California Air Resources Board

PUBLIC MEETING AGENDA

October 20 & 21, 2005
9:00 a.m./8:30a.m.

Agenda Items to be heard;
05-10-1, 05-10-2,
05-10-3, 05-10-4

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California Environmental Protection Agency

ELECTRONIC BOARD BOOK

California Environmental Protection Agency

Air Resources Board

PUBLIC MEETING AGENDA

REVISED

LOCATION:
Air Resources Board
Byron Sher Auditorium, Second Floor
1001 I Street
Sacramento, California 95814

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(This facility is accessible to persons with disabilities.)

October 20 & 21, 2005
9:00 a.m. / 8:30 a.m.

Agenda Item #

05-10-1: Report to the Board on the 2005 Legislative Update

The Legislative Office staff will present a review of air quality legislation for the first year of the 2005-2006 Legislative Session.

05-10-2: 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 will conduct a continuation of a public hearing to consider adoption of amendments to the statewide exhaust emission standards and test procedures for urban bus engines and vehicles and to the ARB fleet rule for transit agencies. These amendments, along with specific changes in the Fleet Rule for Transit Agencies addressing transit vehicles in the South Coast Air Quality Management District (SCAQMD), were described in the Notice for the September 15, 2005 rulemaking hearing. At the September 15, 2005 hearing, only those amendments affecting just the SCAQMD transit fleet were heard by the Board.

05-10-3: Public Hearing to Consider Truck Idling Emission Reduction Requirements

The Board will consider the adoption of idling emission reduction requirements for new 2008 and subsequent model-year heavy-duty diesel engines and trucks and amendments to the airborne toxic control measure to limit engine-idling by the existing fleet of in-use heavy-duty trucks.

05-10-4: Public Hearing to Consider Proposed Suggested Control Measure for Automotive Refinish Coatings

The proposed Suggested Control Measure (SCM) for Automotive Refinish Coatings would improve enforceability, increase consistency among districts, and achieve significant emission reductions of volatile organic compounds (VOC) from the use of automotive refinish coatings. The proposed SCM simplifies coating categories and it lowers VOC limits for coatings and solvents. The proposed SCM also establishes a prohibition of possession of non-complying coatings, which would aid in enforcement of the VOC limits.

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.

At 8:30, it is expected that Board Members will be given the opportunity to ride in an AC transit fuel cell bus from a location next to the building at which the hearing will be conducted.

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

CONTACT THE 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.

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

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

California Environmental Protection Agency

Air Resources Board

LOCATION:
Air Resources Board
Byron Sher Auditorium, Second Floor
1001 I Street
Sacramento, California 95814

PUBLIC MEETING AGENDA

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October 20 & 21, 2005
9:00 a.m. / 8:30 a.m.

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NOTICE OF CONTINUATION

TITLE 13. CALIFORNIA AIR RESOURCES BOARD

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 continuation of a public hearing at the time and place noted below to consider adoption of amendments to the statewide exhaust emission standards and test procedures for urban bus engines and vehicles and to the ARB fleet rule for transit agencies. This amendment, along with specific changes in the Fleet Rule for Transit Agencies addressing transit vehicles in the South Coast Air Quality Management District (SCAQMD), was described in the Notice for the September 15, 2005 rulemaking hearing. At the September 15-16, 2005 hearing, only modifications addressing amendments affecting the SCAQMD transit fleet will be heard by the Board.

DATE: October 20, 2005

TIME: 9:00 a.m.

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

This item will be considered at a two-day meeting of the Board, which will commence at 9:00 a.m., October 20, 2005, and may continue at 8:30 a.m., October 21, 2005. This item may not be considered until October 21, 2005. Please consult the agenda for the meeting, which will be available at least 10 days before October 20, 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.

BACKGROUND

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.

The second policy decision, which affects transit agencies in the SCAQMD only, will be considered by the Board at the September 15-16, 2005 hearing. The first policy decision affects transit agencies throughout the state, and will be considered by the Board at the October 20-21, 2005 hearing.

THE CONTINUED HEARING

The continued hearing will be conducted as described in the original notice, except that written submissions must be addressed to and received by the Clerk of the Board as described below. All comments submitted for the September 15, 2005, hearing will remain part of the rulemaking record. The original 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/sctransit/sctransit.htm and are available as described in the original notice.

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,** October 19, 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,** October 19, 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,** October 19, 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.

Inquiries concerning the substance of the proposed regulation may be directed to the designated agency contact persons, Ms. Kathleen Mead by email at kmead@arb.ca.gov or by phone at (916) 324-9550, or to Ms. Annette Hebert by email at ahebert@arb.ca.gov or by phone at (626) 575-6973.

CALIFORNIA AIR RESOURCES BOARD

Catherine Witherspoon
Executive Officer

Date: September 9, 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

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

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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.

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[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

Model Year	Emissions Standards (g/bhp-hr)			
	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

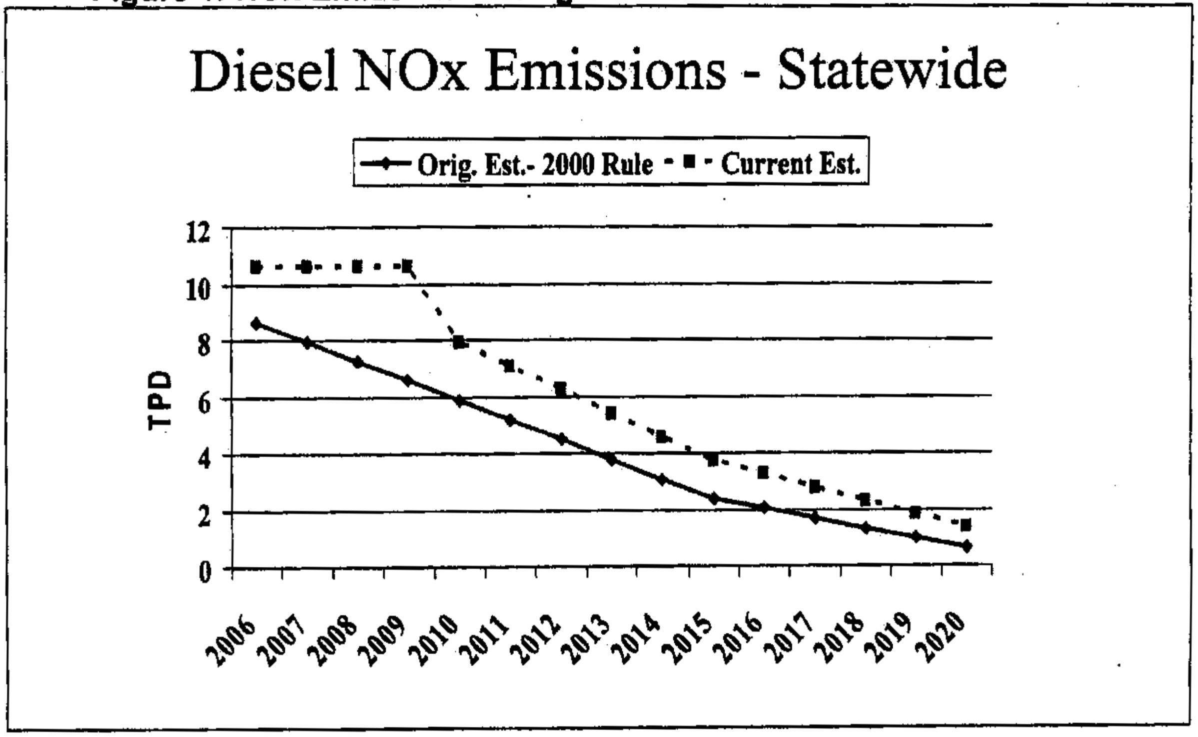
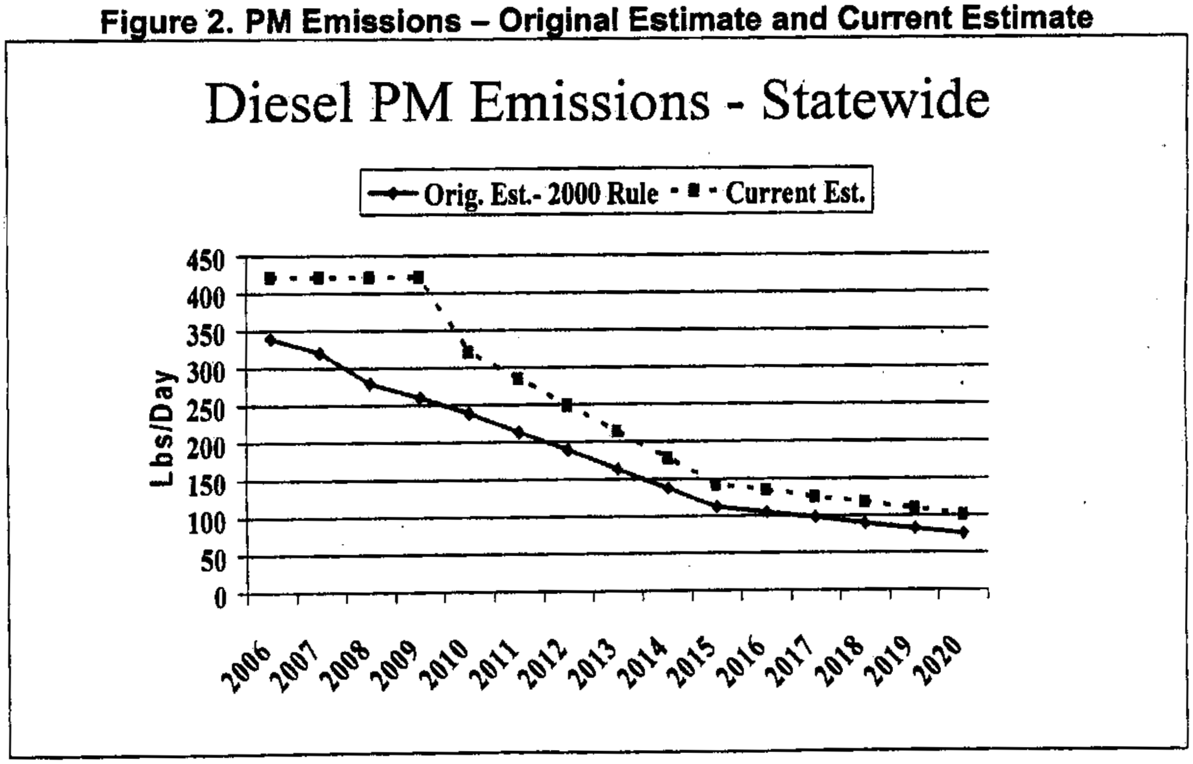


Figure 2. PM Emissions – Original Estimate and Current Estimate



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

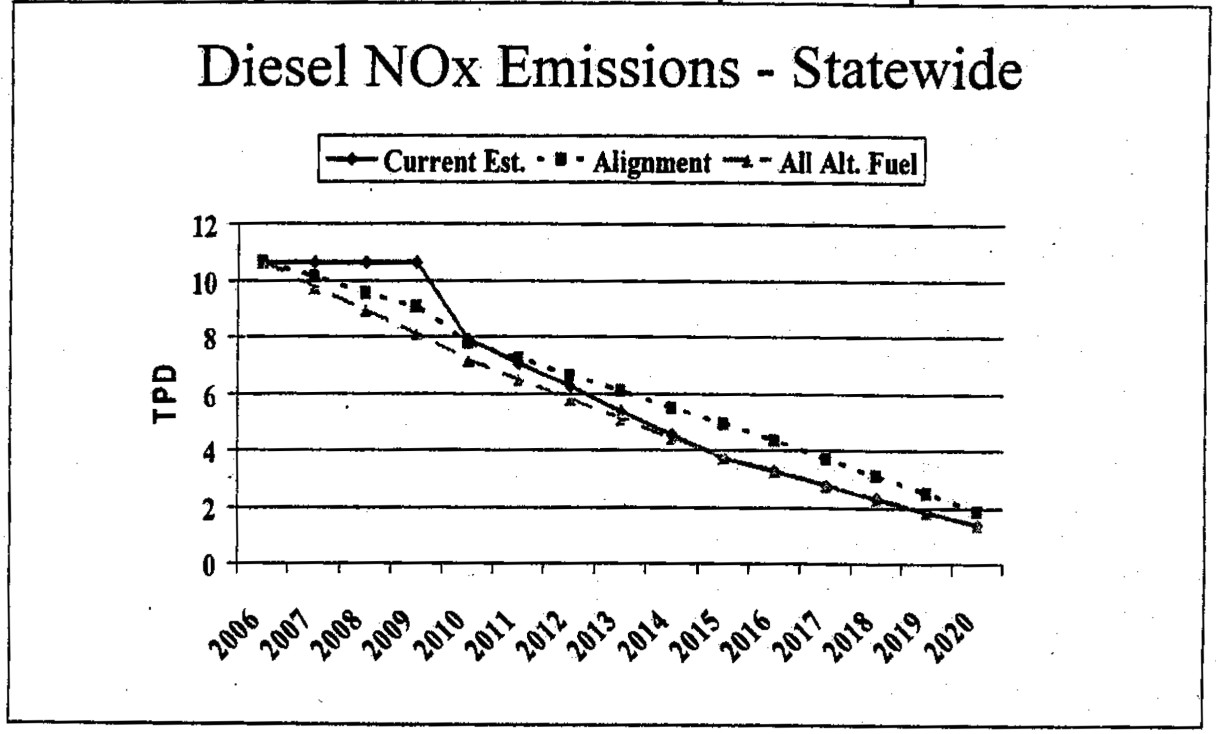
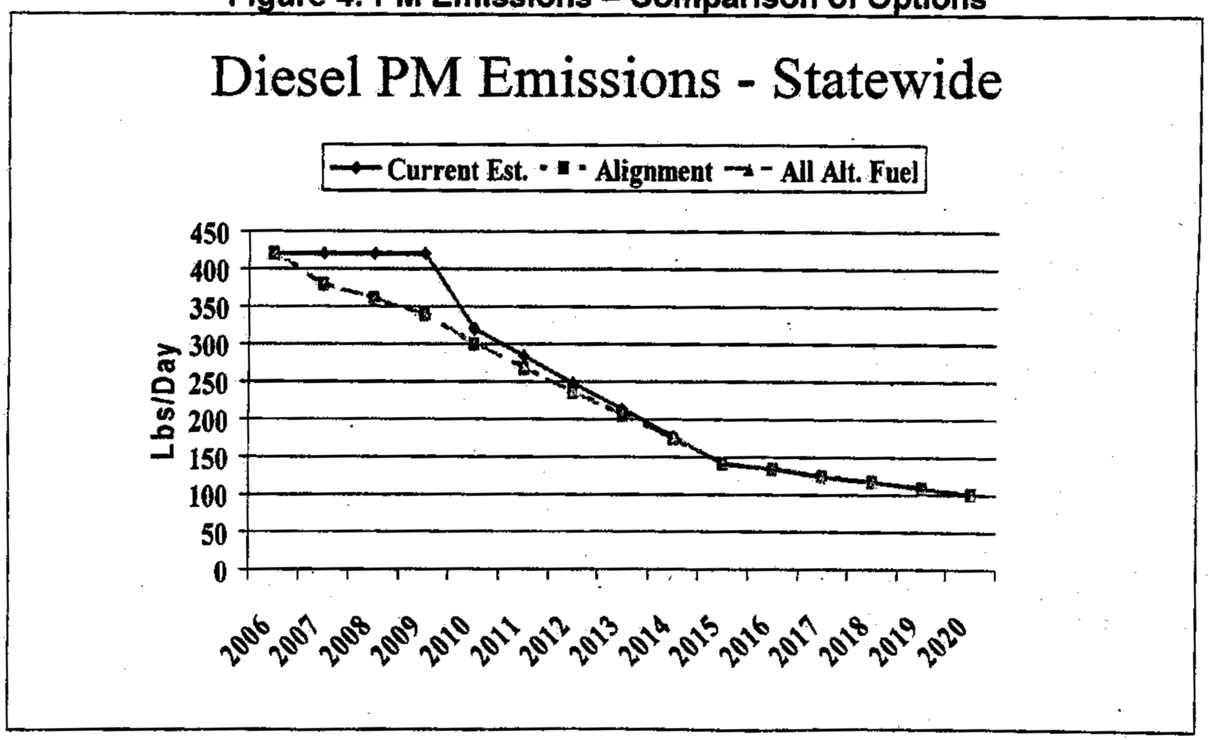


Figure 4. PM Emissions – Comparison of Options



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

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[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

[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.

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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:

$$VMT = \Sigma\,(POP_{age} \times \text{Accrual Rate}_i),\ \text{where } age = 0 \text{ to } 22. \quad (1)$$

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

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TITLE 13. CALIFORNIA AIR RESOURCES BOARD

NOTICE OF PUBLIC HEARING TO CONSIDER REQUIREMENTS TO REDUCE IDLING EMISSIONS FROM NEW AND IN-USE TRUCKS, BEGINNING IN 2008

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 California regulations for new and in-use heavy-duty diesel engines and trucks.

DATE: October 20, 2005

TIME: 9:00 a.m.

PLACE: California Environmental Protection Agency
Air Resources Board
Byron Sher Auditorium
1001 I Street
Sacramento, CA 95814

This item will be considered at a two-day meeting of the Board, which will commence at 9:00 a.m., October 20, 2005, and may continue at 8:30 a.m., October 21, 2005. This item may not be considered until October 21, 2005. Please consult the agenda for the meeting, which will be available at least 10 days before October 20, 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 (CCR), sections 1956.8 and the incorporated "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles," adopted December 12, 2002.

Background:

Health and Safety Code (HSC) sections 43013 and 43018 direct the ARB to adopt emission standards for new heavy-duty motor vehicles to achieve maximum feasible emission reductions. Additionally, HSC section 43104 directs the ARB to adopt test procedures to ensure compliance with those emission standards. Further, in 2000, the

Board approved the Diesel Risk Reduction Plan, which recommended tightening particulate matter (PM) emission standards for heavy-duty diesel engines and vehicles. The 2003 State and Federal Strategy for the California State Implementation Plan (SIP) also calls for the reduction of reactive organic gases (ROG) and oxides of nitrogen (NO_x) which, when combined with high ambient temperatures and sunlight, form ozone air pollution. NOx emissions contribute to secondary PM formation as well.

Exhaust emissions from heavy-duty diesel engines and vehicles have been regulated in California since 1973. With technological advancements and improved engine designs, more stringent standards have been implemented. For example, 2004 model-year engines must be certified to 50 percent lower NO_x emissions compared to 1998 levels. When California's aftertreatment-forcing emission standards become effective in 2007, both NO_x and PM emissions will be reduced by another 90 percent.

Emissions from extended and unnecessary idling pose a significant air quality concern. Idling emissions are particularly significant at locations such as truck stops, travel centers and rest areas where truck drivers stop to rest for long periods of time. Idling emissions are also significant at warehouse/distribution centers and port terminals, where loading and unloading of freight often require long waiting periods. Such locations can experience very high concentrations of trucks idling for extended periods of time, thereby producing highly localized and concentrated emission levels. These emissions affect the health of the drivers, truck stop, warehouse, ports personnel, and the neighboring community. The health concerns in particular become more serious when these idling spots are located in low-income communities that are already impacted by air pollution.

In crafting the proposal, ARB staff met with engine manufacturers, truck manufacturers, and other interested parties in several individual and group conference calls and meetings, including a public workshop on June 4, 2003, and March 23, 2005.

Staff Proposal:

Staff's proposal consists of two parts. The first component regulates new 2008 and subsequent model year heavy-duty diesel engines, and the second component regulates in-use sleeper berth equipped trucks.

The first component applies to new 2008 and subsequent model year heavy-duty diesel engines in trucks with a gross vehicle weight rating greater than 14,000 pounds. Staff's proposal requires these heavy-duty diesel engines to be equipped with a non-programmable engine shutdown system that automatically shuts down the engine after five minutes of continuous idling. In lieu of the engine shutdown system, engine manufacturers may optionally certify to a NOx idling emission standard of 30 grams per hour.

The proposed in-use requirement applies to sleeper berth equipped trucks of all model years, including those registered out-of-state. It requires operators to manually shut off

their engines before the 5-minute idling time is reached. This proposal will modify the airborne toxic control measure that was adopted in July 2004 (13, CCR, § 2485) that limits idling of diesel-fueled commercial heavy-duty vehicles and buses to include trucks with sleeper berths.

The proposal allows the use of optional alternative technologies to provide power for cab comfort and on-board accessories that would otherwise have required continuous idling of the vehicle's main engine. These cab comfort technologies include, but are not limited to, internal combustion auxiliary power systems (APS) and fuel-fired heaters. In order to operate in California, such technologies would need to comply with defined emission performance requirements. Other technologies that do not directly produce emissions, such as thermal storage systems, fuel cell APSs, and power inverter chargers for use with battery packs and grid-supplied electricity are also allowed. Technologies that are not identified in this proposal may also be used, provided they are approved by the Executive Officer. The use of these devices/strategies, in lieu of operating the truck engine at idle, will result in significant NO_x and carbon dioxide reductions. Reductions in ROG and PM are also expected, but to a lesser extent depending on the type of alternative idle reduction device/strategy used.

COMPARABLE FEDERAL REGULATIONS

In January and October 2001, the United States Environmental Protection Agency and ARB, respectively, adopted new, harmonized exhaust emission standards for new 2007 and subsequent model heavy-duty diesel engines and vehicles. However, there are no comparable federal regulations addressing the idling reductions proposed herein.

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: "Notice of Public Hearing to Consider Requirements to Reduce Idling Emissions from New and In-Use Trucks, Beginning in 2008".

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 the ARB's web site listed below, or may be obtained from the Public Information Office, Air Resources Board, 1001 I Street, Visitors and Environmental Services Center, 1st Floor, Sacramento, CA 95814, (916) 322-2990 at least 45 days prior to the scheduled hearing on October 20, 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 web site listed below.

Inquiries concerning the substance of the proposed regulation may be directed to the designated agency contact persons, Mr. Stephan Lemieux, Manager, On-Road Heavy-Duty Diesel Section, (626) 450-6162, or Mr. Daniel Hawelti, Air Resources Engineer, (626) 450-6149.

Further, the agency representative and designated back-up contact persons to who nonsubstantive 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/hdvidle/hdvidle.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 any significant 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 cost or 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. The ARB is not aware of any significant cost impacts that a representative private person or business would necessarily incur in reasonable compliance with the proposed action.

The Executive Officer has made an initial determination that the 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 not significantly affect small businesses. The increase in the purchase price of new trucks with sleeper berths equipped with an alternative idling reduction device will be recaptured through fuel and maintenance savings within a 1- to 2.5-year period.

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, October 19, 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: hdvidle@listserv.arb.ca.gov and received at the ARB **no later than 12:00 noon, October 19, 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 October 19, 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, 39614 (b)(6)(A), 39658, 39667, 43000.5(d), 43013, 43013(b), 43013(h), 43017, 43018, 43018(b), 43018(c), 43100, 43101, 43102, 43104, 43105, 43806; Vehicle Code section 28114; and *Western Oil & Gas Assn. V. Orange County Air Pollution Control Dist. (1975), 14 Cal.3d411.* This action is proposed to implement, interpret and make specific sections 39002, 39003, 39027, 39500, 39600,

39650, 39655, 39656, 39657, 39658, 39659, 39662, 39665, 39674, 39675, 42400, 42400.1, 42400.2, 42400.3, 42402, 42402.1, 42402.2, 42402.3, 42403.5, 42410, 43000, 43013, 43017, 43018, 43100, 43101, 43102, 43104, 43105, 43106, 43150-43154, 43202, 43204, 43205.5, 43206, 43210, 43211, 43212 and 43213, Health and Safety Code. Sections 305, 336, 350, 440, 445, 545, 546, 642, 680, 21400, 22452, 22515, 27153, 28114, 40001 and 40001(b)(5), Vehicle Code. Sections 1201, 1900, 1962 and 2480, title 13, CCR.

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, CA 95814, (916) 322-2990.

CALIFORNIA AIR RESOURCES BOARD

Catherine Witherspoon
Executive Officer

Date: August 23, 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

NOTICE OF PUBLIC HEARING TO CONSIDER REQUIREMENTS TO REDUCE IDLING EMISSIONS FROM NEW AND IN-USE TRUCKS, BEGINNING IN 2008

Date of Release: September 1, 2005
Scheduled for Consideration: October 20-21, 2005

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EXECUTIVE SUMMARY

California's plan for reducing reactive organic gases (ROG) and oxides of nitrogen (NOx), which contribute to both ozone and particulate matter (PM) formation, is set forth in the 2003 State and Federal Strategy for the California State Implementation Plan (2003 SIP). Diesel engines produce a significant portion of the state's air pollution and toxic emissions. Controlling these emissions is therefore an important element of California's strategy for attaining air quality standards and constitutes a significant part of the 2003 SIP. Staff's proposal reduces emissions resulting from the idle operation of diesel trucks, and is part of the 2003 SIP's proposed on-road heavy-duty vehicle control measure "ON-ROAD HEAVY DUTY 3". Staff's proposal will contribute to fulfillment of the committed emission reductions from this control measure.

Impacts of Idling
In California, emissions generated by idling trucks pose a significant air quality problem. Truck operators generally idle their engines at truck stops and rest areas during layover hours to provide heat or cooling to the sleeper berth, to operate on-board electrical accessories, to maintain battery charge, and to warm the engine for easy start-up during cold weather. Truck idling is also significant at warehouse/distribution centers and port terminals where loading and unloading freight require long waiting periods. The high density of idling trucks at such locations for extended periods of time can produce highly localized and concentrated emissions, which adversely affect the health of the drivers and the neighboring communities. The health concerns become more serious when these idling centers are located in low income communities that are already disproportionately impacted by air pollution. Truck idling also consumes fuel, produces greenhouse gas emissions, and increases engine maintenance costs.

Existing Regulations
The Air Resources Board (ARB) on December 12, 2002 adopted requirements that operators of school buses, transit buses, and other commercial vehicles manually shut off their engines upon arriving at a school. Restarting the engines is limited to no more than 30 seconds before departing. The ARB subsequently adopted at its public hearing of July 22, 2004 more general requirements to limit emissions from idling trucks and buses. Operators of commercial trucks and buses are required to manually shut off their engines before the idling time limit of five minutes is reached. However, this requirement does not apply to idling sleeper berth equipped trucks unless they are located within 100 feet from residential homes or schools.

Proposed Regulation
Staff's proposal would limit the amount of time sleeper berth equipped trucks are operated at idle and provide other options to accommodate driver comfort during times when the truck is not being driven. The proposal will also reduce fuel consumption and engine maintenance costs, thereby benefiting owners of compliant trucks. The proposal consists of two major components, affecting new engines and trucks, and existing engines and trucks.

Proposed Requirements for New Trucks
The new engine requirements apply to 2008 and subsequent model year diesel engines in trucks with a gross vehicle weight rating greater than 14,000 pounds. The proposal requires that they be equipped with a non-programmable engine shutdown system that automatically shuts down the engine after five minutes of continuous idling. The system would activate when the truck is stopped, the transmission is set in the "neutral" or "park" position, and the parking brake is engaged. If the parking brake is not engaged, the shutdown system would automatically shut down the engine after 15 minutes of continuous idling. This avoids undesirable or frequent engine shutdowns, such as when a truck is stopped in traffic congestion. In addition, the proposal allows the driver to reset the engine shutdown system timer as long as he or she is present inside the truck. It also includes override provisions when the engine is operating power take-off equipment.

Trucks with an engine that utilizes the idle shutdown system would need to provide other methods for heating/cooling the cabin and powering accessories when the truck is not being driven. To meet those needs the truck manufacturer may install an auxiliary power system (APS), fuel-fired heater, thermal energy storage system, and/or a power inverter/charger with an electrically driven heating and air conditioning system. These systems are currently commercially available.

If cab comfort devices such as those listed above are not offered by the engine or truck manufacturer, the owner may choose to equip his/her truck with *aftermarket* cab comfort devices. Other alternatives include parking at a truck stop that offers an off-board air conditioning or heating system, such as offered by IdleAire Technologies.

