout. Record observations on the field data sheet.

8 QUALITY ASSURANCE / QUALITY CONTROL (QA/QC)

This section is reserved for future specification.

9 RECORDING DATA

Record data on a form similar to the one shown in Figure 1.

10 CALCULATING RESULTS

This section is reserved for future specifications.

11. REPORTING RESULTS

Compliance with the automatic closure requirements of Section 2467.2, Article 6, Chapter 9, Title 13 of the California Code of Regulations is achieved if:

(1) No water leaks when the spill-proof system is inverted for five minutes

and

(2) No water leaks on all three trials when the spill-proof system is removed from the test fixture and observed for one minute

and

(3) No leakage is observed while the modified spill-proof system is immersed in the water bath.

12 ALTERNATIVE TEST PROCEDURES

Test procedures, other than specified above, shall only be used if prior written approval is obtained from the ARB Executive Officer. In order to secure the ARB Executive Officer's approval of an alternative test procedure, the applicant is responsible for demonstrating to the ARB Executive Officer's satisfaction that the alternative test procedure is equivalent to this test procedure.

(1) Such approval shall be granted on a case-by-case basis only.

(2) Documentation of any such approvals, demonstrations, and approvals shall be maintained by the ARB Executive Officer and shall be made available upon request.

13 REFERENCES

This section is reserved for future specification.

14 FIGURES

Figure 1. Field Data Sheet

Figure 2. 0.5 Gallon Test Fixture

Figure 3. Modified Portable Fuel Container

Figure 1. Field Data Sheet

Spill-Proof System Manufacturer: _____

OR

Spill-Proof Spout Manufacturer: _____ **AND**

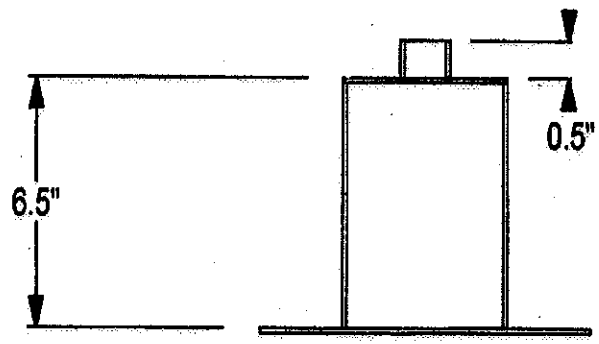
Portable Fuel Container Manufacturer: _____

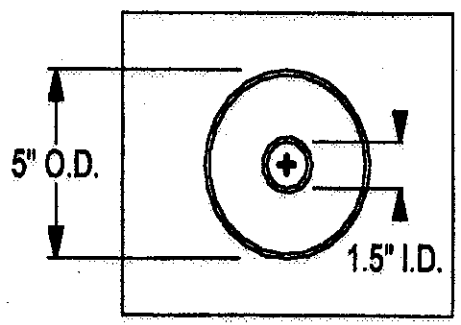
Container Volume: _____

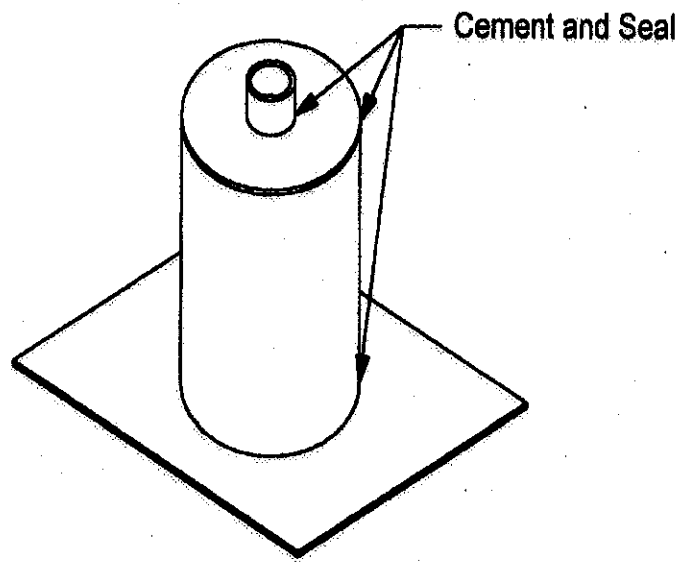
Tested By: _____ Date: _____ Time: _____

INVERTED LEAK TEST RESULTS (pass/fail)	AUTOMATIC CLOSURE TEST RESULTS (pass/fail)			PRESSURE TEST		
	Trial 1	Trial 2	Trial 3	Start Time	Stop Time	Results (pass/fail)