To avoid incorporating a new engine shutdown system, an engine manufacturer may certify an engine to a NOx idling emission standard of 30 grams per hour. This option is proposed because it may be possible to control NOx emissions during idling. However, this option isn't likely to become available prior to 2010 because that is when more advanced NOx controls are expected to be used for all heavy-duty engines.

If manufacturers succeed in developing engines which meet the NOx idling emission standard, operators would be allowed to idle the main engine continuously to provide cab comfort and electrical power during rest periods, and would not need to install alternative cab comfort devices. However, they would still be subject to the existing five minute idling restriction when the truck is located within 100 feet of a restricted area.

The proposed new engine requirements do not apply to gasoline engines or engines produced for use in buses (commercial buses as well as school buses), and recreational vehicles.

Proposed Requirements for Existing Trucks
Starting on January 1, 2008, operators of sleeper berth equipped trucks would be required to shut down their engines before a five-minute idle time limit is reached. This would apply to trucks registered in California and out-of-state.

Owners of pre-2008 model year sleeper berth equipped trucks where drivers rest for extended periods in California, may need to retrofit their trucks to provide cab comfort during these rest periods. These cab comfort devices include, but are not limited to, APSs, fuel-fired heaters, thermal energy storage systems, and power inverter/chargers with electrically driven heating and air conditioning systems. Owners may also choose to park at a truck stop and plug in to on-shore electrical power to run an on-board electrically driven climate control system and accessories or use an off-board air conditioning or heating system, such as offered by IdleAire Technologies.

Owners of 2008 and subsequent model year sleeper berth equipped trucks may also need to retrofit their trucks to provide cab comfort for rest periods if cab comfort devices are not offered by the engine or truck manufacturer at the time the truck is initially offered for sale.

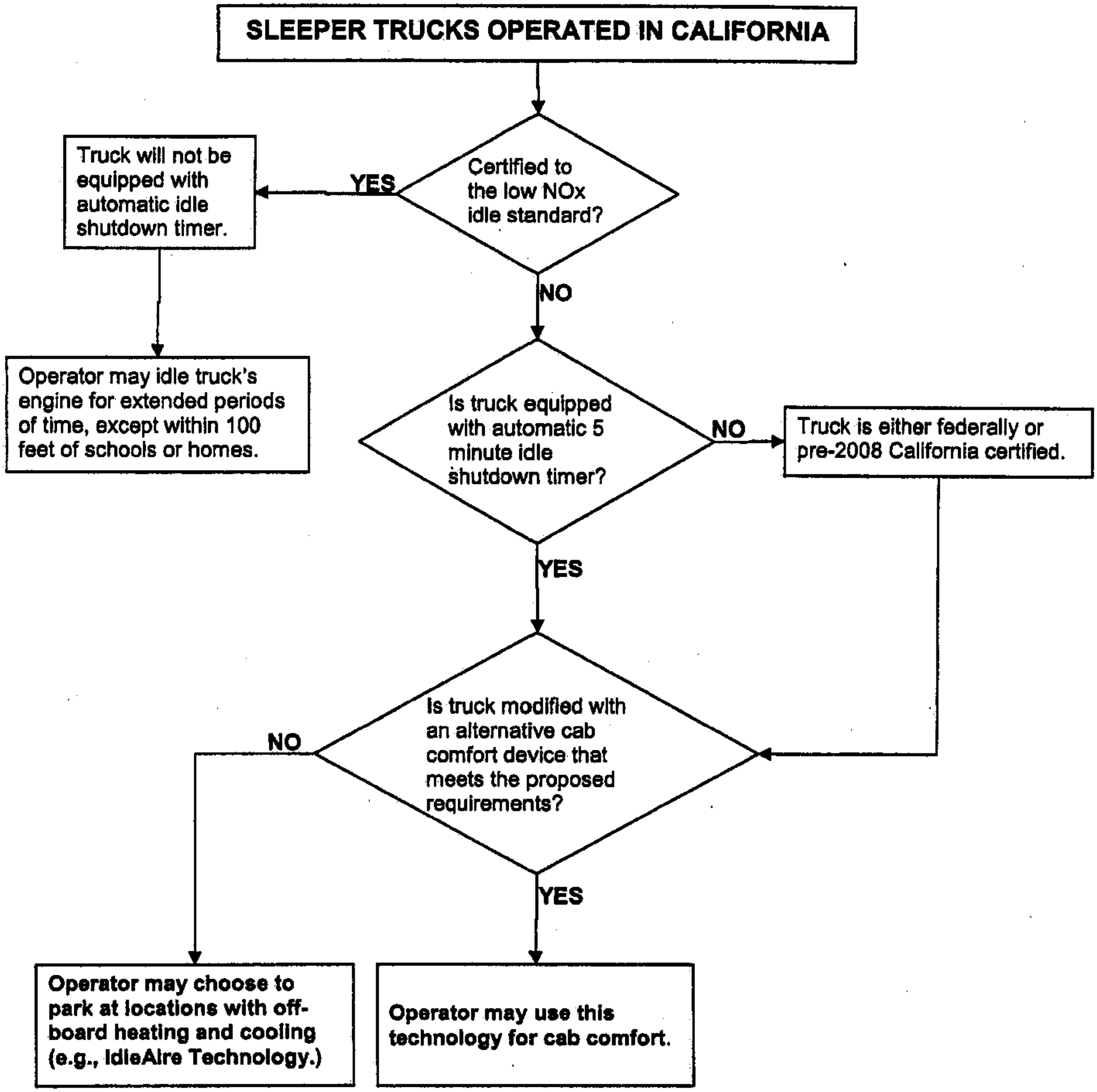
Proposed Emission Performance Requirements for Cab Comfort Devices
Some of the cab comfort devices, such as internal combustion APSs and fuel-fired heaters, produce emissions. Performance requirements are proposed for these systems which differ depending on whether the truck's engine is a 2007 or later model.

All APS engines will have to be certified to the off-road emission standards. Currently available APSs are already doing this. Beginning in 2008, trucks with 2007 and subsequent model year engines equipped with a PM filter, or "trap", will have the additional requirement to either route the APS's exhaust through the PM trap of the main truck engine or to retrofit the APS separately with a "level 3" PM reducing device (likely to be a PM trap) which achieves an 85% reduction in emissions. Because of warranty issues, staff believes connecting main engine and APS exhaust systems together to control PM emissions will occur at the engine or truck manufacturer level rather than by aftermarket APS manufacturers.

Trucks equipped with 2006 or older model year engines do not have PM aftertreatment systems and so owners may use a diesel-fueled APS without adding PM control devices.

Beginning in 2008, all 2007 and subsequent model year trucks equipped with fuel-fired heaters will need to comply with the fuel-fired heater emissions requirements specified in the Low Emission Vehicle Program to operate in California. Several manufacturers currently produce fuel-fired heaters for heavy-duty trucks that meet the proposed requirement.

The following flow chart summarizes in general staff's proposed requirements and their impacts on truck operators.


SLEEPER TRUCKS OPERATED IN CALIFORNIA
Certified to the low NOx idle standard?
YES
Truck will not be equipped with automatic idle shutdown timer.
Operator may idle truck's engine for extended periods of time, except within 100 feet of schools or homes.
NO
Is truck equipped with automatic 5 minute idle shutdown timer?
NO
Truck is either federally or pre-2008 California certified.
YES
Is truck modified with an alternative cab comfort device that meets the proposed requirements?
NO
Operator may choose to park at locations with off-board heating and cooling (e.g., IdleAire Technology.)
YES
Operator may use this technology for cab comfort.

Proposed Label Requirements
Beginning in 2008, trucks equipped with 2007 and subsequent model year PM-trap equipped engines and meeting the NOx idling emission standard or equipped with an internal combustion APS will be required to have a label affixed to the hood of the truck in order for these engines to operate during rest periods in California. The label requirements are being proposed to help enforce the idling requirements in the field by enforcement personnel.

Economic Impacts to Businesses
When the proposed amendments to the new engine and in-use idling ATCM requirements take effect in 2008, trucking businesses that own or purchase new trucks with sleeper berths may incur additional expenses due to the need to buy cab comfort devices to provide sleeper berth climate control and power for accessories. Similarly, owners of out-of-state trucks that frequently operate in California may also need to buy cab comfort devices to provide sleeper berth climate control and power for accessories. However, these expenses will be offset by the savings resulting from reduced fuel use and reduced maintenance requirements. Staff estimates these additional costs can be recovered within 1 to 2.5 years, depending on the number of idle hours reduced and the type of technology used. Therefore, overall the proposed requirements will benefit truck owners and operators because of reduced operating costs.

Air Quality Impacts and Cost-Effectiveness
To estimate the emission reductions from the proposal, staff assumed pre-2007 model year sleeper berth equipped California and out-of-state trucks will use California certified off-road or federally certified non-road diesel-fueled APSs and that diesel-fueled APSs retrofitted with a level 3 verified PM control strategy will be used for 2007 and subsequent model year sleeper berth equipped California and out-of-state trucks. Statewide emission reductions are estimated to be approximately 46 tons per day (tpd) of NOx, 4.2 tpd of ROG, 1930 tpd (0.7 million tons per year) of carbon dioxide (CO_2), and 0.42 tpd of PM emissions in 2010. For the South Coast Air Basin, the corresponding emission reductions are estimated as 18 tpd of NOx, 1.6 tpd of ROG, 740 tpd (0.3 million tons per year) of CO_2, and 0.15 tpd of PM in 2010.

Staff's proposal is expected to provide a cost savings to truck owners over the useful life of the cab comfort device by reducing the amount of fuel consumed and the truck's maintenance requirements. Under these circumstances, the emission reductions would be "free", and the cost-effectiveness could not be calculated. If cost savings were set to zero as a worst case, cost-effectiveness can be estimated and compared to other emission control regulations adopted by the ARB.

For a 2008 and subsequent model year California certified truck equipped with a non-programmable engine shutdown system which uses a diesel fueled APS with a level 3 verified PM trap, the cost-effectiveness is estimated to be \$2.00 per pound of NOx plus ROG reduced.

For a 2007 model year truck, the engine would not have the automatic shutdown system but the truck would have a PM trap. Thus, use of an APS would subject it to the 2008 requirement. Retrofitting a 2007 truck with a diesel-fueled APS with a level 3 verified PM trap produces a cost-effectiveness estimate of $1.98 per pound of NOx plus ROG reduced.

For a 2006 and older model year California truck equipped with a certified diesel-fueled APS with no additional PM control, the cost-effectiveness is estimated to be $1.44 per pound of NOx plus ROG reduced.

Fleets have a distribution of truck model years. Taking this into account produces a fleet average cost-effectiveness estimated to be $1.51 per pound of NOx plus ROG reduced in 2008. These worst-case estimates all compare favorably to the cost-effectiveness of other ARB regulations recently adopted.

I. INTRODUCTION

Over the last thirty years, the California Air Resources Board (ARB or the "Board") has adopted a number of emission control regulations that have resulted in significant emission reductions from both on- and off-road mobile sources. While these regulations have greatly improved air quality, many regions of California continue to exceed state and federal air quality standards for ozone and fine particulate matter. Therefore, more measures need to be taken to improve California's air quality and to protect the health of its citizens.

California's plan for reducing the reactive organic gases (ROG) and oxides of nitrogen (NOx) emissions that contribute to both ozone and particulate matter (PM) formation, is set forth in the 2003 State and Federal Strategy for the California State Implementation Plan (2003 SIP).

In 2010, on-road heavy-duty diesel trucks are estimated to account for as much as 28 percent, or 559 tons per day (tpd), of the statewide mobile source NOx emission inventory and nine percent, or 12 tpd, of the statewide mobile source PM emission inventory[1]. This is of particular concern since these estimates already take into account the stringent 2007 on-road heavy-duty diesel engine (HDDE) exhaust emission standards recently adopted by the ARB and the United States Environmental Protection Agency (U.S. EPA). Therefore, more reductions are needed from these sources.

The proposed regulation has two related, yet distinct, goals. One goal is to reduce idling emissions primarily from new sleeper berth equipped trucks (hereinafter referred to as "sleeper trucks") starting with the 2008 model year. Specifically, the proposed regulation would require new trucks to meet an emissions standard when idling or have a timer system that would automatically shut the engine off after five minutes of continuous idling. The manufacturers using timers may provide heating and cooling for driver comfort using an alternative technology such as an auxiliary power system (APS). Such an alternative technology would have to be comparable, from an emissions standpoint, to the proposed idling requirements.

The other goal of staff's proposal targets the existing fleet of sleeper trucks, registered in both California and out-of-state. For these trucks, the proposed regulation would require the truck operator to manually shut down his/her engine after five minutes of continuous idling. To provide for cab comfort, the operator may choose to retrofit his/her truck with an alternative technology such as an APS which meets specific emissions standards. A more detailed description of staff's proposal is provided below.

Staff's proposal amends sections 1956.8 and 2485 of title 13, California Code of Regulations (CCR). Section 1956.8 of the CCR specifies exhaust emissions standards and test procedures applicable to 1985 and subsequent model year HDDEs. Staff's

[1] Based on California Almanac Emissions Projection Data (Published 2005). Idle emissions from heavy-duty diesel vehicles were adjusted to reflect revised average idle times for medium heavy-duty diesel vehicles.

proposal would modify this section by requiring new 2008 and subsequent model year on-road diesel engines with a gross vehicle weight rating (GVWR) greater than 14,000 pounds to be equipped with an engine shutdown system that automatically shuts down the engine after five minutes of continuous idling. In lieu of the engine shutdown system requirement, manufacturers may optionally certify their engines to a NOx idling emission standard of 30 grams per hour under loaded, low and high idle operating conditions. For purposes of discussion in this document, staff's proposed modifications to section 1956.8 are hereinafter referred to as "new engine requirements".

Section 2485 of the CCR is an airborne toxic control measure (ATCM) that limits idling to no more than five minutes for in-use diesel-fueled commercial vehicles with a GVWR greater than 10,000 pounds. However, the ATCM currently exempts sleeper trucks when the operator is resting in the sleeper berth and idling the main engine for climate control or to power on-board accessories. Starting in 2008, staff's proposal would extend section 2485's applicability to existing and future sleeper trucks. For purposes of discussion in this document, staff's proposed modifications to section 2485 are hereinafter referred to as "in-use idling ATCM requirements".

The proposal also allows the use of alternative technologies to supply power needed for cab/sleeper comfort and/or other on-board accessories that would otherwise have been generated by the continuous idling of the truck's main engine. These technologies include, but are not limited to, internal combustion engine driven APSs and fuel-fired heaters. Such technologies would need to comply with defined performance requirements set forth in this proposal to operate in California and are also supported by the proposed modifications to section 2402, 2424, and 2425 of the CCR. Other technologies that do not directly produce emissions, such as battery electric APSs, fuel cell APSs, thermal energy storage devices, and power inverter chargers for use with battery and grid-supplied electricity are also allowed. Any technology that is not identified in this proposal may also be used provided it is approved by the Executive Officer. The use of these devices in lieu of operating the truck's main engine at idle will result in significant NOx and carbon dioxide (CO_2) emission reductions. Reductions in ROG and PM emissions are also expected, but to a lesser degree, depending on the alternative technology used.

The following chapters of the staff report provide background information, a summary of the proposed amendments, regulatory alternatives evaluated, an economic impact analysis, environmental impact and cost-effectiveness analysis, and conclusions and recommendations.

II. BACKGROUND

This chapter provides an overview of the applicable vehicle classes included in this proposal, a brief description of the truck idling concern, associated emissions, existing regulations, and the 2003 SIP commitments.

A. VEHICLE CLASSES

The proposed new diesel engine requirements apply to trucks with a GVWR greater than 14,000 pounds. Examples of trucks subject to the proposal are line-haul trucks, delivery trucks, trash trucks, bulk-hauling trucks, tankers, utility trucks, and construction vehicles.

The proposed changes to the in-use idling ATCM apply to sleeper trucks with a GVWR greater than 10,000 pounds. The majority of the sleeper trucks are in the heavy-heavy duty diesel vehicle class category (over 33,000 pounds GVWR).

B. TRUCK IDLING EMISSIONS CONCERNS

Emissions from idling trucks pose a significant air quality problem. Idling emissions are particularly significant at locations such as truck stops, travel centers, rest areas, and at warehouse/distribution centers and port terminals where loading and unloading freight require long waiting periods. Such locations can experience a very high density of trucks idling together for extended periods of time, thereby producing highly localized and concentrated emissions. These emissions affect the health of the drivers, truck stop, warehouse, and ports personnel, and the neighboring community. The health concerns in particular become more serious when such locations are located in low income communities that are already disproportionately impacted by air pollution.

C. EXTENT OF IDLING

Diesel trucks operate significant periods of time at idle. The amount of idling varies widely among trucks depending on season, location, company policy, and driver needs. The U.S. EPA estimates a typical long haul sleeper truck to idle approximately 2,400 hours over the course of a year (U.S. EPA, 2004). While a report by the United States Department of Energy (Stodolsky et al., 2000) estimates that long-haul sleeper trucks idle for about 1,800 hours per year. Based on these studies, staff used the average of the U.S. EPA and the Department of Energy estimates, and thus has assumed that sleeper trucks idle for 2,100 hours per year. Normalized over 365 days, the average idling time is therefore assumed to be approximately six hours per day.

The reasons for truck idling vary greatly. Drivers often operate their engines at idle to provide cab climate control, to power on-board accessories and/or to keep the engine warm to avoid cold-start problems during winter months. Many drivers of sleeper and non-sleeper trucks also operate the main engine at idle for extended periods of time simply because of habit and to mask outside noise. But according to a pilot survey on truck idling trends conducted in Northern California, the majority of drivers operate their engines at idle mainly for heating (67 percent) and air conditioning (83 percent) purposes (Brodrick et al., 2001). These survey results suggest that if heating and air conditioning can be maintained using an alternative idle reduction strategy, truck idling emissions in California can be significantly reduced.

D. FUEL CONSUMPTION

Besides generating emissions, engine idling also increases fuel consumption, engine wear and maintenance costs. Studies have shown that during idling, trucks consume approximately 0.4 to 1.6 gallons per hour of fuel depending on engine size, engine speed, heating, air conditioning and electrical loads (Lambert et al., 2001; Lim, 2002). It should also be noted that during idle operation, drivers sometimes operate their engines at elevated engine speeds to provide more power to operate climate control devices and on-board accessories, to reduce cab noise and vibration, and to reduce engine wear associated with low speed idling. Tests have also shown that as engine speed increases, fuel consumption increases proportionally (Lambert et al., 2001; Lim, 2002). Assuming an average fuel consumption of one gallon per hour for an idling diesel truck engine, staff estimates that in 2005 the diesel fuel consumption due to idling of California registered sleeper trucks is approximately 162,000 gallons per day statewide.

E. EMISSIONS INVENTORY

Diesel trucks are major contributors to California's air quality problems. On a per truck basis, they emit relatively high levels of NOx and PM emissions, both of which contribute to serious public health problems. As previously mentioned, it is projected that in 2010, both California and out-of-state registered diesel trucks will contribute approximately 28 percent of the statewide mobile source NOx emissions and nine percent of the statewide mobile source PM emissions.

California's emissions inventory model, EMAFC2002 version 2.2, estimates that, in 2010, the number of diesel tucks (GVWR greater than 33,000 pounds) on the road on a typical day in California to be approximately 180,000 and that 25 percent of these trucks come from out-of-state. Furthermore, based on an analysis of the 2002 Vehicle Inventory and Use Survey database (U.S. Census Bureau, 2005) 20 percent of the California registered diesel trucks are estimated to be sleepers. The majority of the out-of-state trucks are sleeper trucks idling for an extended period of time. Staff assumes that 90 percent of the out-of-state diesel trucks in California are sleepers.

Thus, statewide emissions in 2010 from extended idling of California registered sleeper trucks are estimated to be 20 tpd of NOx and 0.39 tpd of PM emissions. Similarly for the South Coast Air Basin, the 2010 idling emissions from California registered sleeper trucks are estimated to be approximately 8 tpd of NOx and 0.14 tpd of PM emissions.

Statewide emissions in 2010 from extended idling of out-of-state sleeper trucks are estimated to be 33 tpd NOx and 0.34 tpd of PM emissions. Similarly for the South

Coast Air Basin, the 2010 idling emissions from out-of-state trucks are estimated to be approximately 13 tpd of NOx and 0.12 tpd of PM emissions.

F. EXISTING REGULATIONS

ARB's 2004 diesel engine standards reduced NOx emissions from these engines by 50 percent from the 1998 levels (ARB, 1998a). ARB's 2007/2010 diesel engine aftertreatment forcing emission standards will reduce both NOx and PM emissions from new engines by another 90 percent (ARB, 2001a). In addition, California also has a heavy-duty vehicle inspection program aimed at reducing emissions from the existing fleet[2].

While ARB has successfully adopted regulations to reduce emissions from heavy-duty diesel engines, it has not, until recently, specifically sought to control idling emissions. In December of 2002, ARB adopted an ATCM to limit school bus idling at or near schools[3]. This ATCM requires a driver of a school bus, transit bus, or other commercial vehicle to manually turn off the bus or vehicle engine upon arriving at a school and to restart it no more than 30 seconds before departing. In July 2004, ARB adopted an in-use idling ATCM that limits idling of diesel-fueled commercial vehicles and buses to no more than five minutes[4]. However, this ATCM does not apply to idling sleeper trucks that are located further than 100 feet from any restricted area (residential homes and schools).

Section 40720 of the Health and Safety Code requires marine terminals to limit truck idling to no longer than 30 minutes. Failure to comply with this requirement subjects the marine terminal to a fine of $250 per vehicle per violation. The local air pollution control district with jurisdiction over the terminal has the responsibility of enforcing this requirement.

The ARB has also initiated voluntary incentive and demonstration programs to reduce idling. For example, the Carl Moyer Program[5] promotes the introduction of APSs as an idle reduction device for sleeper trucks by providing monetary incentives for the installation costs of APSs. In addition, ARB also provides funds to accelerate the deployment of truck stop electrification. One such grant, for example, is the $2 million grant fund awarded to IdleAire to subsidize the use of 200 new advanced truck stop electrification spaces in the San Joaquin Valley.

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[2] California currently has two heavy-duty vehicle inspection programs, the Heavy-Duty Vehicle Inspection Program (HDVIP) and the Periodic Smoke Inspection Program (PSIP). Under the HDVIP, heavy-duty diesel trucks and buses are tested for excessive smoke emissions and inspected for tampering at random roadside locations, weigh stations and fleet facilities. The PSIP compliments the HDVIP by requiring California-based truck and bus fleets with two or more HDDVs to annually test their own vehicles to measure smoke opacity and to check for tampering. Title 13, California Code of Regulations sections 2180 et seq. and 2190 et seq., respectively.

[3] Title 13, California Code of Regulations, section 2480.

[4] Title 13, California Code of Regulations, section 2485.

[5] An ARB program, implemented in 2000, that provides incentive money to help promote the introduction of emission reduction technologies into California.

G. STATE IMPLEMENTATION PLAN (SIP)

Although many of the measures in the 1994 ozone SIP have been adopted, federal air quality standards will not be attained in many areas of the state by the statutory deadlines. As a result, ARB updated the 1994 SIP and generated a revised 2003 SIP. The 2003 SIP includes new measures to further reduce emissions and to move towards achieving the federal air quality standards for ozone and PM. One on-road heavy-duty vehicle measure contained in the 2003 SIP is measure "ON-ROAD HEAVY-DUTY-3." This measure in turn consists of several other control measures such as PM In-Use Emission Control, Engine Software Upgrade, On-Board Diagnostics, Manufacturers' In-Use Compliance, and Reduced Idling. It commits to achieve between 1.4 and 4.5 tpd of ROG reductions and between 8 and 11 tpd of NOx reductions in the South Coast Air Basin in 2010. This proposal is part of measure ON-ROAD HEAVY-DUTY-3 and will contribute towards fulfillment of the committed emission reductions in the 2003 SIP.

III. NEED FOR CONTROL

As previously mentioned, on-road heavy-duty diesel trucks contribute significantly to the statewide NOx and PM emissions inventory. NOx is one of the two primary contributors to the formation of ozone and contributes to serious public health issues (ARB, 2001b). Diesel PM has been identified by ARB as a toxic air contaminant based on its potential to cause cancer (ARB, 1998b), and can also result in other serious health problems such as asthma and reduced lung function (ARB, 2001b).

Besides generating excess ROG, NOx, CO and PM emissions, unnecessary engine idling also produces undesirable CO_2 emissions. CO_2 is one of the major greenhouse gas emissions responsible for global warming (ARB, 2002b).

Staff's proposal would significantly reduce NOx emissions and associated health risks by reducing the time sleeper trucks are operated at idle. The benefits from this proposal are particularly significant in low-income communities located close to truck stops, travel centers, rest areas, ports, warehouse/distribution centers, and other locations where extended truck idling activity occurs. The proposal will also help reduce CO_2 emissions and the state's dependence on foreign oil (via reduced fuel consumption). It will also result in a net benefit for trucking businesses over the useful life of the truck by saving money through improved fuel economy and reduced maintenance requirements.

IV. SUMMARY OF PROPOSED REQUIREMENTS

Staff recommends the Board amend Sections 1956.8, 2404, 2424, 2425, and 2485 of title 13, CCR, and the incorporated "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles", as set forth in Appendices A and B. Staff's proposal consists of two major components, affecting new engines and trucks, and existing engines and trucks. The component that targets new engines and trucks would require engine manufacturers to install on new 2008 and subsequent model year engines a non-programmable engine shutdown system or optionally certify engines to a low NOx idling emission limit. The second component involves changes to the in-use idling ATCM and affects existing as well as future sleeper trucks. The proposed changes would require operators of sleeper trucks to comply with the existing five minute idling restriction, beginning in 2008. The following sections discuss each element of the proposal in detail, including impacts on truck owners and operators, and the available options.

A. PROPOSED NEW ENGINE REQUIREMENTS

i. Applicability

The proposed new engine requirements apply to new California certified 2008 and subsequent model year diesel engines installed in trucks with a GVWR greater than 14,000 pounds.

The proposed new engine requirements do not apply to gasoline engines or engines produced for use in buses (commercial buses as well as school buses), and recreational vehicles. Gasoline fueled vehicles are excluded because the hot and cold start emissions associated with gasoline engines could cancel out or even exceed the benefits from reduced idling. Commercial buses and school buses are excluded because they have large volumes and window areas that necessitate operating the vehicle's main engine to power an air conditioning system with high heating and/or cooling capacity. The majority of recreational vehicles sold in California are gasoline-fueled and are equipped with generators[6]. Their contribution to idling emissions is negligible and thus these vehicles are also excluded from the proposed requirements.

ii. Engine Shutdown System

The effectiveness of anti-idling measures is largely dependent on the effectiveness of California's enforcement of such measures. However, effective enforcement of anti-idling measures is challenging since it requires considerable enforcement resources throughout the state. Staff believes that anti-idling rules can be an effective emission control strategy, if in addition to enforcement, engine technologies are also used. For example, a truck equipped with an engine that automatically shuts down after a

[6] According the Recreational Vehicle Industry Association, approximately 95 percent of the recreational vehicles sold in California in 2002 are equipped with generators (RVIA, 2003). Based on EMFAC2002 ver2.2, 93 percent of these vehicles are gasoline-fueled (ARB, 2003).

prescribed time period without the assistance of the operator can ensure compliance with statewide in-use idle requirements without depending solely on enforcement personnel. Requiring a non-programmable engine shutdown system on all new engines would significantly reduce extended idling of both new sleeper and non-sleeper trucks, and will help ensure compliance with the statewide in-use idling ATCM rule. As these new trucks eventually replace the older trucks, the resources needed for an effective idling enforcement program will be significantly reduced.

The proposed new engine requirements would require engine manufacturers to install, on new California certified 2008 and subsequent model year diesel engines, an engine shutdown system that automatically turns the engine off after five minutes of continuous idle operation, or, as an option, control engine emissions during extended idling (discussed in section iii below). Engines equipped with the engine shutdown system must have systems that are tamper resistant and non-programmable and must include the following provisions.

Conditions for Shutdown

The engine shutdown system must automatically activate when the truck comes to a stop, the transmission is set in the "neutral" or "park" position, and the parking brake is engaged. Upon activation, the system will shut down the engine after five minutes of continuous engine operation at idle. The requirement that the parking brake be engaged as a condition for the system's activation eliminates the possibility of undesirable engine shutdown, such as when the truck is stopped in traffic idling for more than five minutes. However, there is a possibility that drivers may use this feature to override the engine shutdown system. That is, a driver could park a truck without engaging the parking brake and operate the engine at idle indefinitely. To prevent this, the proposal would require that the engine shutdown system be activated and shut down the engine after 15 minutes of continuous idling if the parking brake is not engaged but the truck is stopped and the transmission is in neutral or in park.

Engine Shutdown Reset

The truck operator would be allowed to reset the engine shutdown system timer before engine shutdown. A warning signal, such as a light or sound indicator inside the truck cabin, may be used to alert the operator up to 30 seconds prior to engine shutdown. The operator could then reset the engine shutdown system by momentarily changing the position of the accelerator, clutch, or brake pedal or any other mechanism only during the last 30 seconds of the five-minute shutdown time limit (or the last 30 seconds of the 15 minutes when the parking brake is not engaged). This will allow the truck operator to continue operating the engine at idle as long as the truck is being driven.

Power Take-Off Devices

The engine shutdown system could be overridden when the engine is operating power take-off (PTO) equipment. A PTO device uses the truck's engine to transfer power to auxiliary equipment. So during periods when the truck's engine is "working" while it is idling, the engine shutdown system would not be activated. Examples of trucks with PTO equipment include trash trucks, cement mixers, mobile cranes, dump trucks, and vehicles with conveyors or other loading or unloading devices. The proposal does not consider equipment such as the truck's air conditioning system and on-board accessories (e.g., a television, microwave, etc.,) as PTO equipment.

Engine Warm Up

The engine shutdown system could also be overridden to warm up the engine if the engine coolant temperature is below 60°F. Thus, the engine shutdown timer would be activated once the coolant temperature reaches 60°F. The engine coolant temperature must be measured using the engine's existing engine coolant temperature sensor designed for engine protection. However, a manufacturer may request the Executive Officer's approval to use other methods of measuring the engine coolant temperature.

Enforcement Mechanism

To discourage tampering and to detect malfunctions of engines, the Board, in July of 2005, adopted On-Board Diagnostic (OBD) system requirements for heavy-duty trucks that will include monitoring of all emission control systems, including tracking the truck engine run time at idle and monitoring proper performance of sensors controlling the engine shutdown system. The OBD system requirements will be implemented starting with 2010 and later model year diesel engines and will monitor the proper function of the engine shutdown system. The OBD system will log fault codes if any sensor malfunctions. The fault codes can then be downloaded from the OBD system and inspected by ARB field inspectors in current or future heavy-duty truck roadside inspection programs. Field inspectors that connect to the truck's OBD system will also be able to analyze the amount of engine run time at idle, providing another way to evaluate whether the engine shutdown system is malfunctioning or has been tampered with.

Furthermore, because engine manufacturers must include a statement in their applications for certification that their engines will comply with the engine shutdown system requirement, violations of this requirement are enforceable through applicable penalty provisions of the Health and Safety Code.

iii. Optional NOx Idling Emission Standard

During the development of this proposal, several engine manufacturers indicated that NOx aftertreatment devices may to some degree reduce NOx idling emissions[7] and requested an option to certify engines to a new NOx idling emission standard as an alternative to meeting the engine shutdown system requirements. Another method suggested by the manufacturers was to take advantage of other strategies, such as advanced combustion processes or operational controls such as cylinder deactivation, to reduce NOx emissions during idling.

To accommodate the engine manufacturer's request, staff's proposal includes an optional NOx idling emission standard and test procedure. To determine the appropriate emission standard, staff evaluated currently available technologies that could provide all the operator needs as an alternative cab comfort device. Staff identified the diesel-fueled APS as the most likely and cost-effective cab comfort technology in 2008, when this proposal is to be implemented. The standard was based on the average NOx emission level of 2005 certification test data of off-road diesel engines used in APSs (engines with power ratings between 5 to 19 kilowatts). The proposed standard takes into account what the average NOx emissions levels will be over the useful life of the engine by incorporating a deterioration factor as part of the certification emission level. Staff's analysis resulted in a proposed optional NOx emission standard of 30 grams per hour. This standard is based on an APS providing 5 kilowatts of power, typically the peak power demand to provide all the necessary cab comfort and on-board accessory demands. The 30 grams per hour standard will provide significant NOx emission reduction, when comparing average NOx idling emissions of 165 grams per hour from late model truck engines, and will be equivalent to trucks operating a diesel-fueled APS as an alternative cab comfort device. A truck equipped with an engine certified to the optional NOx idling emission standard would also be required to have a label affixed to its hood that would permit the truck engine to idle beyond the five-minute idle time limit requirement imposed by the amendments made to the in-use idling ATCM (discussed in section B below).

The test procedure was developed to account for the varied operation of truck engines at idle. Typically, truck operators elevate the idle speed to provide more power for cab comfort and accessory devices. Higher engine speed also reduces truck vibration when idling and thus provides more comfort for the operator during rest periods. The test procedure requires engine testing at "curb idle" and at 1100 revolutions per minute (rpm) idle speed, under loaded and unloaded conditions (described in more detail below).

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[7] NOx aftertreatment devices, such as NOx adsorbers, typically operate most efficiently when exhaust temperatures are above 200°C (MECA, 2000). Exhaust temperatures during extended idling typically reach no more than 150°C (Hallstrom, 2005). Thus, while it is known that NOx adsorbers can significantly reduce NOx emissions, it is unclear at this time what level of reductions can be achieved by using NOx adsorbers during extended idling conditions.

Certification Test Procedure

The proposed test cycle for demonstrating compliance with the optional NOx idling standard utilizes an engine dynamometer operated in accordance with a 2-mode steady-state test cycle summarized in Table 1. Staff believes this test cycle accurately represents the range of sleeper and non-sleeper truck idling operations commonly practiced by truck operators.

Mode 1 involves operating the engine at its manufacturer's recommended curb idle speed. An engine load is applied and must include truck power demands for operating engine accessories, such as the engine cooling fan, alternator, coolant pump, air compressor, engine oil and fuel pumps and any other engine accessory operated during engine curb idle. Mode 1 does not include truck power demands to operate the air conditioning compressor or on-board electrical accessories such as a television, refrigerator, microwave, computer, etc.

Mode 2 involves operating the engine on a dynamometer at a speed of 1100 rpm. The engine load applied must include truck power demands to operate engine accessories at 1100 rpm, power demands to operate the air conditioning compressor at maximum capacity, and an additional load of 2kW to account for power demands for operating on-board accessories such as a television, refrigerator, microwave, computer, etc.

Table 1: Certification Test Cycle

Mode	Engine Speed (rpm)[a]	Time in mode (seconds)	Engine Load
1	Manufacturer Recommended Curb idle	1800	Vehicle power demands to operate engine accessories at curb idle. Engine accessories include, but are not limited to, cooling fan, alternator, fuel and oil pumps, coolant pump, air compressor, etc., (excluding air conditioning compressor and on-board accessories)
2	1100	1800	Vehicle power demands to operate (1) engine accessories (same as for mode 1) at 1100 rpm, (2) the air conditioning compressor operating at maximum capacity, and (3) an additional 2 kW to take into account on-board electrical accessories such as television, computer, etc.

[a] revolutions per minute

Exhaust emissions measurements are taken under hot stabilized conditions. If the engine is cold, the engine would be preconditioned prior to taking any emission measurements by operating it on an engine dynamometer at any speed above peak-torque speed and between 65 to 85% of mapped power until the engine coolant temperature stabilizes. Once the engine coolant temperature stabilizes, emission measurements would be taken continuously for a minimum of 30 minutes for each mode. For each test mode, modal average emissions are then calculated for each regulated pollutant. The calculated average NOx emissions must then be less than 30 grams per hour. Further details on this procedure can be found in Appendix B.

iv. Impact on Truck Operators

2008 and Subsequent Model Year California Certified Truck Engines

If the truck engine is equipped with the non-programmable engine shutdown system, the truck operator would not be able to idle the truck engine for long periods of time, regardless of whether the truck operator's engine idling needs occur in California or out-of-state. This means that sleeper trucks equipped with the engine shutdown system would need to provide other methods for heating/cooling the cabin and powering accessories when the truck is not being driven and the operator is resting in the sleeper berth. Currently available methods include the use of an internal combustion APS, battery electric APS, fuel-fired heater, thermal energy storage system, and/or a power inverter charger with an electrically driven air conditioning system. The engine or truck manufacturer may equip the truck with such a cab comfort device. If not offered by the manufacturer, the owner may choose to equip his/her truck with an aftermarket cab comfort device. However, in order to operate in California, cab comfort devices that produce emissions would need to comply with defined performance requirements set forth in this proposal (see section C.i., below). Other alternatives, that do not require installation of any cab comfort device, include parking at a truck stop that offers an off-board air conditioning, heating and power, such as offered by IdleAire Technologies (see section C.ii.2., below).

If an owner purchases a truck equipped with a diesel engine meeting the optional NOx idling emission standard, the engine would not have an engine shutdown system. Operators of such trucks would be allowed to idle the main engine continuously to provide cab comfort and electrical power during rest periods and would not need to install alternative cab comfort devices. However, they would still be subject to the existing five minute idling restriction when the truck is located within 100 feet of a restricted area and the truck would be required to have a label affixed to its hood (see section D, Label Requirements). It should be noted that staff does not expect this option to become widely available to truck owners/operators before the 2010 timeframe since NOx aftertreatment devices are not anticipated to be employed until 2010 and other engine idling controls/strategies have not yet been fully demonstrated.

2008 and Subsequent Model Year Federally Certified Truck Engines

It is expected that most of the 2008 and subsequent model year out-of-state trucks will be equipped with a federally certified truck engine that does not incorporate the non-programmable engine shutdown system requirements or meet the optional NOx idling emission standard. Operators of such trucks would be able to operate their truck engine continuously at idle outside of California. However, they would not be able to continuously idle their truck engine in California as he/she would also be subject to the five minute idling restriction under the proposed changes to the in-use idling ATCM requirements, discussed in section B, below. As a result, 2008 and subsequent model year federally certified trucks that operate and rest for extended periods in California would also need an alternative cab comfort device to provide for cab cooling/heating and power for accessories during these rest periods. These cab comfort devices are the same as the ones identified above for California certified trucks, and include an internal combustion APS, battery electric APS, fuel-fired heater, thermal energy storage system, and/or a power inverter charger with an electrically driven air conditioning system. Other alternatives, that do not require installation of any cab comfort device, include parking at a truck stop that offers off-board air conditioning, heating and power, such as offered by IdleAire Technologies. Similarly as required for California certified truck engines, in order to operate in California, cab comfort devices that produce emissions would also need to comply with defined performance requirements set forth in this proposal (see section C below for details). Also, to comply with the in-use idling ATCM requirements, a truck equipped with internal combustion engine APS will be required to have a label affixed to the hood of the truck in order to operate the APS in California (see section D below for details).

B. PROPOSED AMENDMENTS TO IN-USE IDLING ATCM AFFECTING EXISTING TRUCKS

i. Applicability

The proposed amendments to the in-use idling ATCM apply to existing and future sleeper trucks greater than 10,000 pounds GVWR, beginning in January 1, 2008. The in-use idling ATCM also applies to out-of-state registered trucks that operate in California. Emergency vehicles performing emergency services, military tactical vehicles during training, and vehicles with engines operating power take-off (PTO) equipment (a more detailed description of a PTO device is provided in section A.ii of this Chapter) are exempted. Other exemptions are specified in the existing in-use idling ATCM, section 2485 of the CCR.

ii. Idling Restriction

The existing in-use idling ATCM, section 2485 of the CCR, prohibits the driver of a diesel-fueled commercial truck with a GVWR greater than 10,000 pounds from idling the truck's main engine for more than five minutes at any location. The existing rule exempts sleeper trucks from this prohibition if they are located more than 100 feet from a restricted area. This exemption was provided at the time the rule was adopted because although staff had identified the diesel-fueled APS as a reliable cab comfort technology that would provide emission benefits on 2006 and older model year trucks, there were unresolved issues related to what these benefits might be when compared to "cleaner" 2007 and subsequent model year trucks. Therefore, staff recommended to the Board to delay consideration of sleeper trucks until 2005 in order to thoroughly evaluate all commercially available options to main engine idling.

Staff is now proposing to remove this exemption so that sleeper trucks would have to comply with the five-minute idling restriction at all times and at any location starting on January 1, 2008. Staff's proposal to remove the exemption is based on the current availability of cost-effective alternatives to truck idling and the resulting emission benefits.

Starting in 2007, trucks will be "cleaner" as a result of new emission standards that will reduce PM emissions by 90 percent or more using exhaust aftertreatment devices such as particulate traps. However, when the proposed no-idling requirements take effect in 2008, diesel-fueled APSs will be certified to the Tier 4 off-road standards, which are less stringent than the 2007 aftertreatment based diesel PM emission standards. Thus, to control the expected excess PM emissions that may result from operating a diesel-fueled APS as an alternative to idling the truck's trap-equipped engine, the proposal requires, starting January 1, 2008, that diesel-fueled APSs installed on trucks equipped with 2007 and subsequent model year diesel engines be retrofitted with a PM control strategy verified as a "level 3" device (i.e., achieve 85% PM reduction efficiency). Based on discussions with PM trap manufacturers, staff also believes that the proposed additional PM control requirement for diesel-fueled APSs is feasible within the timeframe of the proposed regulation.

Staff's proposal also allows the use of other strategies in combination with a diesel-fueled APS that result in an equivalent reduction in PM emissions. This could include, for example, installing a power inverter/charger with an electrically driven air conditioning and heating system in combination with the use of a diesel-fueled APS. A truck equipped with such an APS would also be required to have a label affixed to its hood to operate the APS. As previously mentioned, the labeling requirements are described in Section D of this chapter.

PM emissions from Tier 4 certified APSs are usually lower or, at worst, are the same as idling PM emissions from 2006 or older model year truck engines[8]. Therefore, the proposal allows the use of any Tier 4 certified APS with no additional PM emission control requirements with pre-2007 model year truck engines.

[8] A Tier 4 certified diesel-fueled APS emitting at the certification PM emission standard of 0.4 g/kW-hour and providing an average power of 2.7 kW produces about 1.08 grams per hour of PM emissions. This is lower than the estimated average idling PM emission rate of 1.59 grams per hour for a 2006 model year truck engine.

iii. Impact on Truck Operators

The proposed changes to the in-use idling ATCM will apply to existing and future sleeper trucks, including those registered out-of-state. Starting on January 1, 2008, it will require operators of sleeper trucks to shut down their engine before the five-minute idle time limit is reached and will affect truck operators of California and federal certified engines in different ways. The discussion that follows provides details on how truck operators will be impacted. Following the discussion, a summary of these impacts is graphically depicted in two flow chart diagrams, Figures 1, 2 and 3.

Operators of 2008 and Subsequent Model Year California Certified Diesel Engines

Under staff's proposal, California certified trucks with 2008 and subsequent model year diesel engines will be equipped with either 1) a non-programmable engine shutdown system, or 2) an engine certified to the optional NOx idling emission standard.

Trucks equipped with the engine shutdown system will automatically shut down the engine after five minutes of continuous idling, regardless of whether the truck is in California or in another state. In cases where owners of such trucks rest for extended periods (such as owners of sleeper trucks), it is likely that the owner will want to equip his/her truck with cab comfort devices. Currently available cab comfort devices include the use of an internal combustion APS, battery electric APS, fuel-fired heater, thermal energy storage system, and/or a power inverter charger with an electrically driven air conditioning system. The engine or truck manufacturer may equip the truck with such a cab comfort device. If not offered by the manufacturer, the owner may choose to equip his/her truck with an *aftermarket* cab comfort device. However, in order to operate in California, cab comfort devices that produce emissions would need to comply with defined performance requirements set forth in this proposal (see section C.i., below). Also, to comply with the in-use idling ATCM requirements, a truck equipped with an internal combustion engine APS will be required to have a label affixed to the hood of the truck in order to operate the APS in California. Other alternatives, that do not require installation of any cab comfort device, include parking at a truck stop that offers off-board air conditioning, heating, and power, such as offered by IdleAire Technologies (see section C.ii.2., below).

Trucks equipped with engines certified to the optional NOx idling emission standard will not be equipped with an automatic engine shutdown system. Those trucks will not shut down during continuous idling and will not require the owner to have any alternative cab comfort device installed when he/she rests in their truck during layover hours. Thus, the operator of such a truck will not be required to change the way they currently operate their truck during layover hours. However, to comply with the in-use idling ATCM requirements in California, the engine or truck manufacturer will need to ensure that a label is provided and properly affixed to the hood of the truck in order to operate the main engine at idle for more than five minutes.

Also, all 2008 and subsequent model year trucks equipped with fuel-fired heaters will be required to meet the LEV II fuel-fired heater emission requirements (see section C below) to operate them in California.

Operators of 2008 and Subsequent Model Year Federal Certified Diesel Engines

Trucks equipped with federal certified engines will not be equipped with an automatic engine shutdown system or have engines that meet the optional NOx idling emission standard. Those trucks will not shut down during continuous idling and will not be affected by staff's proposal when they are operated outside of California. However, when operating in California, the operators will also be subject to the in-use idling ATCM requirements. The in-use idling ATCM rule will require the operator of a federally certified truck to manually shut down his/her engine after five minutes of idling. Thus, operators of out-of-state trucks that want to rest in their truck during layover hours in California will need an alternative cab comfort device to provide for cab cooling/heating and power for accessories during these rest periods. These cab comfort devices are the same as the ones identified above for California certified trucks, and include an internal combustion APS, battery electric APS, fuel-fired heater, thermal energy storage system, and/or a power inverter charger with an electrically driven air conditioning system. Other alternatives, that do not require installation of any cab comfort device, include parking at a truck stop that offers off-board air conditioning, heating and power, such as offered by IdleAire Technologies.

Similarly as required for 2008 and subsequent model year California certified trucks, in order to operate in California, cab comfort devices that produce emissions would also need to comply with defined performance requirements set forth in this proposal (see section C below for details). A truck equipped with an internal combustion engine APS will be required to have a label affixed to the hood of the truck in order to operate the APS in California.

Also, all 2008 and subsequent model year trucks equipped with fuel-fired heaters will be required to meet the LEV II fuel-fired heater emission requirements (see section C below) to operate them in California.

Operators of 2007 Model Year California or Federal Certified Diesel Engines

Beginning in 2008, operators of trucks equipped with California or federal certified 2007 model year diesel engines will be required to manually shut down their idling engines after five minutes in California to comply with staff's proposed amendments to the in-use idling ATCM rule. These trucks will not be equipped with a non-programmable engine shutdown system, nor will they be equipped with engines meeting the optional NOx idling emission standards. Owners will need to retrofit their truck with a cab comfort device if they plan to rest in their truck during layover hours in California. Currently available cab comfort devices, as previously mentioned include the use of an internal combustion APS, battery electric APS, fuel-fired heater, thermal energy storage system, and/or a power inverter charger with an electrically driven air conditioning system.

Other alternatives, that do not require installation of any cab comfort device, include parking at a truck stop that offers off-board air conditioning, heating, and power, such as offered by IdleAire Technologies (see section C.ii.2., below).

Because a truck equipped with a 2007 model year diesel engine is also equipped with a PM aftertreatment system, an owner who chooses to install a diesel-fueled APS as a cab comfort device will also need to make sure the APS meets additional PM emission control requirements, specified in section C below, if it is to be operated in California. This requirement is meant to prevent an over-all increase in PM emissions from trucks equipped with 2007 diesel engines if owners choose to meet the proposed in-use idling ATCM by installing a diesel-fueled APS. A truck equipped with an internal combustion engine APS will be required to have a label affixed to the hood of the truck in order to operate the APS in California.

Also, beginning in 2008, all 2007 model year trucks equipped with fuel-fired heaters will be required to meet the LEV II fuel-fired heater emission requirements (see section C below) to operate them in California.

Operators of 2006 and Older Model Year California or Federal Certified Diesel Engines

Beginning in 2008, operators of trucks equipped with California or federal certified 2006 and older model year diesel engines will be required to manually shut down their idling engines after five minutes in California to comply with staff's proposed amendments to the in-use idling ATCM rule. These trucks will not be equipped with a non-programmable engine shutdown system, nor will they be equipped with engines meeting the optional NOx idling emission standards. As with owners of 2007 trucks, owners of 2006 and older trucks will need to retrofit their truck with a cab comfort device if they plan to rest in their truck during layover hours in California. As previously mentioned, currently available cab comfort devices include the use of an internal combustion APS, battery electric APS, fuel-fired heater, thermal energy storage system, and/or a power inverter charger with an electrically driven air conditioning system. Other alternatives, that do not require installation of any cab comfort device, include parking at a truck stop that offers an off-board air conditioning, heating, and power, such as offered by IdleAire Technologies (see section C.ii.2., below).

Unlike the requirements for 2007 and subsequent model year PM trap-equipped trucks, owners of trucks with 2006 and older model year diesel engines who choose to install diesel-fueled APSs will not need to comply with any additional PM emission requirements. As previously mentioned, this is because trucks equipped with 2006 and older model year diesel engines are not equipped with a PM aftertreatment system and thus the PM idling emissions from those engines are the same or greater than the emissions from diesel-fueled APSs. Also, 2006 and older trucks will not be required to have a label on the truck hood to operate their APS. For those trucks equipped with fuel-fired heaters, they will also not be required to meet the LEV II fuel-fired heater emission requirements.

As previously mentioned, the following flow chart diagrams (Figures 1, 2, and 3) graphically summarize how truck operators will be impacted by staff's proposal. As shown, the impacts will differ somewhat, depending on the model year of the truck/engine and whether the truck is registered in California or out-of-state.

Figure 1: Impacts on Operators - 2008 or Newer California Truck

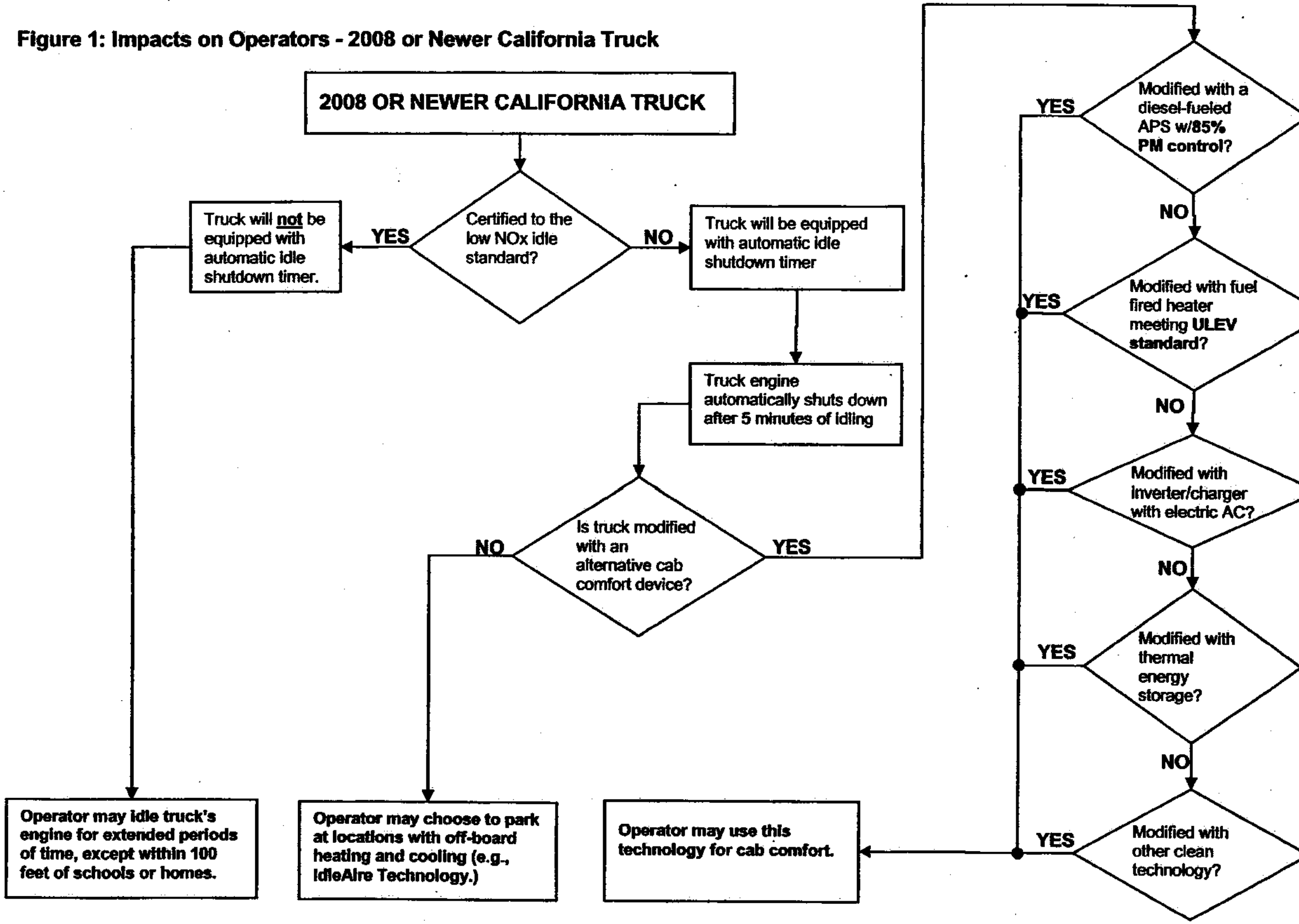


Figure 2: Impacts on Operators –
2007 and Newer Out-of-State Trucks and 2007 California Trucks