Figure 2. 0.5 Gallon Test Fixture

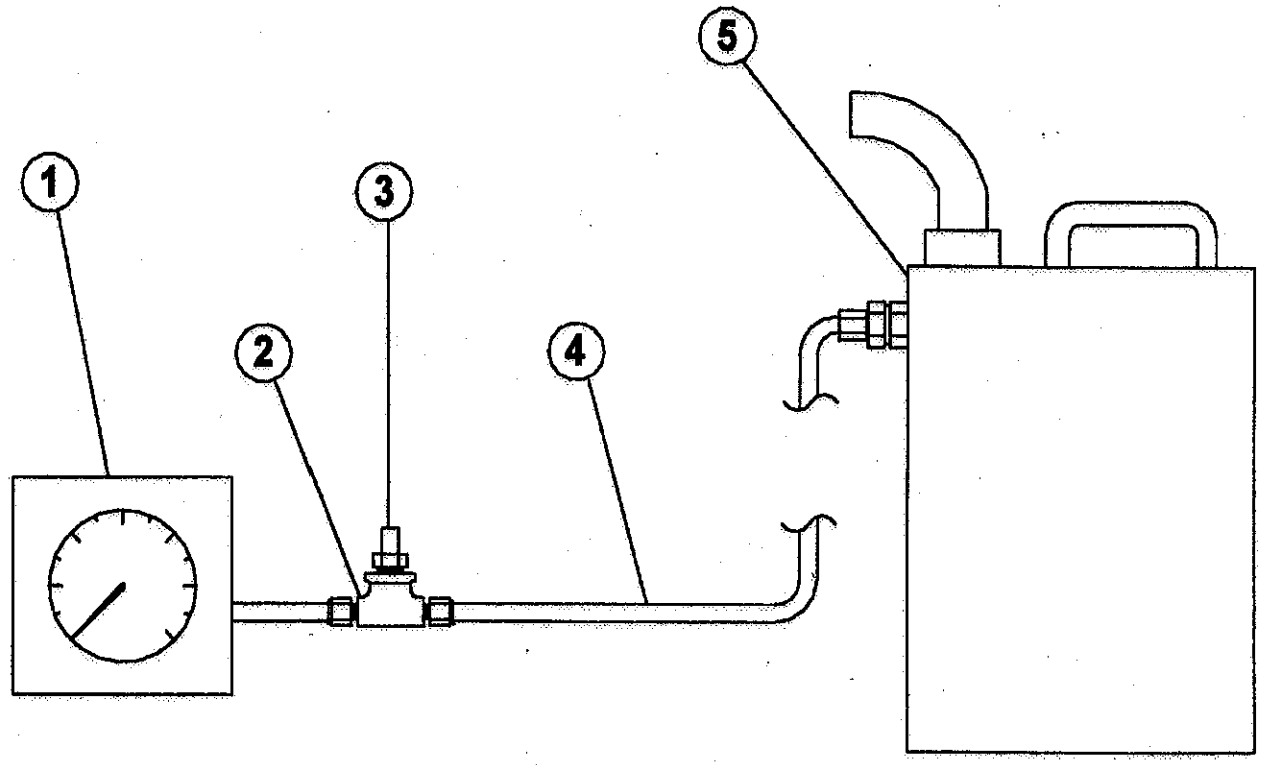






5	1	Silicon Sealant
4	1	Clear, Thickened Cement for Acrylic Sheet
3	2	8"x10"x 1/8" thick clear plexiglass
2	1	1 1/2" I.D x 1/8" thickness x 5/8" clear plastic tubing
1	1	5" O.D. x 1/8" thickness x 6.5" clear plastic tubing
PART NO.	QTY.	DESCRIPTION

Figure 3. Modified Portable Fuel Container

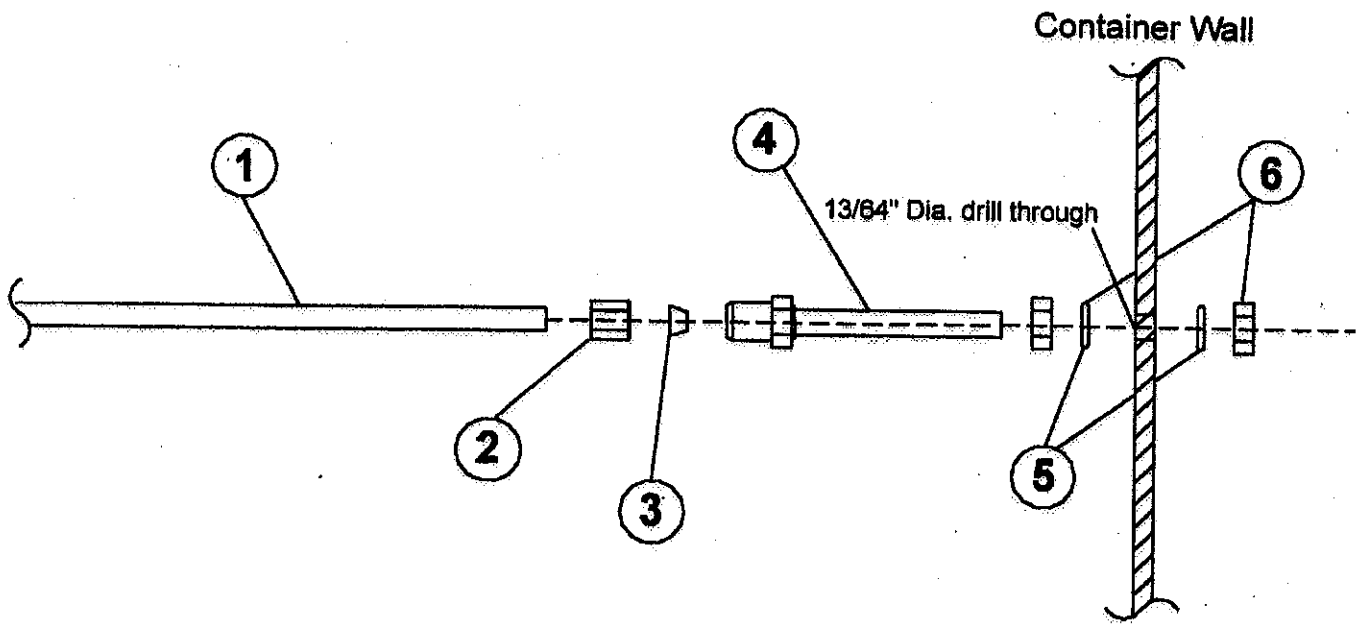


Note: 1. Page 1 of 2

PART NO.	QTY	DESCRIPTION
5	1	Modified Portable Fuel Container
4	1	1/4" O.D. x 3/16" I.D. Teflon Tubing
3	1	1/8" Male NPT Tank Valve
2	1	1/8" NPT Female Branch Tee With 1/4" Tube Ports
1	1	Grade 2A 0-15psi Pressure Gauge

535

Figure 3. Modified Portable Fuel Container



Notes: 1. Install 1/8" NPT bulkhead fitting though container wall. Place one Jam nut on each side of container wall with o-rings located between jam nuts and container wall.

2. If necessary, use a suitable epoxy sealant at the bulkhead and container wall joint.

3. Page 2 of 2

PART NO.	QTY	DESCRIPTION
6	2	5/8" Hex Jam Nut
5	2	7/32" x 11/32" O-ring
4	1	1/8" NPT x 1/4" Tubing Bulkhead Fitting
3	1	1/4" Tube Fitting Ferrule
2	1	1/4" Tube Fitting Cap
1	1	1/4" O.D. x 3/16" I.D. Teflon Tubing

APPENDIX F

PROPOSED AMENDMENTS TO TEST METHOD 512 DETERMINATION OF FUEL FLOW RATE FOR SPILL-PROOF SYSTEMS AND SPILL-PROOF SPOUTS

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California Environmental Protection Agency

Air Resources Board

~~Spill-Proof System and Spill-Proof Spout Test Procedure~~

~~Test Method 512~~

~~DETERMINATION OF FUEL FLOW RATE FOR SPILL-PROOF SYSTEMS AND SPILL-PROOF SPOUTS~~

~~Adopted: July 6, 2000~~
~~(section numbers corrected September 13, 2000)~~
Revised 05/13/05

NOTE: Language to be added is <u>underlined</u> and language to be removed is shown in ~~strikeout~~.