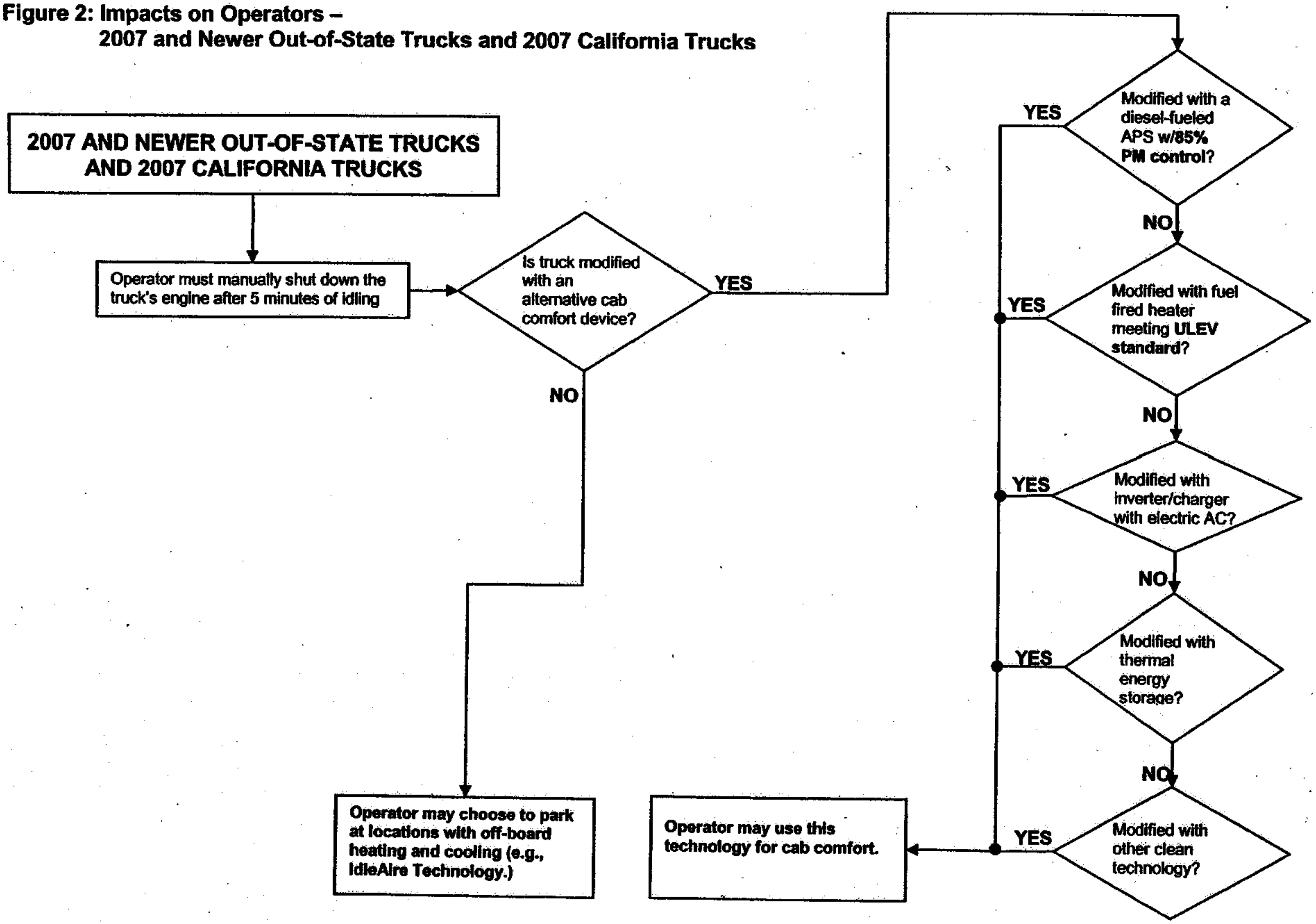
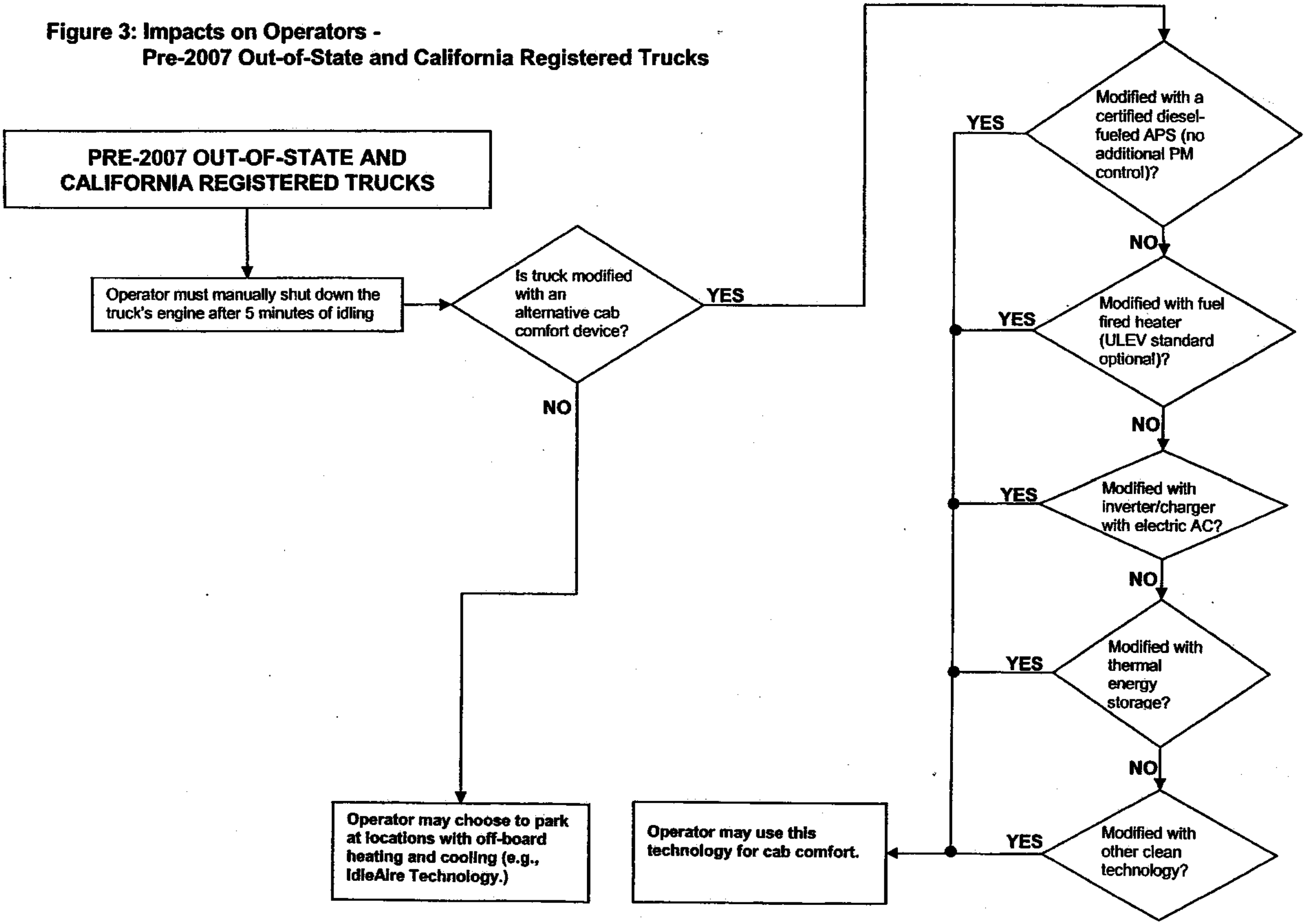


**Figure 3: Impacts on Operators -
Pre-2007 Out-of-State and California Registered Trucks**



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C. PROPOSED EMISSION PERFORMANCE REQUIREMENTS FOR CAB COMFORT DEVICES

When the proposed in-use idling and new engine requirements take effect in 2008, staff expects operators of sleeper trucks will use some type of alternative cab comfort technology to provide power for sleeper berth climate control, engine heating, and electrical power to charge batteries and operate on-board accessories. Some of the commonly used, presently commercially available cab comfort technologies capable of providing some or all of this power include devices such as an internal combustion APS, battery electric APS, fuel-fired heater, thermal energy storage system, and/or a power inverter charger and electrically driven air conditioning system with truck stop electrification[9] (U.S. EPA, 2005). The proposal allows the use of such alternative cab comfort devices. However, some of these devices have associated emissions that must be evaluated and compared to emissions generated from the main engine under idling conditions to ensure the devices do not emit greater emissions than operating the main engine. Thus, staff proposes the following emissions performance requirements for some of the cab comfort devices.

Auxiliary Power Systems

In order to operate in California, internal combustion engines used in APSs must currently comply with applicable California off-road or federal non-road emission standards and test procedures for their fuel type and horsepower category. Staff proposes that diesel-fueled APSs installed on PM trap-equipped 2007 and subsequent model year diesel trucks must also meet additional PM controls because PM emissions from Tier 4 certified off-road diesel engines (less than 19 kW ratings) are expected to be higher than the PM emissions from an idling PM trap-equipped 2007 model year diesel engine[10]. Therefore, diesel-fueled APSs installed on trucks equipped with 2007 and subsequent model year diesel engines will be required to control emissions by either equipping the APS with a level 3[11] verified PM control strategy or by integrating the APS's exhaust system with that of the truck's so that the APS's PM emissions are controlled by the truck's PM trap. Subject to the Executive Officer's advance approval, manufacturers may also use other procedures to demonstrate an equivalent level of emissions compliance (compared to a level 3 verified PM control strategy).

Battery electric and fuel cell APSs have recently been developed and are inherently emissions free. Battery electric APSs, in particular, are currently commercially available and can provide the same performance as diesel-fueled

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[9] A comprehensive list with detailed information of commercially available alternative technologies is available at the U.S. EPA website at http://www.epa.gov/otaq/smartway/idlingtechnologies.htm.

[10] 2007 and subsequent model year on-road HDDEs must comply with a PM exhaust emission standard of 0.01 gram per brake-horsepower-hour.

[11] The PM trap verification procedure and in particular, the level 3 verification level, are specified in sections 2700 to 2710 of title 13, CCR.

APSs. For example, Idling Solutions 9000 is a heavy-duty battery powered APS reportedly capable of providing power for cab comfort and on-board accessories for 8 to 15 hours between charges. Approximately 120 of these systems are currently installed on various fleets including J.B. Hunt Transportation Services, Swift Transportation, John Christner Trucking, Motor Lines, Inc., Wild West Express, etc. (Jay, 2005). Fuel cell APSs are presently not commercially available but are being demonstrated with some truck fleets.

Fuel-Fired Heaters

Beginning in 2008, staff proposes that 2007 and subsequent model year trucks operate only fuel-fired heaters that comply with the requirements specified in the Low Emissions Vehicle program (LEV II) regulations[12] in California. The LEV II regulations require fuel-fired heaters to meet the Ultra Low Emission Vehicle exhaust emission standards for light duty vehicles. However, unlike the LEV II program requirement that limits the operation of fuel-fired heaters to ambient temperatures of 40°F or less, the proposed regulation would allow the operation of fuel-fired heaters at any ambient temperature. Several manufacturers currently produce fuel-fired heaters for heavy-duty trucks that meet the proposed requirement.

Other Idle Reduction Devices

In addition to the above mentioned technologies, other devices may also be used to supply power that would otherwise be generated by idling the truck's main engine. Such devices could include, for example, thermal energy storage devices or power inverter chargers for use with batteries and/or grid supplied electricity. Other devices, not identified here, could also be used, subject to the Executive Officer's advance approval.

D. LABELING REQUIREMENTS

Engine Labeling Requirements

In order to clearly identify compliant diesel engines, staff proposes that each truck engine be equipped with a permanent label indicating that the subject engine complies with the California regulations. Currently, engine manufacturers produce the same engine for all 50 states and therefore produce and affix the same engine label on all diesel engines. The existing engine label indicates that the engine conforms to both U.S. EPA and California regulations. Staff's proposed requirement would not modify a manufacturer's existing engine labeling practice for diesel engines sold in California, but will indirectly require a modification of the engine label placed on federally certified diesel engines for sale outside of California, unless federally certified engines also

[12] The standards are specified in title 13, CCR, section 1961(a)(15) and (d), or in Part I.E.1.13 of the "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles" (adopted August 5, 1999, last amended in May 28, 2004)

comply with the proposed requirements. Therefore, unless federally certified diesel engines also meet the proposed requirements, engine labels for federally certified engines cannot state that the engine conforms to California regulations. This requirement is proposed to serve as an effective tool for in-use compliance testing and other enforcement programs.

Vehicle Labeling Requirements

The proposal would also require that engine manufacturers, original vehicle equipment manufacturers (OEM), or internal combustion engine APS manufacturers, as applicable, to produce and affix a standardized permanent label to the hood of the truck. This vehicle label would aide enforcement personnel in clearly and easily identifying diesel engines and diesel trucks equipped with APSs that comply with the proposed requirements. Staff therefore proposes that a standardized label be affixed on: (1) trucks equipped with an engine certified to the proposed optional NOx idling emission standard, and (2) trucks produced or retrofitted with an internal combustion engine APS that meets the proposed requirements applicable to APSs.

The standardized labels would be required to have the following characteristics:

1. oval in shape
2. minimum dimensions of 6 inches wide and 4 inches high
3. permanently attached and easily destroyed or defaced upon removal
4. includes a hologram (to prevent counterfeit labels)

Figures 4 and 5 are facsimiles of the proposed labels. Figure 6 shows an example of the hologram that would be embedded within the proposed labels. For new engines certified to the proposed optional NOx idling emission standard or engines equipped with an integrated engine-APS exhaust system for which the engine manufacturer is responsible, the engine manufacturer will be responsible for producing the labels and supplying them to the OEM. The OEM would then affix the label to the hood of the truck. For aftermarket internal combustion engine APSs that meet California requirements, the aftermarket manufacturer would be responsible for producing the label and affixing it to the hood of the truck if installed by the APS manufacturer. If the APS manufacturer does not install the APS, the APS manufacturer would supply the label to the party that installs the APS (OEM or any other APS installer).

Figure 4. Label for an engine meeting the optional NOx standard

Figure 5. Label for an APS with additional PM control

Figure 6. Hologram

V. TECHNOLOGICAL FEASIBILITY

Truck idling can be significantly reduced by using currently available idle control technologies. Some of these technologies can also provide sleeper/cab heating and cooling, heat for engine warming, and electrical power for battery charging and on-board accessories. Each technology has its advantages and drawbacks. These technologies include electronically controlled idle engine limiters, on-board auxiliary devices, and grid-supplied electrical power.

A. ENGINE SHUTDOWN DEVICES

Electronic engine shutdown devices are software based idle limit controls and are standard features in most commercially available on-road heavy-duty engines. These systems are built into the engine's electronic control software and enable the engine to shut down automatically if the engine idles more than the programmed time. For example, Detroit Diesel Corporation's system can be programmed to shut down automatically between 2 to 100 minutes, Cummins' system can be programmed to shut down between 2 to 1440 minutes, and Caterpillar's system can be programmed to shut down between 3 to 60 minutes. These systems can also electronically turn off the ignition switch to avoid battery discharge that may occur if accessories, such as lights and/or the radio, were left in the "on" position during engine shutdown. Although shutdown systems are available as standard features in modern electronically controlled engines, in most cases fleet owners and operators do not activate or program these systems to limit idling. All features of the engine shutdown system required by this proposal, such as overriding the system by pressing the gas or clutch pedal, overriding the system if the engine is in PTO mode, conditions for activation of the system, etc., are currently available in modern electronically controlled engines. Therefore, with only minor modifications in the programming of the electronic control software to prevent adjustment or tampering, the key requirement in staff's proposal can already be met with currently available engine shutdown systems.

B. OPTIONAL NOx IDLING STANDARD

The proposed optional NOx emission standard may be met with engines equipped with NOx catalysts. However, this may require a supplemental heat source to raise the exhaust temperatures to a level that would enable the catalyst to sufficiently reduce NOx emissions, since exhaust temperatures during extended idling are generally lower than the catalyst's light-off temperatures. Advanced combustion processes, operational controls such as cylinder deactivation and/or other idling emission control strategies may also be used to achieve the proposed NOx idling emission standard. An engine manufacturer would be required to demonstrate its engines' compliance with the proposed optional NOx idling standard, on average, using the test cycle described in section A of Chapter IV, without increasing other criteria pollutant emissions such as PM, ROG, and CO.

Staff does not expect that engine manufactures will certify to the optional NOx idling emission standard before the introduction of 2010 model year diesel engines. This is because, until that time, it is unlikely that manufacturers will equip their engines with NOx aftertreatment devices capable of meeting the proposed emission standard. Nevertheless, the option to certify to a NOx idling emission standard is being proposed at the request of several engine and truck manufacturers as an alternative to requiring a non-programmable engine shutdown system.

C. ALTERNATIVES TO IDLING

i. On-Board Auxiliary Devices

On-board auxiliary devices are truck mounted and can supply some or all of the power for necessities that would otherwise be generated by idling the truck's engine. The most widely used on-board auxiliary devices on sleeper trucks are diesel-fueled APSs, fuel-fired heaters, and inverter chargers. However, newer on-board based auxiliary devices are also currently being developed and introduced to the market. Examples include battery electric APSs and cold storage systems. Fuel cell-based APSs are also being developed and are currently in the demonstration stage.

1. Auxiliary Power Systems

Most currently available APSs use a small internal combustion engine equipped with a generator/alternator to provide climate control, heat to the engine for cold weather starting, 12-volt DC electrical power to charge the batteries and 110-volt AC power for on-board accessories. Most of the APSs currently used as alternatives to idling are diesel-fueled and typically use fuel from the truck's fuel system. The fuel consumption of diesel-fueled APSs ranges from 0.08 to 0.3 gal/hr (Stodolsky et al., 2000). This represents a significant fuel savings (and lower CO_2 emissions) compared to the truck's main engine idling fuel consumption rate of one gallon or more per hour for trucks (Lambert et al., 2001; Lim, 2002). Drawbacks to diesel APSs are their initial cost, additional weight, and maintenance requirements. The cost for an APS ranges from $5,000 to $8,000 (U.S. EPA, 2005). Opponents of this approach argue that the added weight of an APS reduces the capacity of the truck to carry a full load, resulting in the potential loss of revenue. The APS typically weighs 250 to 400 pounds, which is less than 0.5 percent of the 80,000 pounds a fully laden truck can weigh, so this impact is minor. APSs can have shorter maintenance intervals than the main engine, requiring the operator to modify its periodic maintenance schedules to include APS maintenance. Some engine manufacturers such as Cummins and Caterpillar are currently developing integrated main engine/APS systems that they expect to offer as factory options in 2006. Such systems are expected to significantly minimize the perceived APS drawbacks associated with the high initial cost, shorter maintenance intervals, and the added weight.

Currently, internal combustion engine APSs provide significant NOx emission reductions, ranging from 89 to 94 percent less than NOx emissions generated when the truck's main engine is idling and the air conditioning system is engaged (Lim, 2002). Other criteria pollutants such as CO and ROG are also reduced. PM emissions may be greater or less than the main engine depending on the model year of the truck engine on which the APS is installed. That is, if the APS is installed on pre-2007 model truck engine, PM emissions are usually lower or, at worst, are the same as main engine idle emissions. However, diesel-fueled APSs installed on 2007 and subsequent model year PM trap-equipped truck engines are expected to produce higher PM emissions than the main engine. Therefore, staff is proposing additional diesel-fueled APS PM emission requirements for those APS engines installed on trucks with 2007 and subsequent model year diesel engines.

Staff's proposed PM emission reduction requirement could be met by retrofitting the APS with a level 3 verified particulate trap. The trap may require an active regeneration scheme, since the APS exhaust temperature may not be high enough for passive regeneration to occur. Based on verbal communication with a manufacturer developing PM traps for diesel engines less than 25 hp, it is likely that PM traps for APSs could be used to achieve the level 3 verification requirements with modifications. The modifications would require the design of an active system that would increase the exhaust temperature periodically to reduce the captured PM emissions. These PM trap systems are currently designed for applications in generator sets and transportation refrigeration units, but can readily be adapted for diesel-fueled APSs since they use the same engines and also operate in a similar way as generator sets.

Integration of main engine/APS exhaust systems and passing the APS exhaust through the trap of the main engine may also be used to control PM emissions from the APS. Because of warranty issues, staff believes integration of main engine/APS exhaust systems to occur at the engine or vehicle manufacturer level rather than by aftermarket APS manufacturers. The cost of retrofitting an APS with a diesel-particulate trap is estimated to be approximately $1,200 to $1,500 (Lambe, 2005). However, staff's analysis assumes a conservative incremental cost of $2,000 to comply with the additional PM requirements. With the current average diesel fuel prices of approximately $2.40 per gallon[13], the payback period is estimated to be 1.5 to 2.5 years for a truck that idles approximately 2,100 hours per year.

2. *Fuel-Fired Heaters*

Fuel-fired heaters are used to provide heat to the cab/sleeper berth and/or to preheat the engine block for easy engine start-up during cold weather. Different models exist for a variety of applications, such as pick-up trucks, buses, and marine vessels. They can operate 20 or more hours on a gallon of diesel fuel, and typically use the fuel from the truck's fuel tank. They are relatively small, inexpensive, and consume much less fuel than an idling truck engine. A report by the U.S. EPA estimates that compared to the truck's main engine, diesel fuel-fired heaters reduce NOx emissions by approximately 99 percent and fuel consumption (and CO_2 emissions) by 50 to 80 percent (U.S. EPA,

[13] Average weekly on-highway diesel price for the weeks from January 1 to August 1, 2005. (http://tonto.eia.doe.gov/oog/info/wohdp/diesel.asp)

2002). The only drawback of this technology is its inability to provide cooling. Costs of fuel-fired heaters range from $1,000 to $3,000 per unit (U.S. EPA, 2005).

For applications in light-duty and medium-duty vehicle classes, fuel-fired heaters must meet the Ultra Low Emission Vehicle (ULEV) standards found in the LEV II regulations (13 CCR 1961(a)(15) and (d)). Staff's proposed requirement that fuel-fired heaters meet the ULEV standards in sleeper trucks can be met with existing, commercially available, fuel-fired heaters, since many models used for sleeper truck applications are currently meeting the ULEV standards. For example, all of Espar's and Webasto's fuel-fired heaters currently meet the ULEV standards.

3. Battery Electric and Fuel cell APS

Battery electric APSs provide cooling and heating for sleeper berth climate control without the need to idle the main engine or operate a diesel powered APS. Such systems include an independent electrically driven heating and air-conditioning system and an inverter to provide 120 Volt AC electrical power for on-board accessories. They are capable of providing more than ten hours of continuous cab comfort between charges. Depending on the number of batteries installed and alternator capacity, such systems typically require two to six hours of charging time. Fuel consumption and emissions from the truck engine will increase slightly when the batteries are being charged during engine operation. However, the overall emissions from the truck will be reduced by eliminating the need to idle the truck engine during layover hours. The cost of the commercially available battery systems ranges between $4,000 to $10,000 per unit, the higher amount corresponding to a system with an advanced battery system (higher capacity and longer life), higher capacity heating and air conditioning system, and an inverter charger. Staff estimates that this system would pay for itself in 1 to 2.5 years. Examples of commercially available battery electric APS systems include Idling Solutions' Idling Solutions 9000 and Bergstrom's Nite System.

An auxiliary power source that appears to offer a promising possibility of eliminating truck idling emissions is the fuel cell APS. A fuel cell produces electricity by converting the chemical energy of fuel directly to electrical power in a controlled chemical reaction. Fuel cells are clean and efficient. They can provide sufficient power to heat or cool a cab/sleeper compartment and run on-board electrical equipment. However, technical and economic issues, such as availability and infrastructure of a suitable fuel, the production costs of the units, and integration of the units with other on-board truck systems need to be resolved before such systems can become cost-effective for commercial truck operators.

4. Thermal Energy Storage

Cold storage systems utilize the truck's air conditioning system to store cooling energy when the truck is operated which is later used to cool the sleeper berth when the truck is stopped and the driver is resting. Some aftermarket systems are currently, commercially available. These systems may be used in conjunction with a fuel-fired heater to provide both heating and cooling. As with battery electric APSs, these systems must routinely be recharged (approximately 4 to 6 hours of truck operation is required). Also, fuel consumption will increase slightly due to the need to operate the air conditioning system compressor continuously. However, staff believes that the fuel savings from reducing idling of the main engine will offset this potential drawback. An example of a cold storage system that is currently commercially available is Webasto's BlueCool Truck system. The system costs, including installation, $3,600 per unit, or $4,600 if it includes a heater.

ii. On-Shore Electrical Power

The development of an electrical power infrastructure at truck stops and other locations is another option to reduce engine idling emissions. On-shore electrical power involves the electrification of truck parking spaces to provide power for heating, cooling and on-board accessories. It provides significant emissions benefits at the truck stop area or the site where it is installed. However, it is not available everywhere and may take many years before the system becomes widely available at truck stops. Even if such systems become widely available in the future, truck operators located away from such installations may still need an alternative cab comfort technology that is portable with the truck. There are currently two methods of using on-shore electrical power today. One method allows the truck to "plug-in" to the electrical power grid to power on-board air conditioning and heating systems, referred to as "on-board power infrastructure." The other method relies on heating and air conditioning provided at the location where the infrastructure is installed, referred to as "off-board power infrastructure."

1. On-Board Power Infrastructure

This technology provides trucks with 110-volt AC electrical power at truck stops, or other locations, to run the air conditioning, heating and on-board accessories. This requires truck stops to be equipped with electrical outlets throughout the parking spaces and trucks need to be equipped or retrofitted with inverter/chargers, electrical power connections and electrically driven heating and air conditioning units. The inverter/chargers are used to charge the truck batteries from grid supplied electricity and to convert the truck batteries' 12-volt DC to 120-volt AC power for all on-board accessories. The drawbacks of this system include the high initial infrastructure cost, cost for equipment add-ons to trucks, and its availability, which is limited to where the infrastructure is installed. The aftermarket cost for add-on parts and installation including inverter/chargers, electrical air conditioning system, wiring, outlets, circuit breakers, etc., is approximately $4,000 per truck (Perrot et al., 2004). Power infrastructure installation cost is approximately $3,500 to $6,000 per truck parking space depending on number of pedestals installed (Perrot et al., 2004). The payback period for the truck owner is estimated at about 1.5 years (Perrot et al., 2004)[14].

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[14] The payback period was estimated assuming a diesel fuel cost of $1.50 per gallon and idling 1800 hours per year. With the current higher diesel fuel prices ($2.40 per gallon, California average for the weeks from January 1 to August 1, 2005) the payback period would be much shorter than the period estimated by Perrot.

2. *Off-Board Power Infrastructure*

An alternative to the on-board power infrastructure has been recently introduced by IdleAire Technologies. This system provides 110-volt AC electrical power for on-board accessories, an externally installed heating and air conditioning unit and hook-ups for basic telephone, internet and television (access to cable/satellite) services at each truck parking space. The unit is connected to the truck through a console installed to the truck window using a template insert. The console contains all the necessary connections and controls, including a card reader for the billing system. Currently, the basic services cost about $1.25 to $1.50 per hour. The drawbacks are the high infrastructure installation and maintenance costs and its availability limited to where the infrastructure is installed. The off-board power infrastructure installation cost is approximately $12,000 to $ 20,000 per parking space depending on the number of parking spaces installed (Antares, 2005). The advantage of this type of infrastructure is that the truck does not need to be modified with any alternative cab comfort technology, resulting in immediate benefits to the truck owner using the service through reduced fuel consumption and maintenance savings.

VI. REGULATORY ALTERNATIVES

Staff evaluated several alternatives to the proposed requirements. The first alternative considered was taking no action and solely relying on ARB's existing anti-idling regulatory programs and on voluntary compliance. The second alternative considered was requiring engine/vehicle manufacturers to either certify their engines to a low NOx idling emission standard or to install a compliant APS system on every sleeper truck sold in California. The third alternative considered was staff's current proposal except that the available heating and cooling options for sleeper trucks would be limited to zero emission alternative technologies such as battery electric APSs, fuel cells or truck stop electrification. A description of the alternatives and the rationale for rejecting them are as follows:

A. NO ACTION

This alternative would rely on educational and incentive programs to encourage sleeper truck owners and operators to *voluntarily* reduce idling and use cab comfort devices. It would not require engine shutdown systems on new trucks nor mandate the five-minute idle time limit on sleeper trucks.

Educational programs would require considerable on-going state resources, and the effectiveness of reducing idle emissions is unknown. ARB's Carl Moyer Program has offered incentives to reduce emissions from truck idling by encouraging the purchase and installation of cab comfort devices. It offers funds to cover APS installation costs of up to $1,600 per diesel-fueled APS installation and up to $3,100 per alternative fuel, electric motor, or fuel cell APS installation. To date no applications have been received for this incentive program. Although the cost of currently available cab comfort devices can be recovered within 1 to 2.5 years from fuel savings and reduced maintenance requirements, trucking businesses have not been motivated to use these technologies. Hence, the emission reductions expected from voluntary programs that target truck idling have not been realized. Staff therefore believes that reducing truck idling only through voluntary programs will not be sufficient to achieve ARB's emission reduction goals.

B. IN LIEU OF ENGINE SHUTDOWN SYSTEMS, *REQUIRE* ENGINE MANUFACTURERS TO CERTIFY ENGINES THAT MEET THE LOW IDLE EMISSION STANDARD OR BE EQUIPPED WITH A COMPLIANT APS. INCLUDE THE PROPOSED AMENDMENTS TO THE IN-USE IDLING ATCM AFFECTING SLEEPER TRUCKS

This alternative provides only two options for compliance. Beginning with 2008 model year diesel engines, an engine manufacturer would be required to either certify its main engine to the low NOx idling emission standard or to install an APS on all sleeper trucks sold in California. As in the proposed requirements, the engine's NOx idling emission standard would be comparable to that of a diesel-fueled APS. If the engine or vehicle manufacturer instead chooses to install an APS, the APS would meet additional PM reduction requirements if it were a diesel-fueled APS.

This alternative would also amend the in-use ATCM, consistent with staff's proposal, to include all sleeper trucks beginning in 2008. Thus, California and out-of-state trucks resting during layover hours in California would need to purchase alternative cab comfort devices that meet all the emission performance requirements for their applicable model year and/or technology selected (see section IV.C. and D. above).

Staff did not pursue this alternative primarily because of how it would impact buyers of California certified trucks. Specifically, although this alternative would require all trucks resting during layover hours in California to control idling emissions, it presumes that all California certified sleeper trucks undergo and need extended idling operation in California. This may not be the case; some California trucking companies only idle for extended periods outside of California, or if they do need heating and/or cooling in California for extended rest periods, their drivers may either sleep in a hotel or they rely on available off-board power infrastructure for their needs. Thus, this alternative would force California truck buyers to pay a higher price for a new or used (i.e., 2008 and subsequent model year) truck equipped with cab comfort systems they may never need or use, resulting in their inability to recover their initial cost which would put them in an economic disadvantage with businesses operating out-of-state.

C. REQUIRE ENGINE SHUTDOWN SYSTEMS AND ONLY ZERO-EMITTING ALTERNATIVE TECHNOLOGIES. INCLUDE THE PROPOSED AMENDMENTS TO THE IN-USE IDLING ATCM AFFECTING SLEEPER TRUCKS

Similar to staff's proposal, this alternative would require 2008 and subsequent model year trucks to be equipped with engine shutdown systems that would shut down the engine after five minutes. It would also require, consistent with staff's proposal, that all sleeper trucks control idling emissions beginning in 2008 (see the previous alternative B). This alternative would allow the option of using alternative cab comfort devices but, unlike staff's proposal, it would only allow zero emitting technologies such as battery electric APSs, fuel cell APSs, thermal storage systems, truck stop electrification, or any other zero emitting technology. In other words, it would not allow manufacturers to certify their engines to an optional NOx idling standard or use cab comfort devices such as diesel or gasoline powered APSs, fuel-fired heaters or any other on-board device that produces emissions during its operation. Staff considered this alternative but does not recommend it for the following reasons:

- Truck stop electrification is currently not available everywhere and would take beyond the 2008 timeframe before it is widely available. Thus, truck operator needs could not be met at every location and would require other alternatives.
- Battery electric APS technology would likely be the only available near-term technology that could provide for all the truck operator heating and cooling needs as long as the truck is in operation long enough to recharge the system

after layover periods (typically up to 6 hours of operation is needed to fully charge the APS). However, this technology has only just recently been introduced commercially and acceptance by the industry will be limited until enough units have been placed into service and the technology is proven to be a durable and cost-effective solution. Several fleets are currently evaluating this technology with promising results.

- Fuel cell APSs are a promising technology but are still in the development and demonstration phase and may not be commercially available or cost-effective until after 2010.

Staff believes that most of these alternatives are viable options to comply with staff's regulatory proposal, but availability and commercial acceptance may be limited within the time period of the current proposal. However, as these technologies mature, production volumes increase, and more experience is gained, they will likely be widely used in the future. Thus, while they are certainly viable options, they should not, for the reason cited above, be the only options made available to truck operators.

D. PURSUE REQUIREMENTS THAT ONLY TARGET NEW TRUCKS STARTING IN 2008 (DO NOT PROPOSE REQUIREMENTS THAT WOULD IMPACT THE EXISTING IN-USE FLEET)

This alternative would only impact California certified trucks beginning in 2008. California trucks would be equipped with either the proposed engine shutdown system or the engine would meet an optional NOx idling emission standard. Also, this alternative would not modify the current in-use ATCM to include sleeper trucks.

Under this alternative, owners of 2008 sleeper trucks with engines meeting the NOx idling standard, pre-2008 California sleeper trucks, and federal sleeper trucks would be allowed to idle their engines during layover hours. Owners of 2008 California sleeper trucks equipped with an engine shutdown system would be the only ones that may need to purchase cab comfort devices, regardless of whether they idle their trucks in California or in other states.

This alternative would be effective in controlling idle emissions from California sleeper trucks beginning with the 2008 model year. However, because it can take as long as 30 years before the fleet is fully turned over, the near-term emission benefits would be small. Also, this alternative would not address idling from existing California and out-of-state sleeper trucks. In 2010, the existing pre-2008 model year California sleeper trucks will contribute 30 percent to the total sleeper truck idling emissions in California, while out-of-state sleeper trucks will contribute 63 percent. The remaining 7 percent would be due to idling of new 2008 and subsequent model year California registered sleeper trucks. Therefore, because the idling emissions from existing California and out-of-state sleepers are significant, and controlling these emissions is both feasible and cost-effective, staff rejected this alternative.

VII. ECONOMIC IMPACTS

A. LEGAL REQUIREMENTS

Government Code Sections 11346.3 and 11346.5(a) require state agencies adopting or amending any administrative regulations to identify and assess the potential for adverse economic impacts on California businesses and individuals. The assessment must include a consideration of the impact of the proposed regulation on California jobs, business expansion, elimination or creation of business, and the ability of California businesses to compete with those of other states. State agencies are also required to estimate the cost or savings to any state or local agency, and school districts. The estimate must include any non-discretionary cost or savings to local agencies and the cost or savings in federal funding to the state.

B. AFFECTED BUSINESSES

Businesses that may be affected by the proposed regulation include heavy-duty engine and vehicle manufacturers, manufacturers of alternative idle reduction devices and trucking businesses. Based on certification data, ARB has identified 21 heavy-duty engine manufacturers worldwide that manufacture and certify their engines for sale in California. Approximately eight heavy-duty vehicle manufacturers manufacture and sell heavy-duty vehicles in California. However, none of the heavy-duty engine or vehicle manufacturing businesses is located in California, and none is considered to be small business.

The exact number of manufacturers of idle reduction devices is unknown. However, staff estimates that there are at least 21 manufacturers that produce internal combustion APSs, fuel-fired heaters, truck stop electrification, battery electric APSs, inverter chargers, etc.[15] Approximately 48 percent of these manufacturers produce diesel-fueled APSs and the remaining 52 percent produce other cab comfort devices such as fuel-fired heaters, truck stop electrification, battery electric APSs, etc. Some of the APS manufacturers are part of bigger companies that design and manufacture specialty engineered products for the automotive, marine, industrial, medical and aerospace industries. Such APS manufacturers are not considered small businesses. Staff estimates that about 70% of the internal combustion APS manufacturers are small businesses. However, none of these manufacturers are based in California.

The number of California trucking businesses affected by the proposal was estimated from California Highway Patrol's Biennial Inspection of Terminals [16] Program database. Approximately 98 percent of California trucking businesses have fleet sizes of 24 trucks

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[15] The number of idle reduction technology manufacturers is determined from a listing of idle reduction technologies at the U.S. EPA website (http://www.epa.gov/otaq/smartway/idlingtechnologies.htm) and from a listing at http://www.truckinginfo.com .

[16] California Vehicle Code Section 34501.12 requires any person or organization directing the operation of trucks or trailers to participate in an inspection program conducted by the California Highway Patrol to inspect California truck terminals every two years.

or less. Assuming the fleet size of a small business to consist of 24 trucks or less, approximately 98 percent of the California trucking businesses are in the small business category.

The number of out-of-state based trucking businesses that operate in California is difficult to determine. However, staff analyzed the 2002 Vehicle Inventory and Use Survey database (U.S. Census Bureau, 2005) to get a rough estimate of the fleet composition of the 49-states. Based on this analysis, staff assumes that the out-of-state fleet mix is representative of those trucks operating in California. Similar to California trucking businesses, 99 percent of out-of-state businesses have fleet sizes of 20 trucks or less, and thus could be considered small businesses[17].

C. POTENTIAL COSTS TO ENGINE MANUFACTURERS

The proposal would require engine manufacturers to install a non-programmable and tamper-proof engine shutdown system on new 2008 and subsequent model year California heavy-duty engines. As previously discussed, an engine shutdown system is a standard feature on current electronically controlled on-road diesel engines, but are presently not programmed to shut the engine down after five minutes of idling. Setting the idle time is left to the truck owner, and the system can easily be overridden to allow the engine to idle continuously. Staff therefore, expects engine manufacturers to comply with this requirement through a minor change in the programming of the electronic engine software. As a result, staff expects that engine manufacturers will not incur any significant additional cost in developing the engine shutdown technology to comply with the proposed requirement, as no additional hardware costs should be needed.

In addition, engine manufacturers that certify engines meeting the proposed optional NOx idling emission standard or install a California compliant APS system may incur additional cost due to the proposed vehicle labeling requirements. However, staff believes this incremental cost to be negligible and absorbable within the purchase price of the main engine or the APS system, whichever is applicable.

Since the proposed new engine requirement is a California only requirement, it is projected to have a minimal cost impact on engine manufacturers. This cost is due to additional administrative costs related to the need to separately manufacture and track those engines destined for sale in California from those for sale in the other 49-states. However, these costs may be further reduced should engine manufacturers elect to also incorporate engine shut down systems in engines destined for sale in the other 49-states. Staff has assumed a minimal price increase of $100 per engine to cover the additional administrative costs and the minimal reprogramming costs.

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[17] The reason for using fleet size of 20 trucks or less as a cut point for the 49-state fleet analysis as opposed to 24 trucks or less for the California fleet is because the 2002 Vehicle Inventory and Use Survey database bins fleet sizes as 1 to 5, 6 to 10, 11 to 20, 21 to 50, etc., and therefore, it was not possible to use 24 trucks as a cut-point for the 49-state analysis.

D. POTENTIAL COSTS TO TRUCK MANUFACTURERS

The proposed regulation is not expected to result in any significant increase in costs to truck manufacturers. Engine shutdown software is already present and integrated with the truck. Staff anticipates that current truck manufacturing practices will not be significantly affected by the proposed regulation. Manufacturers will continue to manufacture trucks according to their own or customer specifications. Staff's proposal may also create a demand for "factory installed" cab comfort devices but offering them would be a business decision that would also benefit the manufacturer. However, since the proposed regulation is a California only requirement, they may incur a minimal increase in administrative costs in assuring that the engines installed on the trucks meet the proposed requirements. The proposed vehicle labeling requirements may also add to the cost of the truck, in instances where the truck manufacturer is responsible for producing and affixing the label to the outside of the truck. Staff assumes these incremental costs are negligible and absorbable within current truck pricing since truck manufacturers already have to track engines, transmissions, and other customer order components in vehicle orders.

E. POTENTIAL COST TO DIESEL-FUELED APS MANUFACTURERS

The proposed regulation allows the use of any alternative technology provided that the APS complies with applicable California emission standards and test procedures for their fuel and horsepower category. However, the proposal requires diesel-fueled APSs produced for applications with 2007 and subsequent model year diesel engines to meet additional PM controls. Manufacturers of diesel-fueled APSs that comply with additional PM controls may incur an additional cost in developing a PM trap with an active regeneration scheme capable of reducing PM emissions by 85% from the off-road Tier 4 standards. Furthermore, trucks equipped with PM trap-equipped APSs would need a label affixed to the outside of the truck. According to one diesel PM trap manufacturer, the cost of retrofitting a diesel-fueled APS with an active PM trap is estimated to be \$1,200 to \$1,500 (Lambe, 2005). However, staff assumed a conservative incremental cost of \$2,000 to comply with the additional PM control, including the cost of verifying the APS with a PM trap and creating a label.

F. POTENTIAL IMPACT ON TRUCKING BUSINESSES

The proposed requirements will affect both California and out-of-state trucking businesses that already own sleeper trucks and those that will purchase new ones in 2008. Although not required by the proposal, for purposes of this analysis, staff assumes that all trucking businesses will incur additional costs in purchasing alternative cab comfort technologies to provide for sleeper berth comfort and electrical power for accessories. Assuming businesses will use the most commonly used alternative today, the diesel-fueled APS, staff expects that businesses that own pre-2007 model year sleeper trucks will incur a cost of approximately \$5,000 to \$8,000, while businesses that purchase new 2007 and subsequent model year sleeper trucks will incur a cost of approximately \$7,000 to 10,100 (cost of an APS with additional PM control and, for

California certified trucks, an engine shutdown system for 2008 and subsequent model year engines). These costs are based on purchasing an aftermarket diesel-fueled APS, which is expected to cost more than an APS offered by the vehicle manufacturer as a factory option.

While existing California and out-of-state trucking businesses will certainly be impacted by the proposed regulations, the impact will depend on how often their trucks require extended stays in California. For example, if extended stays for an owner/operator or a truck fleet rarely happen in California, a business decision would need to be made whether to equip its truck(s) with an alternative cab comfort device. This decision would be based on how soon they could recover this additional incurred cost. Depending on the amount of idling hours reduced and the type of alternative cab comfort technology used, these additional costs can be recovered within 1 to 2.5 years through reduced fuel consumption and maintenance requirements. Therefore, overall, the proposed requirements will benefit the truck owner because they will realize a net savings from improved operating costs. An example of how these savings will be achieved is shown below, in Table 2.

Table 2 shows the savings realized and the payback periods for a diesel-fueled APS. The savings were estimated assuming that a sleeper truck idling consumes one gallon per hour and idling is reduced by six hours per day. The cost of diesel fuel was estimated at $2.40 per gallon[18]. The Technology and Maintenance Council's Recommended Practice 1108 (RP 1108) provides a method for estimating preventive maintenance and engine overhaul costs due to long duration idling. Using RP 1108, reducing idling by one hour results in preventive maintenance savings of $0.07 per hour, and engine overhaul savings of $0.16 per hour. It should be noted that the maintenance savings shown in Table 2 account for the additional costs that would be incurred by the maintenance requirements of the diesel-fueled APS[19].

[18] The diesel fuel cost of $2.40 per gallon is obtained by averaging the weekly California diesel fuel prices for the weeks from January 1 to August 1, 2005. Historic weekly retail on-highway diesel prices are available from the U.S. DOE, Energy Information Administration at http://tonto.eia.doe.gov/oog/info/wohdp/diesel.asp.

[19] The APS maintenance cost is based on the AXP 1000 maintenance requirements of $420. AXP 1000 is a diesel-fueled APS manufactured and sold by Engine and Energy Technology Corporation (http://www.eent.net/).

Table 2: Net Fuel and Maintenance Savings

Vehicle	Fuel Savings (gallons/year)	Fuel Cost Savings $/year	Maintenance Savings $/year	Total Savings $/year
Truck with a sleeper berth using a diesel-fueled APS	1750	$ 4,200	$ 77	$ 4,280
Cost of APS				Payback Period
APS without PM aftertreatment - $ 5,000				~ 1.2 years
APS with PM aftertreatment + idle shutdown system - $10,100				≤ 2.5 years

G. POTENTIAL IMPACT ON BUSINESS COMPETITIVENESS

The proposed regulation is not expected to adversely impact the ability of California businesses to compete with businesses in other states. As previously discussed, although businesses owning or purchasing new trucks with sleeper berths will most likely require that they be equipped with an alternative cab comfort technology, resulting in higher initial purchase costs, those businesses will also realize net savings in operating costs for those trucks. Staff's proposal is expected to improve, over the useful life of the truck, California trucking businesses' competitiveness (compared to trucking businesses that do not have alternative cab comfort technology on their trucks) by significantly reducing operating costs. Also, out-of-state trucking businesses that operate in California and install alternative cab comfort technology will also benefit from the same competitiveness advantage.

H. POTENTIAL IMPACT ON JOBS AND BUSINESS CREATION, ELIMINATION, OR EXPANSION

The proposed regulation is not expected to have a significant effect on the creation, elimination or expansion of jobs and businesses in California. However, the regulation may result in an increase in demand for cab comfort devices, and this in turn may result in the creation or expansion of some businesses. The increased demand for alternative cab comfort technologies may also result in the creation of new jobs related to research and development to further improve these technologies, and jobs related to the manufacturing, distribution and marketing of these technologies. Most of the businesses and jobs created are expected to be located near the engine and/or vehicle manufacturing facilities outside of California but some may be created in California.

I. POTENTIAL COSTS TO LOCAL AND STATE AGENCIES

There are no additional net costs for local and state agencies associated with adopting the proposed regulation. Typically, local government and state agencies purchase trucks without sleeper berths, so those trucks only require minimal modifications to the engine's software, resulting in minimal cost to the purchaser. It is expected that agencies purchasing compliant trucks would realize net operating savings from reduced fuel consumption due to the engine shutdown technology. Other costs, such as implementation costs to the state as a result of this rulemaking, would be costs directed to the ARB to implement and enforce the requirements, which should be absorbable within the existing ARB programs and budget.

VIII. ENVIRONMENTAL JUSTICE

The ARB is committed to integrating environmental justice into all of its activities. 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. On December 31, 2001, the Board approved "Policies and Actions for Environmental Justice", which formally established a framework for incorporating environmental justice into the ARB's programs consistent with the directives of state law. The policies developed apply to all communities in California, but recognize that environmental justice issues have been raised more in the context of low income and minority communities.

These 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 the ARB needs to engage community members in a meaningful way as it carries out its activities. People should have the best possible information about the air they breathe and what is being done to reduce unhealthy 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 (ARB, 2001c).

The proposed truck idling emission reduction requirements would benefit the people of California by reducing their exposure to harmful pollutants and diesel toxics. In particular, the proposed requirements will provide significant air quality benefits to communities located in proximity to truck stops, ports, distribution centers, and other truck idling centers where a high density of trucks idle together for extended periods of time. Furthermore, most of these locations are low-income areas that are already affected by the cumulative impact of air pollution from multiple mobile, commercial, industrial, areawide, and other sources. The adoption of this regulation, therefore, affirms the Board's commitment to the fair treatment of all people throughout California.

IX. ENVIRONMENTAL IMPACTS AND COST-EFFECTIVENESS

This chapter presents the air quality benefits and cost-effectiveness resulting from the implementation of the proposed idle reduction requirements.

A. AIR QUALITY BENEFITS

The proposed regulations achieve emission reductions by reducing the idling operations of diesel engines and trucks through the use of existing, cost-effective technologies. For various reasons, it is difficult to precisely estimate the emission benefits of the proposed regulations because staff can not accurately predict at this time the type and distribution of alternative technologies used to comply with the proposed regulation.

Another major uncertainty is the idling emission rate estimates associated with aftertreatment-based NOx and PM control technologies to be used with the 2007 and later model year diesel engines. Staff is not aware of any data that describe the performance of trap-based technologies or NOx catalysts during extended diesel idling operation. However, based on staff's understanding of how these technologies work, the following assumptions have been made for estimating the baseline emissions of 2007 and later model year diesel engines:

1. PM traps by nature of their construction are expected to trap PM at the same efficiency during idling as when the truck is operating under other typical driving conditions. Thus, the 2007 and later model year PM idling emission rates reflect the use of highly efficient PM traps.

2. NOx catalysts require a minimum temperature (light-off temperature) before the catalytic reactions needed to reduce NOx occur. The light-off temperature for NOx catalysts is generally above 200°C (MECA, 2000), while exhaust temperatures during extended idling are typically below 150°C (Hallstrom, 2005). Thus, for purposes of estimating NOx catalyst effectiveness during extended idling, engine-out NOx emissions are assumed to be unaffected by NOx catalysts, unless the engine is idling immediately following over-the-road operation (explained below).

   The U.S. EPA, in laboratory testing to demonstrate the technical feasibility of the 2007 heavy-duty engine standards, observed NOx emission control for more than 10 minutes of idle operation following loaded (or high temperature) conditions due to the thermal inertia of the NOx catalyst (U.S. EPA, 2000). However, the size of the NOx catalyst system relative to the engine size tested was significantly larger than what is currently being developed for diesel engines. A smaller catalyst system would have less thermal inertia, which would correspondingly result in controlling NOx emissions for a shorter period of time than the 10 minutes observed in the U.S. EPA testing. Thus, due to limited data on NOx catalysts currently being developed, staff assumes that NOx control during idling resulting from the thermal inertia mass of the NOx catalysts will be less than five minutes following over-the-road operation. Thus, NOx emission reduction estimates from the proposed requirements will remain unaffected, as the first five minutes of idling operation have not been included in staff's emission benefit estimates for this proposal.

Idle emission rates incorporated in California's emissions inventory model, EMFAC2002 ver 2.2 (ARB 2003), are based on test data from a limited number of trucks. In addition, the emission test data were obtained at "curb" idle speeds and did not include accessory loading. However, studies have shown that idling emissions are greatly dependent on ambient conditions, accessory loading, and engine speed (Lambert et al., 2001; Storey et al., 2003). As a result, staff modified the EMFAC2002 idle emission factors using emissions test data obtained from phase 1 of the Coordinating Research Council (CRC) project E-55/E-59 (Gautam et al., 2003) and emissions test data from a multi-agency study which included the U.S. EPA and Oak Ridge National Laboratory (ORNL) (Storey et al., 2003). The idle emission rates used in quantifying the air quality benefits from the proposed regulation are shown in Table 3.

Table 3: Fleet Average Idle Emission Factors

Weighted Average Idle Emission factors

Calendar Year	Model Year	NOx (grams/hour)	ROG (grams/hour)	PM (grams/hour)	CO_2 (grams/hour)
2010	Pre-1991	39.8	20.2	5.3	6228
	1991-2006	115.3	9.4	1.9	6228
	2007-10	115.3	8.3	0.16	6228
2020	Pre-1991	39.8	20.1	5.2	6228
	1991-2006	115.3	8.9	1.8	6228
	2007-20	115.3	8.3	0.16	6228

As shown, the PM emission rates for pre-2007 and 2007-10 model years differ greatly, as one would expect with the use of PM traps beginning in 2007. The NOx and ROG emission rates are assumed not to be impacted by a NOx catalyst at idle and thus are somewhat comparable for 1991-2006 and 2007-10 model years. The increase in the NOx emission rates for 1991 and later versus pre-1991 model years may be attributed to the high idling NOx emission rates associated with the post-1990 electronically managed engines which are likely to have advanced timing at low loads (or low temperatures) to avoid white smoke conditions (Clark et al., 2005).

Because of the engine shutdown requirements, the proposed regulation affects both sleeper and non-sleeper trucks. However, the emission benefits of staff's proposal consider only sleeper trucks. This is because the existing in-use ATCM already requires the operator of a non-sleeper truck to shut down his/her engine after five minutes of continuous idling, and thus the emission benefits from non-sleeper trucks have already been accounted for. Staff's emission benefit analysis includes both California and out-of-state registered sleeper trucks, and assumes that all pre-2007 sleeper trucks will employ as an alternative to idling, diesel-fueled APSs certified to the California off-road or federal non-road standards. 2007 and subsequent model year sleeper trucks were assumed to employ diesel-fueled APSs verified to a level 3 or 85% PM reduction from the Tier 4 off-road standards shown in Table 4. Furthermore, the average power demand for an APS operating under extreme climate conditions is estimated to be approximately 2.3 kW for winter conditions and 3.1 kW for summer conditions (Wallace, 2003; Lutsey, 2003). Staff assumed that the diesel-fueled APS would provide an average of 2.7 kW power to provide sleeper berth comfort and electrical power for accessories. Also, 25 percent of all trucks on the road on a typical day in California are estimated to be out-of-state registered trucks (ARB, 2003). Staff estimates that 90 percent of those out-of-state registered trucks are sleeper trucks that idle an average of six hours per day in California.

Table 4: Off-Road Diesel Emission Standards (g/kW-hr)

Model Year	Horsepower Category	NOx+NMHC	CO	PM
2005 – 2008 (Tier 2)	hp < 11 (kW < 8)	7.5	8.0	0.8
	11 ≤ hp < 25 (8 ≤ kW < 19)	7.5	6.6	0.8
2008+ (Tier 4)	hp < 11 (kW < 8)	7.5	8.0	0.4
	11 ≤ hp < 25 (8 ≤ kW < 19)	7.5	6.6	0.4

In estimating the emission rates of diesel-fueled APSs, staff analyzed the 2005 emission certification test data of off-road diesel engines used in APSs (engines with power ratings between 5 to 19 kW). The gram per hour emission rates were estimated from the average of the certification test data (in grams per kW-hour) assuming that the APS provides an average power of 2.7 kW. The average of the certification data and the gram per hour emission rates are shown in Table 5. The certification test data does not include CO_2 emissions. Therefore, in calculating the CO_2 emission reductions, staff used CO_2 emission rates from an APS test data report published by U.S. EPA. (Lim, 2002).

Table 5: Diesel Fueled APS Emission Rates

	Number of Engines	NMHC+NOx	CO	PM	CO_2
Average of Certification Test Data (grams/kW-hour)	68	5.6	2.3	0.32	---
APS Emission Rate (grams/hour)		15.1[20]	6.2	0.87	2228

In addition to reducing emissions of criteria pollutants, the proposed regulation also reduces greenhouse gas (GHG) emissions, such as CO_2, methane (CH_4), and nitrous oxide (N_2O) emissions. CO_2 is by far the most prevalent GHG, and as such the major contributor to global warming. A major source of CO_2 emissions is human activity and in particular fossil fuel burning in the electric generation, industrial, and transportation sectors (see Figures 7 and 8) (Bemis, 2005). As discussed in Chapter II, truck idling consumes diesel fuel from 0.4 to 1.6 gallons per hour depending on engine speed and load. Therefore, reduced idling will result in reduced amount of fuel burned. Since CO_2 is the direct product of fuel burning, reducing fuel consumption also reduces CO_2 emissions.

Concerned about the impact on climate change, the state of California has set a target to reduce GHG emissions to 2000 levels by 2010, to 1990 levels by 2020, and to 80% below 1990 levels by 2050. The proposed regulation is estimated to reduce CO_2 emissions by nearly 1930 tpd (0.7 million tons per year) and 2280 tpd (0.8 million tons per year) statewide in 2010 and 2020, respectively. The resulting emission reductions for NOx, ROG, PM, and CO_2 for calendar years 2010 and 2020 for both statewide and the South Coast Air Basin are shown in Tables 6, 7, 8, and 9. The emission reductions assume full compliance with the proposed requirements.

[20] As discussed in Chapter IV, the proposed 30 gram per hour optional NOx idling emission standard was based on the average NOx emission level of 2005 certification test data of off-road diesel engines used in APSs (engine with power ratings between 5 to 19 kW). The difference between the 15.1 grams per hour NOx+NMHC emission rate of the APS (Table 5) and the 30 gram per hour optional NOx emission standard, discussed in Chapter IV, is a result of calculating the optional NOx emission standard based on the assumption that the APS provides the peak power of 5 kW, while the APS NOx+NMHC emission rate in Table 5 assumes that the APS provides an average power of 2.7 kW.

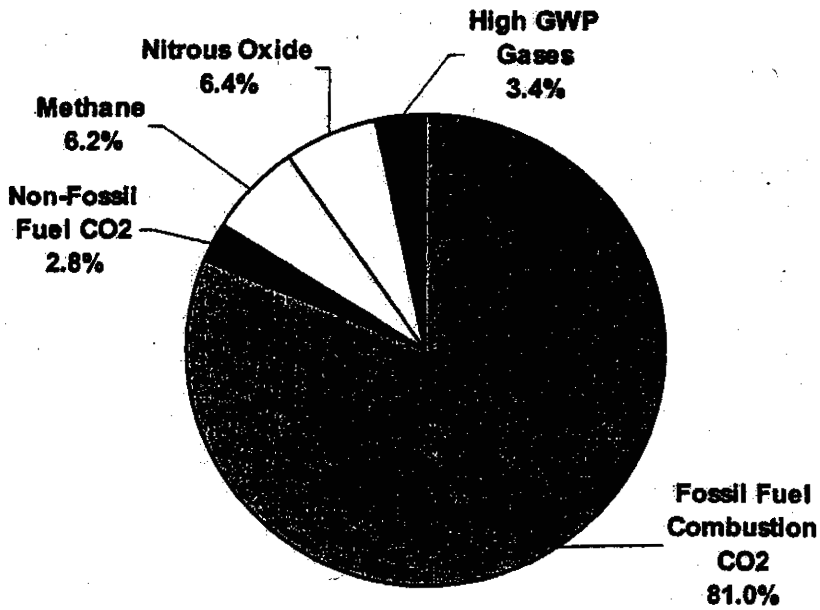

Figure 7. California GHG emissions by Type of Gas in 2003 (Bemis, 2005).