~~TABLE OF CONTENTS~~

~~Page~~

~~1 APPLICABILITY ..... 1~~

~~2 PRINCIPAL AND SUMMARY OF TEST PROCEDURE ..... 1~~

~~3 BIASES AND INTERFERENCES ..... 1~~

~~4 SENSITIVITY, RANGE, AND PRECISION ..... 1~~

~~5 EQUIPMENT ..... 2~~

~~6 CALIBRATION PROCEDURE ..... 2~~

~~7 TEST PROCEDURE ..... 2~~

~~8 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) ..... 3~~

~~9 RECORDING DATA ..... 3~~

~~10 CALCULATING RESULTS ..... 3~~

~~11 REPORTING RESULTS ..... 3~~

~~12 ALTERNATIVE TEST PROCEDURES ..... 3~~

~~13 REFERENCES ..... 4~~

~~14 FIGURES ..... 4~~

~~Test Method 512~~
~~Determination of Fuel Flow Rate for~~
~~Spill-Proof Systems and Spill-Proof Spouts~~

~~1 APPLICABILITY~~

~~For the purpose of this procedure, the term "ARB" refers to the State of California Air Resources Board, and the term "ARB Executive Officer" refers to the Executive Officer of the ARB or his or her authorized representative or designate. Terms used in this test method are defined in Section 2467.1, Article 6, Chapter 9, Title 13 of the California Code of Regulations.~~

~~This procedure is used to quantify the fuel flow rate of spill-proof systems or portable fuel containers and spill-proof spouts. It is applicable in all cases where a spill-proof system or a spill-proof spout is sold, supplied, offered for sale, or manufactured for use in the State of California.~~

~~2 PRINCIPAL AND SUMMARY OF TEST PROCEDURE~~

~~Using water in place of gasoline, the portable fuel container is filled to its nominal capacity and inverted for a period of time to test for leaks. Water is then dispensed through the spill-proof spout while the event is timed. The spill-proof system is pre and post weighed to determine the amount of water dispensed and an average flow rate is calculated in gallons per minute.~~

~~3 BIASES AND INTERFERENCES~~

~~The balance used to determine the amount of water dispensed must be of sufficient capacity to accurately weigh large volume spill-proof systems filled to their nominal capacity with water.~~

~~Allowing spill-proof systems to empty during the test procedure can cause errors in the final measurement of the flow rate.~~

~~Any leaks from either the spill-proof spout or the portable fuel container can cause errors in the final measurement of the weight of water dispensed.~~

~~4 SENSITIVITY, RANGE, AND PRECISION~~

~~Range of measurement of water dispensed is approximately 2000 to 26,000 grams; upper range depends upon the volume of the spill-proof system.~~

~~5 EQUIPMENT~~

~~5.1 A Stopwatch accurate to within 0.2 seconds.~~

~~5.2 A high capacity top loading balance capable of a maximum weight measurement of not less than 2,000 grams greater than weight of the largest water filled spill-proof system tested with a minimum readability of 1 gram and a reproducibility of ± 0.2 grams.~~

~~6 CALIBRATION PROCEDURE~~

~~The high capacity top loading balance shall be calibrated prior to use per the manufacturers specifications.~~

~~7 TEST PROCEDURE~~

~~(1) Fill the container of the spill-proof system to its nominal capacity with water and attach the spill-proof spout per manufacturer recommendations. For spill-proof spouts that are not part of a spill-proof system, select the largest portable fuel container specified for use by the spill-proof spout manufacturer for the test procedure. Fill the selected portable fuel container to its nominal capacity with water and attach the spill-proof spout per manufacturer recommendations. This assembly is now considered a spill-proof system.~~

~~(2) Invert the spill-proof system with the spout in a vertical axis position for a period of five minutes to ensure that there are no leaks. If the spill-proof system is observed leaking, place in the upright position and ensure that the spill-proof spout is correctly and firmly attached. Invert the container again for a period of five minutes. If any leakage of water is observed the spill-proof system is not in compliance with the automatic closure requirements of Section 2467.2, (a), (2), Article 6, Chapter 9, Title 13 of the California Code of Regulations.~~

~~(3) Carefully place the filled spill-proof system on the high capacity balance. Record the pre test weight *(PRE)* on the field data sheet.~~

~~(4) Invert the spill-proof system to a vertical spout axis position over a suitable receptacle. Manually open the spill-proof spout while simultaneously starting the stopwatch. Continue to hold the spill-proof system in the inverted position with the spill-proof spout manually opened. Close the spill-proof spout and simultaneously stop the stopwatch before the container is completely empty leaving approximately one pint of fluid in the container. Record the elapsed time *(t)* on the field data sheet~~

~~(5) Carefully place the spill-proof system on the high capacity balance. Record the post test weight *(POST)* on the field data sheet.~~

~~(6) Repeat this process three times for each spill-proof system tested.~~

~~8 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)~~

~~This section is reserved for future specification.~~

~~9 RECORDING DATA~~

~~Record data on a form similar to the one shown in Figure 1.~~

~~10 CALCULATING RESULTS~~

~~The *flow rate* in gallons/minute for each individual test is calculated as follows:~~

~~Where:~~

~~FlowRate~~	~~=~~	~~The flow rate in gallons/minute~~
~~*PRE*~~	~~=~~	~~The weight of the filled container in grams~~
~~*POST*~~	~~=~~	~~The weight of the empty container in grams~~
~~*d*~~	~~=~~	~~3774 grams/gallon, the density of water at 25 °C~~
~~*t*~~	~~=~~	~~The elapsed time in seconds~~

~~11 REPORTING RESULTS~~

~~After calculating the flow rate for each individual test an average of the three tests is calculated to determine the final flow rate in gallons per minute.~~

~~12 ALTERNATIVE TEST PROCEDURES~~

~~Test procedures, other than specified above, shall only be used if prior written approval is obtained from the ARB Executive Officer. In order to secure the ARB Executive Officer's approval of an alternative test procedure, the applicant is responsible for demonstrating to the ARB Executive Officer's satisfaction that the alternative test procedure is equivalent to this test procedure.~~

~~(1) Such approval shall be granted on a case-by-case basis only.~~

~~(2) Documentation of any such approvals, demonstrations, and approvals shall be maintained by the ARB Executive Officer and shall be made available upon request.~~

~~13 REFERENCES~~

~~**This section is reserved for future specification.**~~

~~14 FIGURES~~

~~**Figure 1. Field Data Sheet**~~

~~Figure 1~~
~~Field Data Sheet~~

~~Spill-Proof System Manufacturer:~~ _____

~~OR~~

~~Spill-Proof Spout Manufacturer:~~ _____ ~~AND~~

~~Portable Fuel Container Manufacturer:~~ _____

~~Container Volume:~~ _____

~~Tested By:~~ _____ ~~Date:~~ _____ ~~Time:~~ _____

~~TEST NUMBER~~	~~PRE – WEIGHT (grams)~~	~~POST – WEIGHT (grams)~~	~~ELAPSED TIME (seconds)~~