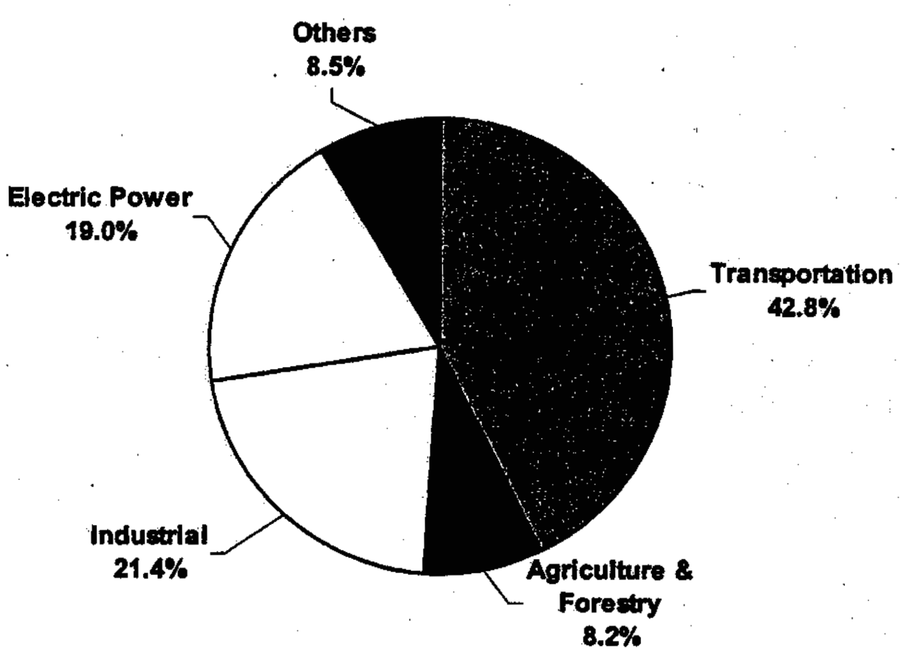

Figure 8. Sources of California's 2003 GHG Emissions (by End-Use Sector) (Bemis, 2005).

Table 6: 2010 Estimated Statewide Idling Emission Benefits Sleeper Trucks Only

	Vehicles	NOx	ROG	PM	CO2
Baseline Emissions (tpd)	**Calendar Year 2010**				
CA Registered Sleeper Trucks	30,161	20	2.1	0.39	1200
Out-of-State Sleeper Trucks	45,241	33	2.5	0.34	1800
Total Baseline	75,402	53	4.6	0.73	3000
Emission Reductions (tpd)	**Calendar Year 2010**				
CA Registered Sleeper Trucks	30,161	17	1.9	0.26	770
Out-of-State Sleeper Trucks	45,241	29	2.2	0.16	1160
Total Reductions	75,402	46	4.2	0.42	1930

Table 7: 2020 Estimated Statewide Idling Emission Benefits Sleeper Trucks Only

	Vehicles	NOx	ROG	PM	CO2
Baseline Emissions (tpd)	**Calendar Year 2020**				
CA Registered Sleeper Trucks	35,652	26	2.0	0.16	1420
Out-of-State Sleeper Trucks	53,478	39	2.8	0.08	2130
Total Baseline	89,130	65	4.8	0.24	3550
Emission Reductions (tpd)	**Calendar Year 2020**				
CA Registered Sleeper Trucks	35,652	22	1.8	0.08	910
Out-of-State Sleeper Trucks	53,478	34	2.6	0.02	1370
Total Reductions	89,130	56	4.4	0.10	2280

Table 8: 2010 Estimated South Coast Air Basin Idling Emission Benefits Sleeper Trucks Only

	Vehicles	NOx	ROG	PM	CO2
Baseline Emissions (tpd)	**Calendar Year 2010**				
CA Registered Sleeper Trucks	11,631	8	0.8	0.14	460
Out-of-State Sleeper Trucks	17,447	13	0.9	0.12	690
Total Baseline	29,078	21	1.7	0.26	1150
Emission Reductions (tpd)	**Calendar Year 2010**				
CA Registered Sleeper Trucks	11,631	7	0.7	0.09	300
Out-of-State Sleeper Trucks	17,447	11	0.9	0.06	440
Total Reductions	29,078	18	1.6	0.15	740

Table 9: 2020 Estimated South Coast Air Basin Idling Emission Benefits Sleeper Trucks Only

	Vehicles	NOx	ROG	PM	CO2
Baseline Emissions (tpd)	**Calendar Year 2020**				
CA Registered Sleeper Trucks	13,988	10	0.8	0.06	560
Out-of-State Sleeper Trucks	20,981	15	1.1	0.03	830
Total Baseline	34,969	26	1.9	0.08	1390
Emission Reductions (tpd)	**Calendar Year 2020**				
CA Registered Sleeper Trucks	13,988	9	0.7	0.03	360
Out-of-State Sleeper Trucks	20,981	13	1.0	0.01	520
Total Reductions	34,969	22	1.7	0.04	880

B. COST-EFFECTIVENESS

Staff's proposal is expected to provide a cost savings to truck owners over the useful life of the truck by reducing fuel consumption and truck's maintenance requirements. For example, as previously shown in Table 2, a truck that idles an average of approximately six hours per day and uses a diesel-fueled APS as an alternative to main engine idling would save approximately $4,300 per year. With such savings, the cost of the APS would be recovered within 1 to 2.5 years. Therefore, the cost-effectiveness of the proposed rule is in reality zero because it is a cost savings. However, staff estimated the cost-effectiveness of the proposal without considering the associated savings in order to see how it compares with cost-effectiveness estimates of other regulations adopted by the ARB.

The proposed rule would require new 2008 and subsequent model year California certified diesel engines to be equipped with a non-programmable engine shutdown system. Pre-2008 trucks would be required to comply with the proposed rule by manually turning the engine off. The staff's proposal does not include any retrofit requirement for these engines. Therefore, the cost of compliance with the proposed requirements should only be the cost incurred to comply with the engine shutdown requirements applicable to only 2008 and later diesel engines. However, although it is not required by the proposed regulation, staff expects that in practice, operators and owners of sleeper trucks of any model year will likely need an alternative cab comfort technology as a substitute to main engine idling. Thus, for new 2008 and subsequent model year sleeper trucks, the costs of complying with the proposed requirements would include costs associated with the engine shutdown system and costs associated with the alternative cab comfort technology/strategy used to replace main engine idling. For existing pre-2008 model year sleeper trucks and out-of-state trucks that frequently operate in California, the costs of complying with the proposed requirements would include costs associated with the retrofit of an alternative cab comfort technology/strategy used to replace main engine idling.

It is difficult at this time to assess to what extent each alternative cab comfort technology will be used when the proposed regulation takes effect. Staff has therefore estimated the cost-effectiveness of the proposed regulation based on the highest cost that a truck operator may incur to comply with the proposed regulation. Thus, our cost-effectiveness calculation for the proposed regulation assumes that a 2008 and subsequent model year California truck would have an engine shutdown system and uses, as an alternative to idling, a diesel-fueled APS equipped with a level 3 verified PM control strategy. A 2007 model year California truck or a 2007 and later model year out-of-state truck is also assumed to use, as an alternative to idling, a diesel fueled APS with a level 3 verified PM control strategy. A pre-2007 California or pre-2007 out-of-state truck is assumed to use a diesel-fueled APS with no aftertreatment. The calculation furthermore assumes the cost of a diesel-fueled APS with aftertreatment to be $10,000, and that of an engine shutdown system to be $100. The cost of a commercially available diesel-fueled APS with no aftertreatment varies from $5,000 to

$8,000. Thus, staff assumed an average cost of $6,500 for an APS with no aftertreatment. The lifetime of the APS is assumed to be 10 years.

As shown in Table 10, the cost-effectiveness of the proposed regulations is $2.00 per pound of NOx plus ROG reduced, for a new 2008 model year California truck; $1.98 per pound of NOx plus ROG reduced, for a 2007 model year California truck or a 2007 model year or newer out-of-state truck; and $1.44 for a pre 2007 California or out-of-state truck.

Table 10: Cost-Effectiveness in Dollars per Pound of NOx+ROG Reduced

		Sleeper Trucks		
		2008 CA Only	2007 CA and Non-CA	Pre 2007 CA and Non-CA
Fleet Average Idle Emission Factor (grams/hour)	NOx	115.3	115.3	99.6
	ROG	8.3	8.3	12.2
Lifetime Truck Emissions (10 years) (pounds per truck)	NOx+ROG	5758	5758	5210
APS Emission Rates (grams/hour)	NOx+ROG	15.1	15.1	15.1
Lifetime APS Emissions (pounds)	NOx+ROG	702	702	702
Lifetime Emission Reduction	NOx+ROG	5056	5056	4507
Cost Of Technology				
APS		$10,000	$10,000	$6,500[a]
Engine Shutdown		100	0	0
APS + Engine Shutdown		$10,100	$10,000	$6,500
Cost-Effectiveness ($ per pound of NOx+ROG)		**$2.00**	**$1.98**	**$1.44**
Fleet Distribution CY 2008		4%	7%	89%
Fleet Average Cost-effectiveness ($ per pound of NOx+ROG)		**1.51**		

The fleet average cost-effectiveness is difficult to estimate as it is difficult to predict the fraction of the fleet that will install cab comfort devices to substitute for main engine idling. In particular, it is more difficult to assess or predict the fraction of out-of-state trucks that will install a cab comfort device. Depending on how often out-of-state sleeper trucks frequent California and require an extended stay, a business decision on the part of the truck fleet or owner/operator would be made whether to have cab comfort devices installed. However, for the purposes of this analysis, staff assumed the "worst", that all out-of-state sleepers entering California would have cab comfort devices installed. Therefore, staff estimated the fleet average cost-effectiveness assuming that all California sleeper trucks and all out-of-state sleeper trucks entering California will be retrofitted with a diesel-fueled APS. Based on these assumptions, the fleet average cost-effectiveness is estimated to be $1.51 per pound of NOx plus ROG reduced, which compares favorably with recently adopted ARB emission reduction regulations.

X. CONCLUSIONS AND RECOMMENDATION

The proposed idle reduction requirements are necessary to achieve emission reductions needed to meet clean air goals as specified in the 2003 SIP. The proposed requirements can be met using existing, commercially available technologies. Such technologies would significantly reduce the idling time of sleeper trucks and result in a substantial reduction in emissions of NOx, ROG, PM, and CO2. The proposed requirements will result in a cost savings to the trucking industry and are therefore clearly cost-effective. But for comparative purposes (i.e., without accounting for the savings associated with reduced fuel consumption and maintenance costs), the cost-effectiveness of the proposed regulation compares favorably with other mobile source and fuels regulations adopted by the Board. In addition to reducing greenhouse gas emissions, it will also help reduce the state's dependency on foreign oil and is also consistent with the Board's policy regarding Environmental Justice. The staff therefore recommends that the Board adopt the proposed truck idling emission reduction requirements for on-road heavy-duty diesel engines/trucks.

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APPENDIX A

PROPOSED REGULATION ORDER

Amend the following sections of Title 13, California Code of Regulations, to read as set forth in the following pages:

§ 1956.8	Exhaust Emission Standards and Test Procedures for 1985 and Subsequent Model Year Heavy-Duty Engines and Vehicles
§ 2404	Emission Control Labels and Consumer Information – 1995 and Later Small Off-Road Engines
§ 2424	Emission Control Labels – 1996 and Later Off-Road Compression-Ignition Engines
§ 2425	Defects Warranty Requirements for 1996 and Later Off-Road Compression-Ignition Engines
§ 2485	Airborne Toxic Control Measure to Limit Diesel-Fueled Commercial Motor Vehicle Idling

Notes:

a) Paragraphs within the section that are not proposed for amendment in this rulemaking are indicated by "[No Change.]".

b) The proposed regulatory amendments are shown in underline to indicate additions to the text and ~~strikeout~~ to indicate deletions.

Amend Title 13, California Code of Regulations, § 1956.8, to read:

§ 1956.8. Exhaust Emissions Standards and Test Procedures - 1985 and Subsequent Model Heavy-Duty Engines and Vehicles.

(a)(1) [No Change.]

(a)(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 Engines (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 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.

(a)(2)(B) through (5) [No Change.]

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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.

(a)(6) Heavy-Duty Diesel Engine Idling Requirements.

(A) Engine Shutdown System. The requirements in this subsection apply to engine manufacturers and original equipment manufacturers, as applicable, that are responsible for the design and control of engine and/or vehicle idle controls.

(i) Requirements: Except as provided in subsections (a)(6)(B) and (a)(6)(C), all new 2008 and subsequent model-year heavy-duty diesel engines shall be equipped with an engine shutdown system that automatically shuts down the engine after 300 seconds of continuous idling operation once the vehicle is stopped, the transmission is set to "neutral" or "park", and the parking brake is engaged. If the parking brake is not engaged, then the engine shutdown system shall shut down the engine after 900 seconds of continuous idling operation once the vehicle is stopped and the transmission is set to "neutral" or "park." The engine shutdown system must be tamper-resistant and non-programmable. A warning signal, such as a light or sound indicator inside the vehicle cabin, may be used to alert the driver 30 seconds prior to engine shutdown. The engine shutdown system must be capable of allowing the driver to reset the engine shutdown system timer by momentarily changing the position of the accelerator, brake, or clutch pedal, or other mechanism within 30 seconds prior to engine shutdown. Once reset, the engine shutdown system shall restart the engine shutdown sequence described in this paragraph above, and shall continue to do so until the engine shuts down or the vehicle is driven.

(ii) Engine Shutdown System Override: The engine shutdown system may be overridden, to allow the engine to run continuously at idle, only under the following conditions:

(I) If the engine is operating in power take-off (PTO) mode. The PTO system shall have a switch or a setting that can be switched "on" to override the engine shutdown system and will reset to the "off" position when the vehicle's engine is turned off or when the PTO equipment is turned off. In addition, the PTO switch or setting shall be designed so that if it fails it will fail in the "off" position. Subject to advance Executive Officer approval, other methods for detecting or activating PTO operation may be allowed; or,

(II) if the vehicle's engine coolant temperature is below 60°F. The engine shutdown system shall automatically be activated once the coolant temperature reaches 60°F or above. The engine coolant temperature shall be measured with the engine's existing engine coolant temperature sensor used for engine protection, if so equipped. Other methods of measuring engine coolant temperature may be allowed, subject to advance Executive Officer approval.

(B) Exempt Vehicles. Heavy-duty diesel engines to be used in buses as defined in California Vehicle Code §§ 233, 612 and 642, school buses as defined in California Vehicle Code § 545, and recreational vehicles as defined in Health and Safety Code 18010 are exempted from these requirements.

(C) Optional NOx idling emission standard. In lieu of the engine shutdown system requirements specified in subsection (a)(6)(A) above, an engine manufacturer may elect to certify its new 2008 and subsequent model-year heavy-duty diesel engines to an optional NOx idling emission standard of 30 grams per hour, without increasing emissions of CO, PM, or ROG. Compliance with this optional standard will be determined based on testing conducted pursuant to the supplemental steady-state test cycle and procedures specified in section 86.1360-2007.B.4 of the "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles", adopted December 12, 2002, as last amended **(amendment date)**, which is incorporated by reference herein. The manufacturer may request an alternative test procedure if the technology used cannot be demonstrated using the procedures in section 86.1360-2007.B.4, subject to advance approval of the Executive Officer.

An engine manufacturer certifying its engine to the optional NOx idling emission standard must also produce a vehicle label, as defined in subsection 35.B.4 of the "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles" adopted December 12, 2002, as last amended **(amendment date)**, which is incorporated by

(D) Optional Alternatives to Main Engine Idling. All new 2008 and subsequent model year heavy duty diesel engines may also be equipped with idling emission reduction devices that comply with the compliance requirements specified in title 13, CCR section 2485(c)(3).

(b) through (h) [No Change.]

NOTE: Authority cited: Sections 39600, 39601, 43013, 43018, 43101, 43102, 43104 and 43105, Health and Safety Code; Sections 27156, 38390, 38391 and 38395, Vehicle Code. Reference: Sections 39002, 39003, 39500, 43000, 43013, 43017, 43018, 43100, 43101, 43101.5, 43102, 43104, 43106, 43150-43154, 43202, 43204, 43205.5, 43206, 43210, 43211, 43212 and 43213, Health and Safety Code.

Amend Title 13, California Code of Regulations, § 2404, to read:

§ 2404. Emission Control Labels and Consumer Information – 1995 and Later Small Off-Road Engines.

(a) *Purpose.* The Air Resources Board recognizes that certain emissions-critical or emissions-related parts must be properly identified and maintained in order for engines to meet the applicable emission standards. In addition, the Board recognizes that information regarding engines' emissions levels may influence consumer choice. These specifications require engine or equipment manufacturers to affix a label (or labels) on each production engine (or equipment, as applicable) to provide the engine or equipment owner and service mechanic with information necessary for the proper maintenance of these parts in customer use. These specifications further require engine or equipment manufacturers to make information regarding relative emissions levels available to potential ultimate purchasers. For engines used in auxiliary power systems which, in turn, are used to comply with the diesel-fueled commercial vehicle idling requirements of title 13, CCR, section 2485(c)(3)(A), additional labeling requirements for the engine or equipment manufacturers apply, as set forth in section 35.B.4 of the "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles" adopted December 12, 2002, as last amended **(amendment date)**, which is incorporated by reference herein.

(b) through (k) [No Change.]

NOTE: Authority cited: Sections 39600, 39601, 43013, 43018, 43101, 43102 and 43104, Health and Safety Code. Reference: Sections 43013, 43017, 43018, 43101, 43102, 43104, 43150-43154, 43205.5 and 43210-43212, Health and Safety Code.

Amend Title 13, California Code of Regulations, § 2424, to read:

§ 2424. Emission Control Labels — 1996 and Later Off-Road Compression-Ignition Engines.

(a) *Purpose.* The Air Resources Board recognizes that certain emissions-critical or emissions-related parts must be properly identified and maintained in order for engines to meet the applicable emission standards. The purpose of these specifications is to require engine manufacturers to affix a label (or labels) on each production engine (or equipment) to provide the engine or equipment owner and service mechanic with information necessary for the proper maintenance of these parts in customer use. For engines used in auxiliary power systems which, in turn, are used to comply with the diesel-fueled commercial vehicle idling requirements of title 13, CCR, section 2485(c)(3)(A), additional labeling requirements for the engine or equipment manufacturers apply, as set forth in section 35.B.4 of the "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles" adopted December 12, 2002, as last amended **(amendment date)**, which is incorporated by reference herein.

(b) through (k) [No Change.]

NOTE: Authority cited: Sections 39600, 39601, 43013, 43018, 43101, 43102 and 43104, Health and Safety Code. Reference: Sections 43013, 43017, 43018, 43101, 43102, 43104 and 43105, Health and Safety Code.

Amend Title 13, California Code of Regulations, § 2425, to read:

§ 2425. Defects Warranty Requirements for 1996 and Later Off-Road Compression-Ignition Engines.

(a) through (d) [No Change.]

(e) Each manufacturer shall furnish with each new engine written instructions for the maintenance and use of the engine by the owner. The instructions shall be consistent with this article and applicable regulations contained herein. <u>In addition, for engines less than 19 kilowatts, each manufacturer shall furnish with each new engine a written statement as follows: "In order to operate in California, a diesel-fueled engine in an auxiliary power system used to comply with the Airborne Toxic Control Measure to Limit Diesel-Fueled Commercial Motor Vehicle Idling requirements of the California Code of Regulations, must have one of the following apply: (1) be equipped with a verified Level 3 in-use strategy for particulate matter control, (2) have its exhaust routed directly into the vehicle's exhaust pipe, upstream of the diesel particulate matter aftertreatment device, or (3) use an alternate particulate matter control strategy with prior Executive Officer approval. (For more details, please see the California Code of Regulations, title 13, CCR, section 2485(c)(3)(A).)"</u>

(f) through (g) [No Change.]

NOTE: Authority cited: Sections 39600, 39601, 43013, 43018, 43101, 43102, 43104 and 43105, Health and Safety Code. Reference: Sections 43013, 43017, 43018, 43101, 43102 and 43205.5, Health and Safety Code.

Amend Title 13, California Code of Regulations, § 2485, to read:

§ 2485. Airborne Toxic Control Measure to Limit Diesel-Fueled Commercial Motor Vehicle Idling.

(a) **Purpose.** The purpose of this airborne toxic control measure is to reduce public exposure to diesel particulate matter and other air contaminants by limiting the idling of diesel-fueled commercial motor vehicles.

(b) **Applicability.** This section applies to diesel-fueled commercial motor vehicles that operate in the State of California with gross vehicular weight ratings of greater than 10,000 pounds that are or must be licensed for operation on highways. This specifically includes:

(1) California-based vehicles; and

(2) Non-California-based vehicles.

(c) **Requirements.**

(1) Idling Restriction

On or after February 1, 2005, the driver of any vehicle subject to this section shall comply with the following requirements, except as noted in subsection (d) below:

(~~1~~A) the driver shall not idle the vehicle's primary diesel engine for greater than 5.0 minutes at any location.~~, except as noted in subsection (d); and~~

(~~2~~B) the driver shall not operate a diesel-fueled auxiliary power system (APS) to power a heater, air conditioner, or any ancillary equipment on that vehicle during sleeping or resting in a sleeper berth for greater than 5.0 minutes at any location when within 100 feet of a restricted area.~~, except as noted in Subsection (d).~~

(2) Use of Alternative Technologies

(A) On or after January 1, 2008, the driver shall not operate an internal combustion APS on any vehicle equipped with a 2007 and subsequent model year primary diesel engine unless the vehicle is:

(1) equipped with an APS meeting the emissions performance requirements found in subsection (c)(3)(A), below; and

(2) the vehicle is equipped with a label meeting the requirements pursuant to section 35.B.4 of the "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles" adopted December 12, 2002, as last amended (**amendment date**) which is incorporate by reference herein.

(B) On or after January 1, 2008, the driver shall not operate a fuel-fired heater on any vehicle equipped with a 2007 and subsequent model year primary diesel engine unless the fuel-fired heater meets the emissions performance requirements found in subsection (c)(3)(B), below;

(C) On or after January 1, 2008, the driver of a vehicle equipped with a 2006 or older model year primary diesel engine may use and operate in California any certified internal combustion APS with or without the additional PM control specified in subsection (c)(3)(A)(1) or any other certified alternative idling reduction technology.

(3) Compliance Requirements. As an alternative to idling the primary engine, diesel engines/vehicles may, as an option, be equipped with alternative technologies, as listed and defined below in (A), (B), and (C) of this subsection. If so equipped, these technologies are subject to the following requirements:

(A) Internal Combustion APS.

(1) In order to operate in California, an APS utilizing an internal combustion engine must comply with applicable California off-road and/or federal non-road emission standards and test procedures for its fuel type and power category. In addition, diesel-fueled APSs installed on vehicles equipped with primary engines certified to the 2007 and subsequent model year heavy-duty diesel engine standards, pursuant to section 1956.8(a)(2)(A) of title 13, CCR, shall either,

(i) be equipped with a verified Level 3 in-use strategy for particulate matter control (see title 13, CCR, sections 2700 to 2710), or

(ii) have its exhaust routed directly into the vehicle's exhaust pipe, upstream of the diesel particulate matter aftertreatment device.

(2) With advance Executive Officer approval, a certifying/verifying APS manufacturer may petition for an alternate compliance strategy

other than described in (A)(1)(i) or (ii) in this subsection above. However, this provision is limited to manufacturers that can demonstrate, to the satisfaction of the Executive Officer, that their alternative strategy is equivalent (or "cleaner"), from an emissions standpoint, compared to the requirement described in (A)(1)(i) or (ii) in this subsection above. As an example, strategies that can use the available electric power infrastructure, instead of solely operating a diesel-fueled APS for engine and/or cab heating and cooling, may be able to use such a strategy to demonstrate compliance with these requirements.

(B) Fuel-Fired Heaters. Fuel-fired heaters must comply with the applicable California emission standards and test procedures as specified in the Low Emission Vehicle program requirements found in title 13, CCR, subsections 1961(a)(15) and (d), or in Part I.E.1.13 of the "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles" adopted August 5, 1999, as last amended May 28, 2004. However, the specified requirement that limits fuel-fired heaters from being operated above 40°F does not apply.

(C) Other Idle Reduction Technologies. Other technologies that will reduce idling emissions may also be used, including the use of batteries, fuel cells, power inverter/chargers for on-shore electrical power, and other technologies that produce minimal or no emissions. The use of other technologies are subject to advance Executive Officer approval and must be at least as effective in reducing idling emissions as the technologies described in subsections (c)(3)(A), above, or the NOx idling emission standard specified in title 13, CCR, section 1956.8(a)(6)(C). The Executive Officer shall use good engineering judgment and test data to determine if an idle reduction technology provides idling emission controls equivalent to the standards specified in subsection (c)(3)(A) above, or in title 13, CCR, subsection 1956.8(a)(6)(C).

(D) Labeling Requirements. 2007 and subsequent model year commercial diesel vehicles equipped with an internal combustion APS meeting the requirements specified in subsection (c)(3)(A) shall have a label affixed to the hood of the vehicle to allow operation of the APS in California. The labels shall meet the requirements specified in section 35.B.4 of the "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles" adopted December 12, 2002, as last amended **(amendment date)**, which is incorporated by reference herein.

(d) **Exceptions.**

(1) Except when a vehicle is located within 100 feet of a restricted area, subsection (c)(1)(A) does not apply, if the vehicle is equipped with

(A) a primary diesel engine meeting the optional NOx idling emission standard pursuant to title 13, CCR, section 1956.8(a)(6)(C); and

(B) a label meeting the requirements pursuant to section 35.B.4 of the "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles" adopted December 12, 2002, as last amended **(amendment date)**, which is incorporated by reference herein.

(2) Subsection (c)(1) does not apply for the period or periods during which

(~~1~~A) a bus is idling for
(~~A~~1) up to 10.0 minutes prior to passenger boarding, or
(~~B~~2) when passengers are onboard;

(~~2~~B) prior to January 1, 2008, idling of the primary diesel engine is necessary to power a heater, air conditioner, or any ancillary equipment during sleeping or resting in a sleeper berth. This provision does not apply when operating within 100 feet of a restricted area;

(~~3~~C) idling when the vehicle must remain motionless due to traffic conditions, an official traffic control device, or an official traffic control signal over which the driver has no control, or at the direction of a peace officer, or operating a diesel-fueled APS or other device at the direction of a peace officer;

(4D) idling when the vehicle is queuing that at all times is beyond 100 feet from any restricted area;

(~~5~~E) idling of the primary diesel engine, ~~or~~ operating a diesel-fueled APS, or operating other devices when forced to remain motionless due to immediate adverse weather conditions affecting the safe operation of the vehicle or due to mechanical difficulties over which the driver has no control;

(~~6~~F) idling to verify that the vehicle is in safe operating condition as required by law and that all equipment is in good working order, either as part of a daily vehicle inspection or as otherwise needed, provided that such engine idling is mandatory for such verification;

(~~7~~G) idling of the primary diesel engine, ~~or~~ operating a diesel-fueled APS, or operating other devices is mandatory for testing, servicing, repairing, or diagnostic purposes;

(~~8~~H) idling~~,~~ when positioning or providing a power source for equipment or operations, other than transporting passengers or propulsion, which involve a power take off or equivalent mechanism and is powered by the primary engine for:

(~~A~~1) controlling cargo temperature, operating a lift, crane, pump, drill, hoist, mixer (such as a ready mix concrete truck), or other auxiliary equipment;
(~~B~~2) providing mechanical extension to perform work functions for which the vehicle was designed and where substitute alternate means to idling are not reasonably available; or
(~~C~~3) collection of solid waste or recyclable material by an entity authorized by contract, license, or permit by a school or local government;

(~~9~~I) idling of the primary diesel engine, ~~or~~ operating a diesel-fueled APS, or operating other devices when operating defrosters, heaters, air conditioners, or other equipment solely to prevent a safety or health emergency;

(~~10~~J) idling of the primary diesel engine, ~~or~~ operating a diesel-fueled APS, or operating other devices by authorized emergency vehicles while in the course of providing services for which the vehicle is designed;

(~~11~~K) idling of military tactical vehicles during periods of training; and

~~(12~~L) idling when operating equipment such as a wheelchair or people assist lift as prescribed by the Americans with Disabilities Act;

(e) **Relationship to Other Law.**

Nothing in this section allows idling in violation of other applicable law, including, but not limited to:

(1) California Vehicle Code Section 22515;

(2) Title 13, Section 2480, California Code of Regulations;

(3) California Health and Safety Code Section 40720; or

(4) any applicable ordinance, rule, or requirement as stringent as, or more stringent than, this section.