APPENDIX G

PROPOSED TP-502, TEST PROCEDURE FOR DETERMINING DIURNAL EMISSIONS FROM PORTABLE FUEL CONTAINERS

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California Environmental Protection Agency

Air Resources Board

Test Procedure for Determining Diurnal Emissions from Portable Fuel Containers

TP-502

Adoption Date:[to be determined]

TABLE OF CONTENTS

1. APPLICABILITY **3**

1.1 Requirement to Comply with All Other Applicable Codes and Regulations 3

1.2 Safety 3

2. PRINCIPLE AND SUMMARY OF TEST PROCEDURE **3**

3. BIASES AND INTERFERENCES **4**

4. SENSITIVITY AND RANGE **5**

5. EQUIPMENT **5**

6. CALIBRATION PROCEDURE **5**

7. DURABILITY DEMONSTRATION **6**

8. PRECONDITIONING **7**

Ambient Condition Soak *7*

Elevated Temperature Soak *7*

9. DIURNAL TEST WITH TRIP BLANK CORRECTION **8**

10. CALCULATING RESULTS **10**

Calculating Weight Loss Using Trip Blank *10*

Diurnal Rate Calculation *10*

Elevated Temperature Data Point Correlation *10*

11. RECORDING DATA **11**

12. QUALITY ASSURANCE / QUALITY CONTROL **11**

13. ALTERNATIVE TEST PROCEDURES **11**

14. REFERENCES **11**

Figure 1 Diurnal Test Data Sheet *13*

California Environmental Protection Agency
Air Resources Board

Test Procedure for Determining Diurnal Emissions from Portable Fuel Containers

The definitions in Section 2467.1, Article 6, Chapter 9 of Title 13, California Code of Regulations (CCR) applies to this test procedure.

For the purpose of this procedure, the term "ARB" refers to the California Air Resources Board, and the term "Executive Officer" refers to the ARB Executive Officer or his or her authorized representative or designate.

1. APPLICABILITY

This Test Procedure is used by the ARB to determine the diurnal emission rate from portable fuel containers as defined in Certification Procedure 501. This procedure is applicable in all cases where portable fuel containers are subject to the maximum allowable diurnal emission standard for portable fuel containers that are manufactured for sale, advertised for sale, sold, or offered for sale in California or that are introduced, delivered or imported into California for introduction into commerce.

1.1 Requirement to Comply with All Other Applicable Codes and Regulations

Certification or approval of a portable fuel container by the Executive Officer does not exempt the container from compliance or with other applicable codes and regulations such as local, State or federal safety codes and regulations.

1.2 Safety

This test procedure involves the use of flammable materials and operations and should only be used by or under the supervision of those familiar and experienced in the use of such materials and operations. Appropriate safety precautions should be observed at all times while performing this test procedure.

2. PRINCIPLE AND SUMMARY OF TEST PROCEDURE

This procedure is used to determine the diurnal emission rate of a portable fuel container (PFC) sealed with a spill-proof spout. Testing includes a preconditioning period to demonstrate permeation rate equilibrium, a durability demonstration, and a three-day diurnal test using a variable temperature profile. The durability demonstration requires that the spout be actuated while exposed to certification fuel as defined in Section 5.7 of this test procedure.

Equilibrium is defined as the state where gasoline permeates through the container at a

constant, steady state rate. During preconditioning, equilibrium can be demonstrated by soaking the container with fuel for 140 days. Equilibrium may also be demonstrated by subjecting the container to an elevated temperature and obtaining a weight loss correlation coefficient of 95% or greater as measured over ten consecutive daily weighings. Once equilibrium is demonstrated, the container is subjected to three consecutive diurnal cycles and weighed before and after each cycle. Each daily weigh-in shall be corrected for moisture, temperature and pressure with use of a trip blank. The diurnal emission rate shall be calculated using the highest recorded daily weight loss divided by the container's rated storage capacity.

3. BIASES AND INTERFERENCES

3.1 Certification fuel is required for testing. Currently certification fuels do not contain alcohol. Fuels containing alcohol may increase the diurnal rate. Only the fuel specified in Section 5.7 shall be used for testing.

3.2 Moisture, temperature and pressure can bias mass measurements. In order to eliminate bias, a sealed trip blank shall be used to correct for atmospheric conditions.

3.3 The trip blank may absorb hydrocarbons and gain weight if stored in close proximity to high levels of gasoline vapor. Care shall be taken to purge the temperature enclosure at regular frequencies to limit gasoline vapor buildup and potential bias.

3.4 Incorrectly installed spill-proof spouts can bias the reported results.

3.5 Calibration frequency and calibration standard(s). In order to obtain accurate weight measurements, the balance listed in Section 4 shall be calibrated by an independent agency using National Institute of Standards and Technology (NIST) mass standards every six months. The balance must also be checked using NIST mass standards both prior to and following mass measurements (25 containers maximum). At minimum, the balance shall be checked at 80%, 100% and 120% of the containers test mass. If the readability drifts more than +/- 0.2 grams between initial and final measurements, the balance shall be re-calibrated or a different balance that is within specification shall be used.

3.6 Care shall be taken to ensure no bias occurs as a result of static electricity. Some electronic balances are sensitive to the effects of small static charges produced by permeating plastic fuel containers. If small amounts of static electricity influence the balance, the container shall either be statically discharged or the balance shall be shielded from the effects of static electricity.

4. SENSITIVITY AND RANGE

The range of the mass measurement of filled containers is approximately 1,750 grams to 26,000 grams depending on the container capacity. A top loading balance, capable of a maximum weight measurement of not less than 2,000 grams greater than the weight of the largest filled container, with a minimum readability of 0.1 gram and reproducibility of ± 0.2 grams, must be used to perform mass measurements.

5. EQUIPMENT

5.1 A top loading balance that meets the requirements of Section 4 above.

5.2 NIST mass standards. A sufficient number of mass standards to verify the measurements listed in Section 3.5.

5.3 A ventilated, temperature-conditioning enclosure capable of controlling the internal air temperature from 65 °F to 105°F, +/- 2°F. The enclosure shall be capable of producing a variable temperature profile as specified in Table 9-1.

5.4 A temperature instrument capable of measuring the internal temperature of the temperature conditioning enclosure with a sensitivity of +/- 2°F.