(f) **Enforcement.** This section may be enforced by the Air Resources Board; peace officers as defined in California Penal Code, title 3, chapter 4.5, Sections 830 et seq. and their respective law enforcement agencies' authorized representatives; and air pollution control or air quality management districts.

(g) **Penalties.** For violations of subsection (c)(1), (c)(2) or (c)(~~2~~3), the driver of a subject vehicle is subject to a minimum civil penalty of 100 dollars and to criminal penalties as specified in the Health and Safety Code and the Vehicle Code.

(h) **Definitions.**

The following definitions apply to this section:

(1) "Authorized emergency vehicle" is as defined in Vehicle Code Section 165.

(2) "Auxiliary power system" or "APS" means any device that provides electrical, mechanical, or thermal energy to the primary diesel engine, truck cab, or sleeper berth as an alternative to idling the primary diesel engine.

(3) "Bus" means any vehicle defined in Title 13, California Code of Regulations, Section 2480, subsections (h) (13)-(16), inclusive or as defined in the Vehicle Code Section 233.

(4) "Commercial Motor Vehicle" means any vehicle or combination of vehicles defined in Vehicle Code Section 15210(b) and any other motor truck or bus with a gross vehicle weight rating of 10,001 pounds or more, except the following:
(A) a zero emission vehicle; or
(B) a pickup truck as defined in Vehicle Code Section 471.

(5) "Driver" is as defined in Vehicle Code Section 305.

(6) "Fuel-fired heater" means a fuel burning device that creates heat for the purpose of (1) warming the cab or sleeper berth compartment of a vehicle or (2) warming the engine oil and/or coolant for easy start-up of the vehicle's engine but does not contribute to the propulsion of the vehicle.

(~~6~~7) "Gross vehicle weight rating" is as defined in Vehicle Code Section 350.

(~~7~~8) "Highway" is as defined in Vehicle Code Section 360.

(~~8~~9) "Idling" means the vehicle engine is running at any location while the vehicle is stationary.

(~~9~~10) "Motor truck" or "motortruck" means a motor vehicle designed, used, or maintained primarily for the transportation of property.

(~~10~~11) "Official traffic control device" is as defined in Vehicle Code Section 440.

(~~11~~12) "Official traffic control signal" is as defined in Vehicle Code Section 445.

(~~12~~13) "Owner" is as defined in Vehicle Code Section 460.

(~~13~~14) "Primary diesel engine" means the diesel-fueled engine used for vehicle propulsion.

(~~14~~15) "Queuing" means (A) through (C)

- (A) the intermittent starting and stopping of a vehicle;
- (B) while the driver, in the normal course of doing business, is waiting to perform work or a service; and
- (C) when shutting the vehicle engine off would impede the progress of the queue and is not practicable.
- (D) Queuing does not include the time a driver may wait motionless in line in anticipation of the start of a workday or opening of a location where work or a service will be performed.

(~~15~~16) "Restricted area" means any real property zoned for individual or multifamily housing units that has one or more of such units on it.

(~~16~~17) "Safety or health emergency" means:

- (A) a sudden, urgent, or usually unforeseen, occurrence; or
- (B) a foreseeable occurrence relative to a medical or physiological condition.

(~~17~~18) "Sleeper berth" is as defined in Title 13, California Code of Regulations, Section 1265.

(~~18~~19) "Vehicle" is as defined in the Vehicle Code Section 670.

Authority: Sections 39600, 39601, 39614(b)(6)(A), 39658, 39667, 43000.5(d), 43013(b), 43013(h), 43018(b), and 43018(c), Health and Safety Code; and Western Oil & Gas Assn. v. Orange County Air Pollution Control Dist. (1975) [14 Cal.3d.411].

Reference: Sections 39002, 39003, 39027, 39500, 39600, 39650, 39655, 39656, 39657, 39658, 39659, 39662, 39665, 39674, 39675, 42400, 42400.1, 42400.2, 42400.3, 42402, 42402.1, 42402.2, 42402.3, 42403.5, 42410, 43013, 43018, Health and Safety Code; Sections 305, 336, 350, 440, 445, 545, 546, 642, 680, 21400, 22452, 22515, 27153, 40001, 40001(b)(5), Vehicle Code; and Sections 1201,1900, 1962, 2480, Title13, California Code of Regulations.

APPENDIX B

PROPOSED AMENDMENTS TO THE CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 2004 AND SUBSEQUENT MODEL HEAVY-DUTY DIESEL ENGINES AND VEHICLES

State of California
AIR RESOURCES BOARD

CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 2004 AND SUBSEQUENT MODEL HEAVY-DUTY DIESEL ENGINES AND VEHICLES

Adopted: December 12, 2002
Amended: [Insert date of amendment]

NOTE: The proposed amendments are indicated by underline for additions and ~~strikeout~~ for deletions compared to the adopted test procedures. Only those portions of the existing language containing the proposed modifications are included. All other portions remain unchanged and are indicated by the symbol "* * * * *" for reference. A complete set of the adopted test procedures (without the proposed amendments) is available at http://www.arb.ca.gov/regact/levhdg02/levhdg02.htm .

CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 2004 AND SUBSEQUENT MODEL HEAVY-DUTY DIESEL ENGINES AND VEHICLES

The following provisions of Subparts A, I, and N, Part 86, Title 40, Code of Federal Regulations, as adopted or amended by the U.S. Environmental Protection Agency on the date set forth next to the 40 CFR Part 86 section listed below, and only to the extent they pertain to the testing and compliance of exhaust emissions from heavy-duty diesel engines and vehicles, are adopted and incorporated herein by this reference as the "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles," except as altered or replaced by the provisions set forth below.

Part I. GENERAL PROVISIONS FOR CERTIFICATION AND IN-USE VERIFICATION OF EMISSIONS.

Subpart A - General Provisions for Emission Regulations for 1977 and Later Model Year New Light-Duty Vehicles, Light-Duty Trucks, and Heavy-Duty Engines, and for 1985 and Later Model Year New Gasoline-Fueled, Natural Gas-Fueled, Liquefied Petroleum Gas-Fueled and Methanol-Fueled Heavy-Duty Vehicles.

1. General Applicability. [86.xxx-1]

* * * * *

11. Emission standards for diesel heavy-duty engines and vehicles. [§86.xxx-11]

A. **Federal provisions.**

* * * * *

B. **California provisions.**

1. **Urban Bus Standards.**

* * * * *

<u>6. **Heavy-Duty Diesel Engine Idling Requirements.**</u>

<u>6.1 **Engine Shutdown System.** The requirements in this subsection apply to engine manufacturers and original equipment manufacturers, as applicable, that are responsible for the design and control of engine and/or vehicle idle controls.</u>

<u>6.1.1 **Requirements.** Except as provided in subsections 11.B.6.2 and 3, all new 2008 and subsequent model-year heavy-duty diesel</u>

engines shall be equipped with an engine shutdown system that automatically shuts down the engine after 300 seconds of continuous idling operation once the vehicle is stopped, the transmission is set to "neutral" or "park", and the parking brake is engaged. If the parking brake is not engaged, then the engine shutdown system shall shut down the engine after 900 seconds of continuous idling operation once the vehicle is stopped and the transmission is set to "neutral" or "park." The engine shutdown system must be tamper-resistant and non-programmable. A warning signal, such as a light or sound indicator inside the vehicle cabin, may be used to alert the driver 30 seconds prior to engine shutdown. The engine shutdown system must be capable of allowing the driver to reset the engine shutdown system timer by momentarily changing the position of the accelerator, brake, or clutch pedal, or other mechanism within 30 seconds prior to engine shutdown. Once reset, the engine shutdown system shall restart the engine shutdown sequence described in this paragraph above, and shall continue to do so until the engine shuts down or the vehicle is driven.

6.1.2 **Engine Shutdown System Override**. The engine shutdown system may be overridden, to allow the engine to run continuously at idle, only under the following conditions:

(1) If the engine is operating in power take-off (PTO) mode. The PTO system shall have a switch or a setting that can be switched "on" to override the engine shutdown system and will reset to the "off" position when the vehicle's engine is turned off or when the PTO equipment is turned off. In addition, the PTO switch or setting shall be designed so that if it fails it will fail in the "off" position. Subject to advance Executive Officer approval, other methods for detecting or activating PTO operation may be allowed; or,

(2) If the vehicle's engine coolant temperature is below 60°F. The engine shutdown system shall automatically be activated once the coolant temperature reaches 60°F or above. The engine coolant temperature shall be measured with the engine's existing engine coolant temperature sensor used for engine protection, if so equipped. Other methods of measuring engine coolant temperature may be allowed, subject to advance Executive Officer approval.

6.2 **Exempt Vehicles**. Heavy-duty diesel engines to be used in buses as defined in California Vehicle Code §§ 233, 612 and 642, school buses as defined in California Vehicle Code § 545, and recreational vehicles as defined in Health and Safety Code 18010 are exempted from these requirements.

6.3 **Optional NOx Idling Emission Standard**. In lieu of the engine shutdown system requirements specified in subsection 11.B.6.1 above, an engine manufacturer may elect to certify its new 2008 and subsequent model-year heavy-duty diesel engines to an optional NOx idling emission standard of 30 grams per hour, without increasing emissions of CO, PM, or ROG. Compliance with this optional standard will be determined based on testing conducted pursuant to the supplemental steady-state test cycle and procedures specified in section 86.1360-2007.B.4, below. The manufacturer may request an alternative test procedure if the technology used cannot be demonstrated using the procedures in section 86.1360-2007.B.4, subject to advance approval of the Executive Officer.

An engine manufacturer certifying its engine to the optional NOx idling emission standard must also produce a vehicle label, as defined in subsection 35.B.4, below.

(D) Optional Alternatives to Main Engine Idling. All new 2008 and subsequent model year heavy duty diesel engines may also be equipped with idling emission reduction devices that comply with the compliance requirements specified in title 13, CCR section 2485(c)(3).

* * * * *

12. Alternative certification procedures. [§86.080-12] April 17, 1980. [No change.]

* * * * *

21. Application for certification. [§86.xxx-21]

A. **Federal provisions.**

* * * * *

B. **California provisions**

1. For 2004 and subsequent model-year medium-duty ultra-low emission and super-ultra-low emission vehicles and engines not powered exclusively by diesel fuel, the manufacturer shall submit projected California sales and fuel economy data two years prior to certification.

2. **Heavy-Duty Diesel Engine Idling Requirements.**

2.1 For 2008 and subsequent model-year heavy-duty diesel engines, the manufacturer must provide a statement in the application for certification that the heavy-duty diesel engine for which certification is being requested will comply with the automatic engine shutdown requirements to control idle emissions as specified in subsection 11.B.6.1. If the heavy-duty diesel engine for which certification is being requested is explicitly designed for exempt vehicles, per the provisions in 11.B.6.2, then the manufacturer must also provide a statement in its application for certification so stating.

2.2 A manufacturer that elects to certify engines to the optional NOx idling emission standard, specified in subsection 11.B.6.3, must provide in the application for certification information pertaining to the NOx idling emission certification test conducted under 86.1360-2007.B.4, below, including emissions data for total particulate matter, non-methane hydrocarbons or total hydrocarbons, oxides of nitrogen, carbon monoxide, and carbon dioxide in grams per hour, the test load in brake-horsepower, and engine test speeds in revolutions per minute for both mode 1 and mode 2 testing. With advance Executive Officer approval, a manufacturer may use an alternative procedure to show compliance with the optional NOx idling emission standard. Regardless of the procedure used, the manufacturer shall also provide the appropriate labels to be affixed to the vehicle on which the engine is going to be installed as required in subsection 35.B.4. below. The manufacturer must maintain records at the manufacturer's facility that contain all test data, engineering analyses, and other information which provide the basis for the compliance statement, where such information exists. The manufacturer must provide such information to the Executive Officer within 30 days upon request.

2.3 If the heavy-duty diesel engine for which certification is being requested incorporates any of the alternative idle emission control strategies contained in title 13, CCR, section 2485(c)(3), then the manufacturer must provide in its application for certification a description of the alternative strategy or technology including the type, brand name, model identification number, and where applicable emissions data and power rating. In addition, the manufacturer must also provide the appropriate labels to be affixed to the outside of the vehicle as required in subsections 35.B.4. If the alternative technology is a fuel-fired heater, then the manufacturer must provide with the application for certification the information required under subsection H.4.4, Part I of the "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles", adopted August 5, 1999, as last amended May 28, 2004.

22. Approval of application for certification; test fleet selections; determinations of parameters subject to adjustment for certification and Selective Enforcement Audit, adequacy of limits, and physically adjustable ranges. [§86.001-22]
April 6, 1994. [No change.]

* * * * *

35. Labeling. [§86.xxx-35] ~~.~~

A. **Federal Provisions.**

1. **§86.001-35** January 18, 2001.

1.1 Add the following sentence to the introductory paragraph: The labeling requirements of this section shall apply to all new motor vehicle engines certified according to the provisions of California Health and Safety Code Section 43100.

1.2 Subparagraphs (a)(1) through (a)(3)(iii)(G). [No change.]

1.3 Amend ~~Add the following language to~~ subparagraph (a)(3)(iii)(H) as follows: ~~.~~

1.3.1 An unconditional statement of compliance with the appropriate model year California regulations; for example, "This engine conforms to California regulations applicable to XXXX model year new heavy-duty diesel engines." It may also state that the engine conforms to any applicable federal or Canadian emission standards for new heavy-duty diesel engines.

1.3.2~~1~~ For 2004 through 2006 model year heavy heavy-duty diesel-fueled, dual-fuel, and bi-fuel engines to be used in urban buses that are certified to the optional reduced emission standards and are sold to any transit agency exempted under paragraphs (c)(8) and (d)(7), title 13, CCR, §1956.2 from the requirements of paragraphs (c)(5) and (d)(4), title 13, CCR §956.2.

"This engine conforms to California regulations applicable to XXXX model year new urban bus or heavy-duty diesel engines and is certified to a NOx plus NMHC optional reduced-emission standards of XXX g/bhp-hr (for optional reduced-emission standards specify between 0.3 and 1.8, inclusive, at 0.3 b/bhp-hr increments, and a particulate matter standards of 0.01 g/bhp-hr)."

1.3.3~~2~~ For all other 2004 through 2006 model year heavy-duty diesel cycle engines, including those used in urban buses, that are certified to the optional reduced-emission standards, the label shall contain the following statement:

"This engine conforms to California regulations applicable to XXXX model year new (specify urban bus or heavy-duty diesel) engines and is certified to a NOx plus NMHC optional reduced-emission standards of XXX g/bhp-hr (for optional reduced-emission standards specify between 0.3 and 1.8, inclusive, at 0.3 b/bhp-hr increments, and a particulate matter standard of 0.03 g/bhp-hr, 0.02 g/bhp-hr, or 0.01 g/bhp-hr)."

1.4 Subparagraphs (a)(3)(I) through (i). [No change.]

2. **§86.007-35.** January 18, 2001.

2.1 Subparagraphs (a) through (i). [No change except that the amendments set forth in §86.001-35 apply.]

B. California provisions.

1. For 2004 and later model year heavy-duty diesel engines certified under the requirements of title 13, CCR, §1956.8(a)(3), the statement of compliance requirements of this subsection shall be repeated for each of the two fueling modes of operation. Appended to the statement for the lower emitting fueling mode of operation shall be the following sentence:

"This certification is valid only while operating on ___ (indicate the fuel or fuel combination under which this mode of operation was certified) fuel. Operation using any other fueling mode will result in significant increases in exhaust emissions and significantly reduce engine performance."

2. Manufacturers may elect to use a supplemental label in addition to the original label if there is not sufficient space to include all the required information. The supplemental label must conform to all specifications as the original label. In the case that a supplemental label is used, the original label shall be numbered "1 of 2" and the supplemental label shall be numbered "2 of 2."

3. Statements shall not be used on labels placed on engines that, in fact, do not comply with all applicable California regulations.

<u>4. **Vehicle Labels for Heavy-Duty Diesel Engine Idling Requirements.** For each 2008 and subsequent model year heavy-duty diesel engine certified to the optional NOx idling emission standard pursuant to paragraph 11.B.6.3 or equipped with a certified/verified auxiliary power system (APS) pursuant to title 13, CCR, section 2485(c)(3)(A), a single label shall be produced and affixed, as applicable, on each vehicle equipped with such heavy-duty diesel engine.</u>

<u>4.1 The labeling requirements for engine manufacturers, aftermarket APS manufacturers and installers, and original equipment manufacturers are as follows:</u>

<u>4.1.1 Engine manufacturers. The engine manufacturer that has certified an engine to the optional NOx idling emission standard pursuant to paragraph 11.B.6.3, or certified/verified an APS pursuant to title 13, CCR, section 2485(c)(3)(A), shall produce the appropriate label for each new engine or APS pursuant to paragraph 35.B.4.2, below. The label shall be affixed on the outside of the vehicle pursuant to paragraph 35.B.4.3 by the original equipment manufacturer.</u>

<u>4.1.2 Aftermarket APS manufacturers and installers. An aftermarket APS manufacturer that has certified/verified an APS pursuant to title 13, CCR, section 2485(c)(3)(A), shall produce the appropriate label for each APS system pursuant to paragraph 35.B.4.2, below. The label shall be affixed on the outside of the vehicle pursuant to paragraph 35.B.4.3 by the party that is responsible for installing the APS on the vehicle.</u>

<u>4.1.3 Original equipment manufacturer. An original equipment manufacturer that has certified an engine to the optional NOx idling emission standard pursuant to paragraph 11.B.6.3, or certified/verified an APS pursuant to title 13, CCR, section 2485(c)(3)(A), shall produce and affix the appropriate label on the outside of the vehicle pursuant to paragraphs 35.B.4.2 or 35.B.4.3, whichever is applicable.</u>

<u>4.2 **Label Format.** Figure 1 shows a facsimile of the label format for an engine certified to the optional NOx idling emission standard pursuant to paragraph 11.B.6.3. Figure 2 shows a facsimile of the label format for an</u>

engine in a certified/verified APS pursuant to title 13, CCR, section 2485(c)(3)(A). The engine manufacturer, APS manufacturer or original equipment manufacturer, whichever is applicable, that produces and affixes the label on the vehicle must ensure that the label has the following characteristics:

Figure 1

Figure 2

4.2.1 Oval shape.

4.2.2 Dimensions of no less than 6 inches wide by 4 inches high.

4.2.3 The color of the outer and inner ellipses shall be dark blue and the stars in red. The background of the label shall be light blue in color. The size of the stars shall be equal to the size of the characters as specified in paragraph 35.B.4.2.4 below.

4.2.4 A vehicle equipped with an engine that is certified pursuant to paragraph 11.B.6.3 shall have a label with the word "CERTIFIED," and below it the phrase "CLEAN IDLE," as shown in Figure 1. A vehicle equipped with an APS certified/verified pursuant to title 13, CCR, section 2485(c)(3)(A) shall have a label with the word "VERIFIED," and below it the phrase "CLEAN APS," as shown in Figure 2. The label information shall be written in the English language with sans serif font, black in color, and in upper case letters. The size of the font shall be at least 7/16 inch (or 32 points) and the spacing of the fonts must be such that the longest phrase (for example, "CLEAN IDLE") extends from the left edge to the right edge of the inner edge of the inner ellipse, without touching the edges. The label information shall be centrally aligned, both vertically and horizontally.

4.2.5 A hologram as shown in Figure 3 shall be embedded within the proposed label. The hologram must cover the entire label. The hologram shall have the phrase "Clean Skies" repeatedly written from edge to edge of the label boundaries and each phrase shall be separated by a circular bullet. The position of the circular bullet in each line shall be exactly above the space between the words "Clean" and "Skies" of the line below. The color of the font shall be orange. The font size" shall be less than or equal to a quarter of the font size of the phrase "CLEAN IDLE" or "CLEAN APS" as specified in subsection 35.B.4.2.4, above. The hologram shall have the map of the State of California, in orange color, overlaid over the text and positioned in the center of the label as shown in Figure 3, below.

Figure 3

4.3 Label Location and Attachment Requirements

4.3.1 The appropriate label shall be permanently affixed to the driver's side of the hood, in an area within one foot by one foot from the top and front edges of the hood. If such an attachment is not feasible, the label may be attached at a different location subject to advance approval by the Executive Officer.

4.3.2 Each label must be affixed in such a manner that it can not be removed without destroying or defacing the label. The label must not be affixed to any vehicle component that can easily be detached from the vehicle.

4.3.3 The label and any adhesives used must be designed to withstand, for a period of 10 years, typical environmental conditions. Typical environmental conditions include, but are not limited to, exposure to extreme heat or cold, moisture, engine fuels, lubricants and coolants.

4.4 The party that certifies/verifies the engine pursuant to paragraph 11.B.6.3 or the APS pursuant to title 13, CCR, section 2485(c)(3)(A) shall be the ultimate party responsible for ensuring that the labels are correctly produced. Samples of labels produced pursuant to this subsection must be submitted to the Executive Officer with the applicable certification or verification application.

4.5 Labels on vehicles may also be applied by distributors or dealers. However, the party that certified the engine or the APS and produced the labels remains the ultimate party responsible for ensuring that the labels are correctly administered. If the labels are administered by the dealer or distributor, the producer of the label shall include its name and a serial number on the label. The location of the producer's name and serial number on the label shall be written in the lower part of the label, in the space vertically centered between the label wording and the inner ellipses, and the font must contrast the label background. The serial numbers of the labels administered must be recorded by the distributor or dealer and reported to the party responsible for producing the labels. This information shall be maintained by the party responsible for producing the labels for a period of 10 years, and shall be made available to the Executive Officer upon request.

4.6 A heavy-duty diesel engine that has been certified pursuant to subsection 11.B.6.3 shall not be modified or altered unless said modification or alteration has been approved by the Executive Officer pursuant to title 13 CCR sections 2220 through 2225.

4.7 An idling emission reduction device or system that has been certified/verified pursuant to title 13, CCR, section 2485(c)(3)(A) shall not be modified or altered unless said modification or alteration has been approved by the Executive Officer pursuant to title 13 CCR sections 2470 through 2476.

36. Submission of vehicle identification numbers. [§86.079-36] [n/a]

* * * * *

PART II TEST PROCEDURES

Subpart I - Emission Regulations for New Diesel-Fueled Heavy-Duty Engines; Smoke Exhaust Test Procedure

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Subpart N - Emission Regulations for New Otto-Cycle and Diesel Heavy-Duty Engines; Gaseous and Particulate Exhaust Test Procedures

* * * * *

86.1360-2007 Supplemental steady-state test; test cycle and procedures. January 18, 2001.

A. Federal provisions

* * * * *

B. California provisions

1. **Emission testing caps for the 2005 and subsequent model years.**

* * * * *

4. **Determination of NOx Idling Emissions.** The requirements set forth in this subparagraph apply to 2008 and subsequent model year heavy-duty diesel engines certifying to the *optional* NOx idling emission standard specified in subsection 11.B.6.3, above. To determine whether an engine meets the optional NOx idling emission standard, emissions *shall be measured by testing the* engine on an engine dynamometer as described below.

4.1 **Test Cycle.** The following 2 mode duty cycle shall be performed on a dynamometer on the test engine:

Mode	Engine Speed (rpm)	Time in mode (seconds)	Engine Load
1	Manufacturer Recommended Curb idle	1800	See subparagraph 4.1.1 below
2	1100	1800	See subparagraph 4.1.2 below

4.1.1 For mode 1, the dynamometer load or torque applied shall be based on the vehicle power requirements during curb idle operation.

The engine manufacturer shall determine the curb idle speed and the appropriate test load for the test engine. The load shall include curb idle power requirements needed for operating engine accessories, such as the engine cooling fan, alternator, coolant pump, air compressor, engine oil and fuel pumps and any other engine accessory operated during curb idle of the engine. The load for mode 1 may not include power requirements for operating the air conditioning compressor or for operating on-board accessories, such as a microwave, refrigerator, television, computer, etc., that the vehicle operator may use during rest periods.

4.1.2 For mode 2, the dynamometer load or torque applied shall be based on the vehicle power requirements during idle speed operations of 1100 revolutions per minute (rpm). The engine manufacturer shall determine the appropriate test load for the test engine. The load shall include high engine idle speed power requirements needed for operating engine accessories, such as the engine cooling fan, alternator, coolant pump, air compressor, engine oil and fuel pumps, air conditioning compressor set at maximum capacity, and any other engine accessory operated during the idle operation of the engine. The total test load shall be equal to the test load so determined plus an additional load of 2 kilowatts to take into account the power needs for operating on-board accessories such as a television, refrigerator, microwave, computer, etc.

4.2 **Test Requirements.**

4.2.1 **Pre-conditioning.** Prior to measuring emissions, bring the engine to a warm condition as follows:

(a) If the idling test follows directly after testing over the Federal Test Procedure or the supplemental emission tests, consider the engine warm. Bring down the engine to the manufacturer recommended curb idle speed, apply the appropriate load as determined in subparagraph 4.1.1, and start measuring emissions after 10 minutes and only after achieving temperature stability. Temperature stability may be determined as the point at which the engine coolant is within 2% of its mean value for at least 2 minutes.

(b) If the engine is cold, warm-up the engine by operating it at any speed above peak-torque speed and between 65 to 85% of maximum mapped power until the engine coolant temperature is within 2% of its mean value for at least 2 minutes or until the thermostat controls engine temperature.

4.2.2 **Test Sequence.** Following engine warm-up as described in subparagraph 4.2.1, the test shall be performed first for mode 1. Bring down the engine to the curb idle speed, apply the appropriate load as determined in subparagraph 4.1.1, and start measuring emissions after 10 minutes and only after achieving temperature stability. Temperature stability may be determined as the point at which the engine coolant is within 2% of its mean value for at least 2 minutes. Upon completion of mode 1 testing, the engine speed shall be ramped up to 1100 rpm. Once the engine starts operating at 1100 rpm, apply the appropriate load as determined in subparagraph 4.1.2, and start measuring emissions after 10 minutes and only after achieving temperature stability. Temperature stability may be determined as the point at which the engine coolant is within 2% of its mean value for at least 2 minutes. The engine shall be operated for the prescribed time in each mode. The specified test speed shall be held to within ±50 rpm and the specified torque shall be held to within ±2 percent.

4.2.3 **Calculations.** For each test mode, calculate the modal average mass emissions level for each regulated pollutant, in grams per hour, the modal average power, in brake horsepower and the modal average speed, in rpm.

86.1370-2007 Not-To-Exceed test procedures. January 18, 2001.

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CALIFORNIA AIR RESOURCES BOARD

NOTICE OF PUBLIC MEETING TO CONSIDER A SUGGESTED CONTROL MEASURE FOR AUTOMOTIVE COATINGS

The Air Resources Board (ARB or Board) will conduct a public meeting at the time and place noted below to consider approval of a Suggested Control Measure (SCM) for emissions of volatile organic compounds (VOC) from the application of automotive coatings.