5.5 A barometric pressure instrument capable of measuring atmospheric pressure at the location of the balance to within +/- 0.02 inches of mercury.

5.6 A relative humidity measuring instrument capable of measuring the relative humidity (RH) at the location of the balance with a sensitivity of +/-2% RH.

5.7 Certification fuel as described in Part II, Section 100.3 of the Air Resources Board "California Exhaust Emissions Standards and Test Procedures for 2001 and Subsequent Model Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles, "adopted August 5, 1999, which is incorporated by reference herein.

6. CALIBRATION PROCEDURE

6.1 All instruments and equipment used to conduct this procedure shall be calibrated prior to use per the manufacturer's specifications.

6.2 The balance shall be checked using NIST traceable mass standards prior to and following mass measurements (25 containers maximum). At minimum, the balance shall be checked at 80%, 100% and 120% of the containers test weight. Refer to Section 3.5.

7. DURABILITY DEMONSTRATION

A durability demonstration is required at the beginning and at conclusion of the preconditioning period (Section 8). This requires at least two weeks of testing at both the beginning and end of the preconditioning period. This test exposes the spout, seals and mechanisms to fuel in order to demonstrate durability.

7.1 Use a permanent marker to identify the container(s). Use a unique ID number for each container. Record the ID number on the data sheet.

7.2 Fill the container to 50% of the rated capacity (+/- 1%) with certification fuel and install the spill-proof spout. Record the amount of fuel dispensed into the container.

7.3 Install the spill-proof spout per the manufacturer's instructions. Check the leak tightness of the spout by raising the ambient temperature 30ºF +/- 5ºF for a minimum of two hours. This should slightly expand the container. If the container does not expand, there may be a leak.

Submerge in a water bath large enough to submerge the entire container to a depth of least six (6) inches. Tilt the container back and fourth while submerged to dislodge any air from external cavities. Wait at least thirty (30) seconds. Any bubbles coming from the container denotes a leak.

No repairs may be performed unless documentation from the manufacturer is provided. Leaks, repairs or adjustments shall be listed on the data sheet. For containers with leaks that cannot be repaired without the use of tools, sealant, etc., those containers and spouts shall be removed from testing and the failure documented on the data sheet. Remove the container from the water bath and dry off all excess water from the exterior surfaces.

7.4 Slowly invert the container for at least five (5) seconds to ensure that the spout and mechanisms become saturated with fuel. Any fuel leaking from any part of the container will denote a leak and shall be reported on the data sheet. Once completed, place the container on a flat surface in the upright position.

7.5 Actuate the spout by fully opening and closing without dispensing fuel. The spout shall return to the closed position without the aid of the operator (i.e., pushing or pulling the spout closed, etc.). Repeat for a total of ten (10) actuation's.

7.6 Repeat steps 7.4 and 7.5.

7.7 After twenty (20) actuation's are completed, remove and replace the spout to simulate filling the container.

7.8 Repeating steps 7.4 through 7.7 four (4) more times until one hundred (100) actuation's and five (5) spout replacements are completed in a minimum seven (7) day period.

7.9 Repeat steps 7.4 through 7.8 until at least two-hundred (200) actuation's and ten (10) spout replacements are completed in a minimum two week period.

7.10 The durability demonstration shall be repeated (an additional 200 actuation's) during the time periods specified below:

a. If the ambient condition equilibrium demonstration is used, repeat steps 7.4 through 7.9 near conclusion of the 140-day soak (i.e., the period starting prior to day 126 and ending on day 140).

b. If the elevated temperature equilibrium demonstration is used, repeat steps 7.4 through 7.9 after a total of 126-days has lapsed where the container is continuously stored with certification fuel (i.e., the period starting prior to day 126 and ending on day 140).

7.11 Record the dates and number of cycles on the data sheet where provided.

8. PRECONDITIONING

A preconditioning period is required to demonstrate permeation equilibrium. Equilibrium occurs when the container's walls have become saturated with fuel. Preconditioning may be combined with the durability demonstration listed above. In order to achieve equilibrium, the container can be soaked with fuel at ambient or elevated temperatures.

Ambient Condition Soak

8.1 Store the container at ambient conditions for at least 140 days with the spill-proof spout installed.

Elevated Temperature Soak

8.2 The leak check described in Section 7.3 shall be repeated on the container prior to this portion. The container shall be tested at elevated temperature with the same fuel as used for durability testing.

8.3 The balance shall be checked using NIST traceable mass standards both prior to and following mass measurements (25 containers maximum). At minimum, the balance shall be checked at 80%, 100% and 120% of the containers test weight. Refer to Section 3.5.

8.4 Ensure that the exterior surface of the container is clean, dry, and free of dirt or debris. Carefully place on the balance. Record the date, initial weight, start

time, relative humidity and barometric pressure on the data sheet (Figure 1).

8.5 Check that the balance has not deviated using the NIST traceable mass standards. Refer to Section 3.5.

8.6 Place the container into the temperature enclosure and begin soaking at a constant temperature of 105°F +/- 2°F. Alternate constant temperatures (i.e., 90°F +/- 2°F or 140°F +/- 2°F, etc.) may also be used. Document the temperature applied on the data sheet.

8.7 Continue soaking at elevated temperature until equilibrium is reached. The results of 10 consecutive daily weigh-ins (one weigh-in per 24-hour period) identifying constant weight loss with a cumulative weight loss correlation coefficient of 95% or greater shall demonstrate equilibrium. See Section 10 for calculation.

9. DIURNAL TEST WITH TRIP BLANK CORRECTION

The diurnal test is used to determine the emission rate when the container is subjected to a minimum of three (3) consecutive diurnal cycles as specified in Table 9-1. This test measures evaporative emissions (permeation and vented) when a container is subjected to California's summertime temperature profile after permeation equilibrium has been reached.

9.1 The leak check described in Section 7.3 shall be repeated on the CERT fuel container prior to this portion. The container may continue being tested with the same CERT fuel as used for durability and equilibrium testing.

9.2 Install an identical spout on an identical new container (trip blank). This container shall remain empty and shall not have been previously subject to gasoline or gasoline vapors. Using a compressed air source, slowly pressurize the trip blank to 5.0 psig. Submerge in a water bath large enough to submerge the entire container to a depth of least six (6) inches. Tilt the container back and fourth while submerged to dislodge any air from external cavities. Observe the container for leaks for at least thirty (30) seconds. Leaks are determined through the evidence of any bubbles coming from the container. If any evidence of leaks is observed, remove the trip blank from testing. Record observations on the field data sheet. Remove the trip blank from the water bath and dry off all excess water from the exterior services.

9.3 Place the trip blank and CERT fuel containers into a temperature enclosure acclimated at 105°F +/- 2°F for a minimum of 24-hours to remove excess hydrocarbon buildup that may have resulted from preconditioning.

9.4 Clean the exterior surface of the containers with Alconox or another hydrocarbon dissolving solution that effectively removes hydrocarbon residue

from the outer surfaces of the containers. This step shall only be conducted following Section 9.3 and shall not be repeated for the remainder of testing.

9.5 Place the trip blank and CERT fuel containers into a temperature enclosure acclimated at a 65°F +/- 2°F for a minimum of 6 to a maximum of 36 hours to eliminate potential temperature bias that may occur from Section 9.3.

9.6 The balance shall be checked using NIST traceable mass standards prior to and following mass measurements (25 containers maximum). At minimum, the balance shall be checked at 80%, 100% and 120% of the containers test weight. Refer to Section 3.5

9.7 Carefully place each container on the balance. Record the date, initial weight, start time, relative humidity and barometric pressure on the data sheet. No more than fifteen (15) minutes shall lapse between the temperature stabilization period (section 9.5) and replacing the containers into the temperature enclosure after weighing. Precautions should be taken to ensure the containers remain at 65°F +/- 2°F.

9.8 Check that the balance has not deviated using the NIST traceable mass standards. Refer to Section 3.5.

9.9 Begin the variable temperature profile (diurnal cycle) as shown in Table 9-1.

9.10 At conclusion of the diurnal cycle, place each container on the balance and record the final weight, date, end time, relative humidity and barometric pressure on the field data sheet. If the containers are removed from the enclosure for weighing, no more than fifteen (15) minutes shall lapse before being replaced into the enclosure. Repeat Section 9.8 and Section 9.9.

9.11 Repeat Section 9.10 until three (3) consecutive diurnal cycles is completed.

9.12 The leak checks described in Section 7.3 and Section 9.3 shall be repeated at the conclusion of diurnal testing. Any leak check failure(s) shall be recorded on the data sheet and the containers removed from testing.

9.13 Correct each mass measurement using the daily trip blank measurements. Refer to Section 10 for calculations. Calculate the diurnal rate using the highest recorded daily weight loss observed of the three diurnal cycles.

Table 9-1 Diurnal Temperature Profile

Hour	0	1	2	3	4	5	6	7	8	9	10	11	12
(°F)	65	66.5	72.7	80.2	86.2	90.7	94.6	98.1	101.1	103.5	104.9	105.1	104.2
Hour	13	14	15	16	17	18	19	20	21	22	23	24	--
(°F)	101.1	95.4	88.9	84.4	80.8	77.7	75.4	72.0	70.0	68.2	66.5	65	–

10. CALCULATING RESULTS

The diurnal rate is calculated by using the highest recorded daily weight loss of the three diurnal cycles tested. The diurnal rate and elevated temperature correlation coefficient (if used) shall be calculated using the equations listed below.

Calculating Weight Loss Using Trip Blank

$$L = W_i - C_T$$

Where:

L = The corrected weight loss (grams)
W_i = Initial weight of full container (grams)
C_T = $W_f + D_T$ (Trip Blank Correction) (grams)

Where:

W_f = Final weight of full container (grams)
D_T = $T_i - T_f$ (Difference in Trip Blank weight) (grams)

Where:

T_i = Initial weight of Trip Blank (grams)
T_f = Final weight of Trip Blank (grams)

Diurnal Rate Calculation

$$D_{rate} = A_{Loss} / C_{container}$$

Where:

D_{rate} = The diurnal rate (grams/gal-day)
A_{Loss} = The average corrected weight loss (grams/day)
$C_{container}$ = The rated capacity of the container (gallons)

Elevated Temperature Data Point Correlation

If elevated temperature was used in the equilibrium demonstration, plot the cumulative daily weight loss (grams) against the sampling time (days). Perform a linear regression

of ten consecutive data points (spreadsheet or hand calculation) as shown. If the correlation coefficient is 95% or greater, the container is considered to have reached equilibrium.

$$r = \frac{n\left(\sum XY\right) - \left(\sum X\right)\left(\sum Y\right)}{\sqrt{\left[n\sum X^2 - \left(\sum X\right)^2\right]\left[n\sum Y^2 - \left(\sum Y\right)^2\right]}}$$

Where:

r	= The correlation coefficient
n	= The number of samples (10)
X	= The Day Number (i.e., 1-10)
Y	= The cumulative weight loss per day (grams)

11. RECORDING DATA

Record data on the field data sheet shown in Figure 1. Alternate test forms may be used provided they list the same minimum parameters as shown in Figure 1.

12. QUALITY ASSURANCE / QUALITY CONTROL

All data must be carefully recorded on the field data sheet during the test. Any unusual occurrences in the process operation, unusual test instrument readings or items that could possibly affect the test results should be noted on the data sheet. It is recommended that a checklist, in addition to the data sheet be used to assure all data needed for calculation or process information are obtained.

13. ALTERNATIVE TEST PROCEDURES

Test procedures, other than specified above, shall only be used if prior written approval is obtained from the ARB Executive Officer. In order to secure the ARB Executive Officer's approval of an alternative test procedure, the applicant is responsible for demonstrating to the ARB Executive Officer's satisfaction that the alternative test procedure is equivalent to this test procedure.

(1) Such approval shall be granted on a case-by-case basis only.

(2) Documentation of any such approvals, demonstrations, and approvals shall be maintained by the ARB Executive Officer and shall be made available upon request.

14. REFERENCES

Certification fuel as described in Part II, Section 100.3 of the Air Resources Board "California Exhaust Emissions Standards and Test Procedures for 2001 and Subsequent Model Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles," adopted August 5, 1999.

Figure 1 Diurnal Test Data Sheet

Container Manufacturer: _____ Test Company: _____

CERT Fuel Container I.D: _____ Trip Blank Container ID: _____

Container Model: _____ Spout Model: _____ Rated Capacity: _____(gal)

Durability Testing Gallons of CERT fuel Placed in Container: _____ gallons

Initial Trip Blank Weight: _____ (T_i) grams Weigh-In Date: _____

Date	Number of Cycles	Date	Number of Cycles

Ambient Condition Soak Start Date: _____ End Date: _____

Elevated Temperature Soak Constant Temperature Applied: _____ Correlation Coefficient: ____%

Date/Time Start		Date/Time End		Initial Weight W_i (grams)	Final Weight W_f (grams)	Difference (grams)	%RH	Barometric Pressure

Diurnal Test Results (Trip Blank Container)

Date/Time Start		Date/Time End		Final Weight T_f (grams)	Difference D_T (grams)	%RH	Barometric Pressure

Continued on Next Page

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Diurnal Test Results (CERT Fuel Container)

Date/Time Start		Date/Time End		Initial Weight W_i (grams)	Final Weight W_f (grams)	Trip Blank Correction C_T	Corrected Loss L (grams)

*Relative Humidity and Barometric Pressure Recorded under Trip Blank

Average Corrected Daily Weight Loss: _____ g/day

Container Capacity: _____ gallons

Diurnal Rate: _____ g/gal/day

Documentation of Performance

Date: Description of Repair, Adjustment or Failure:

_____ _____

_____ _____

_____ _____

_____ _____

_____ _____

Comments:

_____

_____

APPENDIX H

PROPOSED AMENDMENTS TO TEST METHOD 513 DETERMINATION OF PERMEATION RATE FOR SPILL-PROOF SYSTEMS

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California Environmental Protection Agency

Air Resources Board

Proposed

Spill-Proof System Test Procedure

Test Method 513

DETERMINATION OF PERMEATION RATE FOR SPILL-PROOF SYSTEMS

Adopted: July 6, 2000
(section numbers corrected September 13, 2000)

NOTE: Language to be added is underlined and language to be removed is shown in ~~strikeout~~.

TABLE OF CONTENT

		Page
1	APPLICABILITY	1
2	PRINCIPAL AND SUMMARY OF TEST PROCEDURE	1
3	BIASES AND INTERFERENCES	1
4	SENSITIVITY, RANGE, AND PRECISION	2
5	EQUIPMENT	2
6	CALIBRATION PROCEDURE	2
7	DURABILITY PROCEDURE	2
8	PRECONDITIONING PROCEDURE	2
9	SEALING PROCEDURE	3
10	TEST PROCEDURE	3
11	QUALITY ASSURANCE / QUALITY CONTROL (QA/QC)	4
12	RECORDING DATA	4
13	CALCULATING RESULTS	4
14	REPORTING RESULTS	5
15	ALTERNATIVE TEST PROCEDURES	6
16	REFERENCES	6
17	FIGURES	6

Test Method 513
Determination of Permeation Rates For
Spill-Proof Systems

1 APPLICABILITY

For the purpose of this procedure, the term "ARB" refers to the State of California Air Resources Board, and the term "ARB Executive Officer" refers to the Executive Officer of the ARB or his or her authorized representative or designate. Terms used in this test method are defined in Section ~~2471~~ 2467.1, Article 6, Chapter 9, Title 13 of the California Code of Regulations.

This procedure is used to determine the permeation rate of spill-proof systems with non-metallic portable fuel containers. It is applicable in all cases where a non-metallic spill-proof system is sold, supplied, offered for sale, or manufactured for use in the State of California.

This test procedure involves the use of flammable materials and operations and should only be used by or under the supervision of those familiar and experienced in the use of such materials and operations. Appropriate safety precautions should be observed at all times while performing this test procedure.

2 PRINCIPAL AND SUMMARY OF TEST PROCEDURE

Portable fuel containers are subjected to 1000 pressure/vacuum cycles and then filled with gasoline and allowed to precondition at ambient temperature and pressure for a minimum of four weeks. The portable fuel containers are then emptied, blown dry and immediately refilled with Phase II California Reformulated Certification (CERT) Fuel. A High Density Polyethylene (HDPE) coupon is then fusion welded over the container opening, the containers are weighed and subjected to a 24-hour variable temperature profile. The containers are then re-weighed and the weight loss in grams is calculated.

3 BIASES AND INTERFERENCES

Portable fuel containers incorrectly sealed will emit evaporative emissions, which can effect the final weight loss calculations.

To accurately quantify the losses attributed to permeation during the test procedure the portable fuel containers must be exposed to the variable temperature for 24-hours ± 30 minutes.

The balance used to determine the weight lost between 24-hour variable temperature profiles must be of sufficient capacity to accurately weigh large volume portable fuel containers filled to their nominal capacity with CERT fuel.

4 SENSITIVITY, RANGE, AND PRECISION

Range of measurement of filled portable fuel containers is approximately 1,750 grams to 26,000 grams; upper range depends on the volume of the portable fuel container.

5 EQUIPMENT

5.1 A hand held Teflon coated aluminum hot plate thermostatically controlled to approximately 425 °F (hand held fusion welder) and 1/4" thick HDPE coupons. Both the hand held fusion welder and HDPE coupons must be of sufficient diameter to completely cover the opening of the portable fuel container.

5.2 A high capacity top loading balance capable of a maximum weight measurement of not less than 2,000 grams greater than the weight of the largest fuel filled portable fuel container tested with a minimum readability of 1 gram and a reproducibility of ± 0.2 grams.

5.3 Sealed Housing For Evaporative Determination (SHED). Either a fixed or variable volume enclosure as specified in 40 CFR, Chapter 1, Part 86, Section 1207-96 with a temperature conditioning system capable of controlling the internal enclosure air temperature with an instantaneous tolerance of ± 3.0 °F of the nominal temperature versus time profile throughout the test, and an average tolerance of ± 2.0 °F over the duration of the test.

6 CALIBRATION PROCEDURE

The high capacity top loading balance shall be calibrated prior to use per the manufacturer specifications.

7 DURABILITY PROCEDURE

Pressurize the empty portable fuel container to 5 pounds per square inch gauge (psig) using room air heated to 120 °F and then evacuate to 2 inches mercury ("hg). Repeat the pressure/vacuum process until the portable fuel container has been subjected to not less than 1000 cycles in approximately 8 hours.

8 PRECONDITIONING PROCEDURE

Fill the portable fuel container of the spill-proof system to its nominal capacity with gasoline and firmly attach either the spill-proof spout or an appropriate plug or cap. Place the portable fuel container in a suitable vented enclosure. Record the preconditioning start date on the field data sheet (see figure 2). The portable fuel container shall remain undisturbed

for a period of not less than four weeks.

9 SEALING PROCEDURE

(1) After preconditioning, remove the portable fuel container from the enclosure to a well-ventilated area. Record the preconditioning end date on the field data sheet. Remove the cap, plug, or spill-proof spout and empty the portable fuel container. The portable fuel container must not remain empty for more than fifteen minutes. Quickly dry the interior of the portable fuel container with compressed air. Immediately refill the portable fuel container to its nominal capacity with CERT fuel. Fusion weld the HDPE coupon over the portable fuel container opening taking care to completely seal the container opening.

Heat the sealed portable fuel container until positive pressure (container swelling) is observed. This could be accomplished in several ways. One method is to place the portable fuel container in a well-ventilated area exposed to direct sunlight for two to four hours. If positive pressure (container swelling) is not observed after heating, the closure or portable fuel container is leaking. Carefully check the fusion weld and use good engineering practices to correct the problem. Once positive pressure is observed test the integrity of the closure and sealant by completely immersing the portable fuel container in a water bath for a period of two minutes. Select a water bath large enough to completely cover the portable fuel container plus six inches. Place the portable fuel container upright in the water bath making sure to position it so that no fuel is in contact with the closure. To accomplish this it may be necessary to tilt the portable fuel container back slightly so that the closure is the highest point while holding it under water. Observe the portable fuel container and the closure for any leaks. Leak points will be visible as a bubble or stream of bubbles while immersed in the water bath. Identify and mark any leak points. If leaks are observed remove and dry the portable fuel container and repair all leaks. Continue this process until no leaks are observed.

10 TEST PROCEDURE

(1) Make sure that the exterior surface of the sealed portable fuel container is clean, dry, and free of dirt and debris. Carefully place the sealed portable fuel container on the high capacity balance. Record the initial weight (Wi), date, and start time on the field data sheet.

(2) Immediately place the sealed portable fuel container in the SHED. Begin the 24-hour variable temperature profile (see figure 1). If more than one hour elapses between the time the sealed portable fuel container was weighed and the initiation of the variable temperature profile, the sealed portable fuel container must be re-weighed before initiating the 24-hour variable temperature profile.

(3) At the conclusion of the 24-hour variable temperature profile immediately remove the sealed portable fuel container from the SHED and ensure that the exterior surface is clean, dry, and free of dirt and debris. Carefully place the sealed portable fuel container on the high capacity balance. Record the final weight (*Wf*), date, and end time on the field data sheet. If more than one hour elapses between the conclusion of the 24-hour variable temperature profile and the final weighing of the sealed portable fuel container, the final weight is invalid and should not be used in future calculations. If this occurs, the test procedure must be reinitiated. Calculate the difference between the initial weight (*Wi*) and the final weight (*Wf*). This is the weight loss (*Wl*) due to permeation. Record the weight loss (*Wl*) on the field data sheet.

(4) Repeat this process until the weight loss (*Wl*) from five consecutive 24-hour cycles displays a standard deviation of 0.25 grams.

(5) When sufficient weight loss data have been collected, move the sealed portable fuel container to a well-ventilated area. Place the sealed portable fuel container on a clean surface such as a large sheet of paper or cardboard. Carefully remove the threaded plug or cap allowing the loose sealant to fall on the paper. Drain the contents of the portable fuel container into an appropriate receptacle through a finely screened funnel. Dry the interior of the portable fuel container with compressed air. Check the screened funnel for any sealant that may have fallen into the portable fuel container during remove of the cap or plug. Place any particles of sealant found in the screened funnel on the paper or cardboard and allow them to air dry. Collect the particles of sealant from the paper or cardboard, the cap or plug, and the portable fuel container and place them on the high capacity balance. Record this weight on the field data sheet as the tare weight (*Wt*).

11 QUALITY ASSURANCE / QUALITY CONTROL (QA/QC)

This section is reserved for future specification.

12 RECORDING DATA

Record data on a form similar to the one shown in Figure 2.

13 CALCULATING RESULTS

The weight loss in grams is calculated for each 24-hour cycle as follows:

$$Wl = Wi - Wf$$

Where:

Wl = The weight loss in grams

Wi	= The initial weight of the portable fuel container in grams
Wf	= The final weight of the portable fuel container in grams

The standard deviation of five consecutive diurnal cycles is calculated as follows:

$$SDV = \sqrt{\frac{\sum_{i=1}^{n} \left(xi - \overline{x}\right)^2}{n-1}}$$

Where:

SDV	=	Standard Deviation
n	=	number of samples
Xi	=	ith weight loss in grams
$\bar{x}$	=	mean of weight losses in grams

The permeation rate in grams per gallon per day for each 24-hour cycle is calculated as follows:

$$P = \frac{Wl}{\left(\frac{Wi - Wt}{d}\right)}$$

Where:

P	=	The permeation rate in grams/gallon/day
Wl	=	The weight loss in grams
Wi	=	The initial weight of the portable fuel container in grams
Wt	=	The tare weight of the portable fuel container in grams
d	=	The density of CERT fuel in grams/gallon

14 REPORTING RESULTS

After calculating the permeation rate for each 24-hour cycle, an average of the five consecutive rates selected is calculated to determine the final permeation rate in grams per gallon per day.

15 ALTERNATIVE TEST PROCEDURES

Test procedures, other than specified above, shall only be used if prior written approval is

obtained from the ARB Executive Officer. In order to secure the ARB Executive Officer's approval of an alternative test procedure, the applicant is responsible for demonstrating to the ARB Executive Officer's satisfaction that the alternative test procedure is equivalent to this test procedure.

(1) Such approval shall be granted on a case-by-case basis only.

(2) Documentation of any such approvals, demonstrations, and approvals shall be maintained by the ARB Executive Officer and shall be made available upon request.

16 REFERENCES

This section is reserved for future specification.

17 FIGURES

Figure 1. 24-Hour Variable Temperature Profile
Figure 2. Field Data Sheet

Figure 1
24-Hour Variable Temperature Profile

HOUR	MINUTE	ET / MIN	TEMP °F
0	0	1440	65.0
1	60	1380	66.6
2	120	1320	72.6
3	180	1260	80.3
4	240	1200	86.1
5	300	1140	90.6
6	360	1080	94.6
7	420	1020	98.1
8	480	960	101.2
9	540	900	103.4
10	600	840	104.9
11	660	780	105.0
12	720	720	104.2
13	780	660	101.1
14	840	600	95.3
15	900	540	88.8
16	960	480	84.4
17	1020	420	80.8
18	1080	360	77.8
19	1140	300	75.3
20	1200	240	72.0
21	1260	180	70.0
22	1320	120	68.2
23	1380	60	66.5
24	1440	0	65.0

Figure 2. Field Data Sheet

Spill-Proof System Manufacturer: _____

Container Volume: _____

Container I.D: _____

Tested By: _____

Water Bath Test (pass/fail): _____

Tare Weight (*Wt*) (grams): _____

DATE/TIME START		DATE/TIME END		INITIAL WEIGHT *Wi* (grams)	FINAL WEIGHT *Wf* (grams)	WEIGHT LOSS *Wl* (grams)