DATE: October 20, 2005

TIME: 9:00 a.m.

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

This item will be considered at a two-day meeting of the ARB, which will commence at 9:00 a.m., October 20, 2005, and may continue at 9:00 a.m., October 21, 2005. This item may not be considered until October 21, 2005. Please consult the agenda for the meeting, which will be available at least 10 days before October 20, 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.

Background

Automotive coatings are coatings used in motor vehicle or mobile equipment refinishing, repair, and restoration. Estimated VOC emissions from automotive coatings in California were about 20.7 tons per day in 2001, representing about two percent of the total stationary source (stationary and area-wide) VOC emissions. These coatings are used for refinishing vehicles such as automobiles, trucks, buses, golf carts, vans, motorcycles, trains, railcars, truck trailers, mobile cranes, bulldozers, and street cleaners.

Under California law, the primary authority for controlling emissions from automotive coatings is vested in the local air pollution control districts and air quality management districts ("districts", see Health and Safety Code, Sections 39002, 40000, and 40001). However, the ARB often provides guidance and other assistance to the districts, including the development of model rules such as the SCM for automotive coatings. The ARB's authority to do this is provided by sections 39001, 39003, 39500, 39600, 39602, 39605, 40916, and 41500 of the Health and Safety Code.

Of the 35 districts in California, 20 districts have rules regarding automotive coatings. Currently, approximately 95 percent of the State's population is covered by the existing district rules. The districts that do not have their own rule for automotive coatings implement the United States Environmental Protection Agency's (U.S. EPA) National Rule.

Automotive refinishing operations are conducted at auto body repair/paint shops, production auto body paint shops, new car dealer repair/paint shops, fleet operator repair/paint shops and custom restoration facilities. The total number of facilities in California involved in the repair and refinishing of vehicles is estimated to range from about 4,000 to over 6,000.

ARB staff developed the proposed SCM in consultation with the districts, the affected industry representatives, and the U.S. EPA. The proposed SCM is designed to be used by the districts as a model when they adopt or amend rules regarding automotive coatings. The proposed SCM will provide statewide uniformity, enhance enforcement, and reduce VOC emissions.

The Board's approval of the proposed SCM will not impose binding requirements on any person. Binding requirements will only be imposed if a district adopts the SCM as a district rule. Upon adoption, a district rule would then apply to affected persons within the jurisdiction of the district. In addition, the Board's approval of the SCM will not impose an obligation on any district to subsequently adopt the SCM. It will be up to each district to decide if adoption of the SCM as a district rule is needed to attain the state and federal ambient air quality standards within the district. Automotive coatings rules now in place in the districts will remain in effect, unchanged, until district adoption of the SCM.

Description of the Proposed SCM

The proposed SCM applies to manufacturers, distributors, sellers, and users of automotive coatings. The proposed SCM applies to coatings that are used to coat any part or component of motor vehicles (such as cars, buses, and golf carts) or mobile equipment (such as railcars and tractors). The proposed SCM also applies to manufacturers, distributors, sellers, and users of surface preparation and clean-up solvents associated with the use of automotive coatings. Implementation of the

proposed SCM would reduce VOC emissions by 13.4 tons per day statewide beginning in 2009.

The proposed SCM does not apply to aerosol coatings (e.g., spray paint) or automotive coatings that are sold, supplied, or offered for sale in 0.5 fluid ounce or smaller containers intended to be used by the general public to repair tiny surface imperfections. The proposed SCM also does not apply to coatings applied to motor vehicles or mobile equipment, or their associated parts and components, during manufacture on an assembly line.

The proposed SCM differs from the U.S. EPA's National Rule and current district rules by eliminating the composite VOC limit for base coat (color) and clear coatings systems. The composite VOC limit is being replaced with individual VOC limits for color coatings and clear coatings. The proposed SCM specifies VOC limits for 12 coating categories; these limits would become effective on January 1, 2009.

The coating categories include clear coatings, color coatings, single-stage coatings, primers, and a variety of specialty coatings such as pretreatment coatings and adhesion promoters. If the coating is represented in such a way that indicates it can be used for more than one of the coating categories listed, then the lowest, or most restrictive, VOC content limit will apply.

If a coating does not meet any of the definitions for the categories listed, that coating will fall into the category labeled "Any other coating type" and a VOC limit of 250 grams per liter will apply. Limits are expressed in grams of VOC per liter of coating as applied, excluding the volume of any water and exempt compounds.

The proposed SCM specifies that no person shall manufacture, blend, repackage for sale, supply, sell, offer for sale, distribute, or apply any automotive coating or automotive coating component that does not meet the VOC limits in the proposed SCM.

The proposed SCM also prohibits anyone from possessing (at an automotive refinishing facility) any coating that does not meet the VOC limits listed, except when the coating is used with an approved emission control system that is at least 85 percent efficient. It is a violation of the proposed SCM to solicit, require, or specify the use of a coating that does not meet the VOC limits set forth in the proposed SCM, unless the coatings are used at a facility that complies with the alternative compliance provisions.

The manner in which coatings may be applied is specified in the proposed SCM. With the exception of underbody coatings, truck bed liner coatings, coatings used in graphic arts, and coatings of any type if less than one fluid ounce, the automotive coating must be applied by brushing, dipping, rolling, electrostatic spraying, or spraying with a high-volume, low-pressure spray gun or its approved equivalent.

The proposed SCM prohibits the use of cleaning solvents that exceed a VOC content of 25 grams per liter at an automotive refinishing facility. Any coating components,

coatings, and VOC-containing products used for cleaning must be stored in closed, vapor-tight containers when not in use. Spray guns must be cleaned in a closed system or its approved equivalent.

The proposed SCM has recordkeeping and labeling requirements. The proposed SCM requires each manufacturer to provide written data for each of their products that include the physical properties of the coating, coating component, or solvent. Manufacturers must also clearly label all coatings and coating components with the applicable coatings category and the VOC content. Manufacturers must label solvents with the VOC content.

Those who use automotive coatings are required under the proposed SCM to keep records indicating the name and manufacturer of the coating, method of applying the coating, coating type and mix ratio, VOC content of the coating, and whether the product used is a coating or a solvent. This information, along with manufacturer's data sheets or other written materials that provide the actual and regulatory VOC content and purchase records listing the coating type, name, and volume of coatings or solvents must be kept at the location where the coatings are applied for a minimum of three years. These records are to be made available for inspection upon request.

Anyone using an approved emission control system instead of using coatings that meet the VOC limits in the proposed SCM must keep daily records, to be maintained for a minimum of three years. These records will prove continuous and correct use of the control system during the time that emissions are occurring.

AVAILABILITY OF DOCUMENTS AND AGENCY CONTACT PERSONS

The ARB staff has prepared a Staff Report on the proposed SCM. The Staff Report contains the full text of the proposed SCM, and discusses the background, necessity for, technical basis, and the environmental and economic impacts of the proposed SCM.

Copies of the Staff Report may be obtained from the ARB's Public Information Office, 1001 I Street, Visitors and Environmental Services Center, 1st Floor, Sacramento, CA 95814, (916) 322-2990. In addition, this notice and the Staff Report will be available on the ARB internet site at http://www.arb.ca.gov/coatings/autorefin/scm/scm.htm.

Inquiries concerning the substance of the proposed SCM may be directed to Mr. Jose Gomez at (916) 324-8033 or by email at jgomez@arb.ca.gov, or Mr. David Mehl at (916) 324-8177 or by email at dmehl@arb.ca.gov.

SUBMITTAL OF COMMENTS

The public may present comments relating to this matter orally or in writing at the meeting, and in writing or by email before the meeting. To be considered by the Board, written submissions not physically submitted at the public meeting must be received **no later than 12:00 noon, October 19, 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 autocoat@listserv.arb.ca.gov and received by the ARB **no later than 12:00 noon, October 19, 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 October 19, 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 public meeting so that ARB staff and Board Members have time to fully consider each document. The Board encourages members of the public to bring to the attention of staff in advance of the public meeting any suggestions for modification of the proposed suggested control measure.

CALIFORNIA AIR RESOURCES BOARD

Catherine Witherspoon
Executive Officer

Date: September 20, 2005

California Environmental Protection Agency

AIR RESOURCES BOARD

STAFF REPORT
FOR THE
PROPOSED SUGGESTED CONTROL MEASURE
FOR AUTOMOTIVE COATINGS

Stationary Source Division
Measures Assessment Branch

October 2005

CALIFORNIA AIR RESOURCES BOARD

NOTICE OF PUBLIC MEETING TO CONSIDER A SUGGESTED CONTROL MEASURE FOR AUTOMOTIVE COATINGS

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DATE: October 20, 2005

TIME: 9:00 a.m.

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

This item will be considered at a two-day meeting of the ARB, which will commence at 9:00 a.m., October 20, 2005, and may continue at 9:00 a.m., October 21, 2005. This item may not be considered until October 21, 2005. Please consult the agenda for the meeting, which will be available at least 10 days before October 20, 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.

Background

Automotive coatings are coatings used in motor vehicle or mobile equipment refinishing, repair, and restoration. Estimated VOC emissions from automotive coatings in California were about 20.7 tons per day in 2001, representing about two percent of the total stationary source (stationary and area-wide) VOC emissions. These coatings are used for refinishing vehicles such as automobiles, trucks, buses, golf carts, vans, motorcycles, trains, railcars, truck trailers, mobile cranes, bulldozers, and street cleaners.

Under California law, the primary authority for controlling emissions from automotive coatings is vested in the local air pollution control districts and air quality management districts ("districts", see Health and Safety Code, Sections 39002, 40000, and 40001). However, the ARB often provides guidance and other assistance to the districts, including the development of model rules such as the SCM for automotive coatings. The ARB's authority to do this is provided by sections 39001, 39003, 39500, 39600, 39602, 39605, 40916, and 41500 of the Health and Safety Code.

Of the 35 districts in California, 20 districts have rules regarding automotive coatings. Currently, approximately 95 percent of the State's population is covered by the existing district rules. The districts that do not have their own rule for automotive coatings implement the United States Environmental Protection Agency's (U.S. EPA) National Rule.

Automotive refinishing operations are conducted at auto body repair/paint shops, production auto body paint shops, new car dealer repair/paint shops, fleet operator repair/paint shops and custom restoration facilities. The total number of facilities in California involved in the repair and refinishing of vehicles is estimated to range from about 4,000 to over 6,000.

ARB staff developed the proposed SCM in consultation with the districts, the affected industry representatives, and the U.S. EPA. The proposed SCM is designed to be used by the districts as a model when they adopt or amend rules regarding automotive coatings. The proposed SCM will provide statewide uniformity, enhance enforcement, and reduce VOC emissions.

The Board's approval of the proposed SCM will not impose binding requirements on any person. Binding requirements will only be imposed if a district adopts the SCM as a district rule. Upon adoption, a district rule would then apply to affected persons within the jurisdiction of the district. In addition, the Board's approval of the SCM will not impose an obligation on any district to subsequently adopt the SCM. It will be up to each district to decide if adoption of the SCM as a district rule is needed to attain the state and federal ambient air quality standards within the district. Automotive coatings rules now in place in the districts will remain in effect, unchanged, until district adoption of the SCM.

Description of the Proposed SCM

The proposed SCM applies to manufacturers, distributors, sellers, and users of automotive coatings. The proposed SCM applies to coatings that are used to coat any part or component of motor vehicles (such as cars, buses, and golf carts) or mobile equipment (such as railcars and tractors). The proposed SCM also applies to manufacturers, distributors, sellers, and users of surface preparation and clean-up solvents associated with the use of automotive coatings. Implementation of the

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 autocoat@listserv.arb.ca.gov and received by the ARB **no later than 12:00 noon, October 19, 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 October 19, 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 public meeting so that ARB staff and Board Members have time to fully consider each document. The Board encourages members of the public to bring to the attention of staff in advance of the public meeting any suggestions for modification of the proposed suggested control measure.

CALIFORNIA AIR RESOURCES BOARD

Catherine Witherspoon
Executive Officer

Date: September 20, 2005

proposed SCM would reduce VOC emissions by 13.4 tons per day statewide beginning in 2009.

The proposed SCM does not apply to aerosol coatings (e.g., spray paint) or automotive coatings that are sold, supplied, or offered for sale in 0.5 fluid ounce or smaller containers intended to be used by the general public to repair tiny surface imperfections. The proposed SCM also does not apply to coatings applied to motor vehicles or mobile equipment, or their associated parts and components, during manufacture on an assembly line.

The proposed SCM differs from the U.S. EPA's National Rule and current district rules by eliminating the composite VOC limit for base coat (color) and clear coatings systems. The composite VOC limit is being replaced with individual VOC limits for color coatings and clear coatings. The proposed SCM specifies VOC limits for 12 coating categories; these limits would become effective on January 1, 2009.

The coating categories include clear coatings, color coatings, single-stage coatings, primers, and a variety of specialty coatings such as pretreatment coatings and adhesion promoters. If the coating is represented in such a way that indicates it can be used for more than one of the coating categories listed, then the lowest, or most restrictive, VOC content limit will apply.

If a coating does not meet any of the definitions for the categories listed, that coating will fall into the category labeled "Any other coating type" and a VOC limit of 250 grams per liter will apply. Limits are expressed in grams of VOC per liter of coating as applied, excluding the volume of any water and exempt compounds.

The proposed SCM specifies that no person shall manufacture, blend, repackage for sale, supply, sell, offer for sale, distribute, or apply any automotive coating or automotive coating component that does not meet the VOC limits in the proposed SCM.

The proposed SCM also prohibits anyone from possessing (at an automotive refinishing facility) any coating that does not meet the VOC limits listed, except when the coating is used with an approved emission control system that is at least 85 percent efficient. It is a violation of the proposed SCM to solicit, require, or specify the use of a coating that does not meet the VOC limits set forth in the proposed SCM, unless the coatings are used at a facility that complies with the alternative compliance provisions.

The manner in which coatings may be applied is specified in the proposed SCM. With the exception of underbody coatings, truck bed liner coatings, coatings used in graphic arts, and coatings of any type if less than one fluid ounce, the automotive coating must be applied by brushing, dipping, rolling, electrostatic spraying, or spraying with a high-volume, low-pressure spray gun or its approved equivalent.

The proposed SCM prohibits the use of cleaning solvents that exceed a VOC content of 25 grams per liter at an automotive refinishing facility. Any coating components, coatings, and VOC-containing products used for cleaning must be stored in closed, vapor-tight containers when not in use. Spray guns must be cleaned in a closed system or its approved equivalent.

The proposed SCM has recordkeeping and labeling requirements. The proposed SCM requires each manufacturer to provide written data for each of their products that include the physical properties of the coating, coating component, or solvent. Manufacturers must also clearly label all coatings and coating components with the applicable coatings category and the VOC content. Manufacturers must label solvents with the VOC content.

Those who use automotive coatings are required under the proposed SCM to keep records indicating the name and manufacturer of the coating, method of applying the coating, coating type and mix ratio, VOC content of the coating, and whether the product used is a coating or a solvent. This information, along with manufacturer's data sheets or other written materials that provide the actual and regulatory VOC content and purchase records listing the coating type, name, and volume of coatings or solvents must be kept at the location where the coatings are applied for a minimum of three years. These records are to be made available for inspection upon request.

Anyone using an approved emission control system instead of using coatings that meet the VOC limits in the proposed SCM must keep daily records, to be maintained for a minimum of three years. These records will prove continuous and correct use of the control system during the time that emissions are occurring.

AVAILABILITY OF DOCUMENTS AND AGENCY CONTACT PERSONS

The ARB staff has prepared a Staff Report on the proposed SCM. The Staff Report contains the full text of the proposed SCM, and discusses the background, necessity for, technical basis, and the environmental and economic impacts of the proposed SCM.

Copies of the Staff Report may be obtained from the ARB's Public Information Office, 1001 I Street, Visitors and Environmental Services Center, 1st Floor, Sacramento, CA 95814, (916) 322-2990. In addition, this notice and the Staff Report will be available on the ARB internet site at http://www.arb.ca.gov/coatings/autorefin/scm/scm.htm.

Inquiries concerning the substance of the proposed SCM may be directed to Mr. Jose Gomez at (916) 324-8033 or by email at jgomez@arb.ca.gov, or Mr. David Mehl at (916) 324-8177 or by email at dmehl@arb.ca.gov.

SUBMITTAL OF COMMENTS

The public may present comments relating to this matter orally or in writing at the meeting, and in writing or by email before the meeting. To be considered by the Board, written submissions not physically submitted at the public meeting must be received **no later than 12:00 noon, October 19, 2005,** and addressed to the following:

State of California
AIR RESOURCES BOARD

STAFF REPORT
FOR THE
PROPOSED SUGGESTED CONTROL MEASURE
FOR AUTOMOTIVE COATINGS

To be considered by the Air Resources Board on October 20 and 21, 2005, at:

California Environmental Protection Agency
Headquarters Building
1001 "I" Street
Sacramento, California

Stationary Source Division:
Robert Fletcher, Chief
Robert D. Barham, Assistant Chief
Measures Assessment Branch:
Barbara Fry, Chief
Technical Development Section:
Jose Gomez, Manager

State of California
AIR RESOURCES BOARD

STAFF REPORT FOR THE PROPOSED SUGGESTED CONTROL MEASURE FOR AUTOMOTIVE COATINGS

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Acknowledgements

We wish to acknowledge the participation and assistance of air pollution control and air quality management districts. In particular, we would like to thank the following district representatives that participated in the ARB/District Working Group:

Dan Belik, Bay Area Air Quality Management District
Victor Douglas, Bay Area Air Quality Management District
Bob McLaughlin, Butte County Air Quality Management District
Dave Valler, Feather River Air Quality Management District
Kevin Williams, Sacramento Metropolitan Air Quality Management District
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Stan Cowen, Ventura County Air Pollution Control District
Keith Duval, Ventura, San Joaquin Valley Air Pollution Control District
Rebecca Geyer, Yolo Solano Air Quality Management District
Francisco Donez, U.S. EPA Region IX

We would also like to acknowledge the participation and assistance of:

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Jones-Blair
Magni
Montana Products
PPG
Sherwin Williams
Spies Hecker
Standox
Valspar

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ACRONYMS

2002 Survey	2002 Automotive Refinish Survey
APA	Administrative Procedure Act
AQMP	Air Quality Management Plan
ARB/Board	Air Resources Board
ATCM	Airborne Toxic Control Measure
BAAQMD	Bay Area Air Quality Management District
Cal/OSHA	California Department of Industrial Relations, Division of Occupational Safety and Health Administration
CAPCOA	California Air Pollution Control Officers' Association
CCAA	California Clean Air Act
CCR	California Code of Regulations
C.E.	Control Efficiency
CESQG	Conditionally Exempt Small Quantity Generators
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CRF	Capital Recovery Factor
district	Air Pollution Control or Air Quality Management District
DTSC	Department of Toxic Substances Control
EU	European Union
FCAA	Federal Clean Air Act
g/l	Grams Per Liter
HAP	Hazardous Air Pollutant
HEPA	High Efficiency Particulate Abatement
HRA	Health Risk Assessment
HSC	Health and Safety Code
HVLP	High Volume Low Pressure
MEK	Methyl Ethyl Ketone
NAICS	North American Industry Classification System
NAP	Neighborhood Assessment Program
NIOSH	National Institute for Occupational Safety and Health
NO_x	Nitrogen Oxides
OEHHA	Office of Environmental Health Hazard Assessment
OEM	Original Equipment Manufacturer
PCBTF	Parachlorobenzotrifluoride
PEL	Permissible Exposure Limit
PM	Particulate Matter
PM_{10}	Particulate Matter with an aerodynamic diameter less than or equal to 10 microns
$PM_{2.5}$	Particulate Matter with an aerodynamic diameter less than or equal to 2.5 microns
ppm	parts per million
REL	Reference Exposure Level
ROE	Return On Owner's Equity
RTS	Ready To Spray
SCAQMD	South Coast Air Quality Management District

ACRONYMS

SCM	Suggested Control Measure
SIC	Standard Industrial Classification
SIP	State Implementation Plan
SJVUAPCD	San Joaquin Valley Unified Air Pollution Control District
SMAQMD	Sacramento Metropolitan Air Quality Management District
SOA	Secondary organic aerosols
SRP	Scientific Review Panel
SWA	Sales-Weighted Average
TAC	Toxic Air Contaminant
TBAC	Tertiary-Butyl acetate
TCLP	Toxicity Characteristic Leaching Procedure
TE	Transfer Efficiency
tpd	tons per day
TSP	Total Suspended Particulate
ug	Microgram
ug/m3	Micrograms per Cubic Meter
U.S. EPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
VOC_{act}	VOC in grams per liter of coating
VOC_{reg}	VOC in grams per liter of coating, excluding water and exempt compounds

EXECUTIVE SUMMARY

In this executive summary, we provide a summary of the information provided in the staff report. The executive summary is written in "question and answer" format and includes:

- Background;
- SCM development process and evaluation of alternatives;
- Summary of the proposed Suggested Control Measure (SCM);
- Technical analysis of coating categories in the proposed SCM;
- Environmental Impacts;
- Economic Impacts; and
- Future Plans.

I. BACKGROUND

What are automotive coatings?

Automotive coatings, as defined in the SCM, are coatings that are applied to motor vehicles and mobile equipment. Automotive coatings are sold as components that must be mixed to be applied. The main coating categories include primers, color coatings, and clear coatings. These three broad categories of coatings account for about 84 percent of the sales reported in 2001. The remaining sales consist of a variety of coatings such as pretreatment coatings or adhesion promoters intended for use on bare metal or plastics. Automotive coatings, as defined in this SCM, do not include aerosol coatings (e.g., spray paint) or original equipment manufacturer coatings.

What are the emissions from automotive coatings?

The annual average volatile organic compound (VOC) emissions from automotive coatings are estimated to be about 20.7 tons per day in California in 2001 or about two percent of the total stationary source VOC emissions statewide. When automotive coatings are applied, the solvents that hold the coatings in suspension evaporate into the atmosphere and contribute to VOC emissions.

VOC emissions are precursors to the formation of ozone and particulate matter (PM), California's most serious air quality problems. VOCs react photochemically with oxides of nitrogen (NO_x) to form ozone. Ozone is a strong oxidizer that irritates the human respiratory system, increases airway hyperreactivity, increases airway inflammation, and damages plant life and property. Exposure to ozone is also associated with premature death, hospitalization for cardiopulmonary causes, asthma episodes and restrictions in physical activity. VOCs also react in the atmosphere to form PM which consists of very small liquid and solid particles suspended in the air. PM includes particles smaller than 10 microns in size (PM_{10}), as well as the subset of fine particles smaller than 2.5 microns in size ($PM_{2.5}$). PM_{10} and $PM_{2.5}$ are inhaled deeply into the lungs and reduce human pulmonary function. Premature deaths linked to PM_{10} and

$PM_{2.5}$ exposure are now at levels comparable to deaths from motor vehicles and second hand smoke. PM_{10} and $PM_{2.5}$ may also contain toxic compounds. In the atmosphere, PM_{10} and $PM_{2.5}$ reduce visibility.

Who is responsible for controlling VOC emissions from automotive coatings?

Control of emissions from automotive coatings is primarily the responsibility of the local air pollution control and air quality management districts (districts). However, the Air Resources Board (ARB) provides technical support to districts through the development of SCMs and other similar efforts. ARB staff, in cooperation with the districts, has developed the proposed SCM for automotive coatings. The SCM will serve as a model for districts when adopting and amending their automotive coatings rules. The proposed SCM, in part, relies upon the efforts of the Enforcement Managers Committee of the California Air Pollution Control Officers' Association. The proposed SCM reflects nearly four years of study of automotive coatings, and was developed in cooperation with the districts, the United States Environmental Protection Agency (U.S. EPA), and the affected industry.

Why are we proposing the SCM?

We are proposing the SCM to promote consistency and uniformity among district rules and to achieve VOC emission reductions. The proposed SCM will also improve the enforceability of the rules by simplifying coating categories and establishing individual VOC limits for color coatings and clear coatings.

The proposed SCM will achieve significant emission reductions from this category. Many of the facilities that use these coatings are located in or near residential areas and can create disproportionate impacts to neighborhoods. Reducing emissions in neigborhoods is part of the ARB's Environmental Justice Policies and Goals. The emission reductions achieved by the SCM will help the districts meet state implementation plan (SIP) and California Clean Air Act (CCAA) plan requirements.

How are emissions from automotive coatings controlled in the SCM?

Automotive coatings contain solvents which evaporate when they are applied. Most of the solvents used in automotive coatings are VOCs that contribute to California's air quality problems. The SCM controls VOC emissions by establishing limits on the VOC content of automotive coatings. These VOC limits are expressed in grams of VOC per liter of coating, less water and exempt compounds, and vary with each coating category. In general, manufacturers will meet the VOC limits by replacing some of the solvents in automotive coatings with water or other exempt compounds[1], or by increasing the amount of solids, such as resins and pigments or a combination of these approaches.

[1] Solvents with low photochemical reactivity

II. SUMMARY OF PROPOSED SUGGESTED CONTROL MEASURE (SCM)

What automotive coating categories are in the proposed SCM?

As shown in Table ES-1 below, the proposed SCM (see Appendix A) will establish VOC content limits for twelve coating categories of automotive coatings. Many of these automotive coating categories are similar to those in existing district rules. The SCM would lower VOC limits for many categories but would retain some VOC limits currently in effect in California.

Table ES-1 - Proposed Coating Categories and VOC Limits

Coating Category	VOC regulatory limit as applied Effective January 1, 2009	
	grams/liter	(pounds per gallon*)
Adhesion Promoter	540	4.5
Clear Coating	250	2.1
Color Coating	420	3.5
Multi-Color Coating	680	5.7
Pretreatment Coating	660	5.5
Primer	250	2.1
Single-Stage Coating	340	2.8
Temporary Protective Coating	60	0.5
Truck Bed Liner Coating	310	2.6
Underbody Coating	430	(3.6
Uniform Finish Coating	540	4.5
Any other coating type	250	2.1

* English units are provided for information only. VOC limits are expressed in grams VOC per liter of coating, less water and exempt compounds.

How does the proposed SCM differ from existing district rules?

Current district rules have two sets of VOC limits for automotive coatings. The automotive coatings used on passenger cars typically have higher VOC limits than the automotive coatings used on large vehicles such as trucks and buses (commonly referred to as Group I and Group II vehicles). The district rules also have composite VOC limits for multi-stage systems that apply to the total VOC content of the color coat and clear coat combined. The proposed SCM would establish a single set of VOC limits for all automotive coatings and would eliminate the composite VOC limits for multi-stage systems. The key differences between the proposed SCM and the existing district rules are discussed below.

The SCM:

- Combines the Group I and Group II vehicle categories, and establishes the same VOC limits for passenger vehicles, heavy-duty vehicles, and mobile equipment. This would improve enforcement and simplify recordkeeping;

- Eliminates the composite VOC limit for multi-stage systems, and replaces it with specific VOC limits for clear coatings and color coatings. This would improve enforcement;

- Simplifies and combines district coating categories reducing the total number of categories from thirty-four to twelve. See Table IV-3 in Chapter IV for a list of coating categories typically found in district rules and the corresponding category in the proposed SCM;

- Eliminates the specialty coatings category and replaces it with two specific category limits. The survey data indicate that several coating types qualifying for a high VOC limit under the districts' specialty coatings category were not sold in California in 2001;

- Establishes a prohibition of possession provision, which would prohibit any person from having, at any automotive refinishing facility, coatings or solvents that do not comply with the proposed VOC limits. Only one district rule currently has a prohibition of possession. This would improve enforcement;

- Establishes a 25 grams per liter VOC limit for solvents used in cleaning operations, including surface preparation and spray gun cleaning. This limit is consistent with the most stringent district VOC limit for solvents which is in the South Coast Air Quality Management District (SCAQMD);

- Improves recordkeeping and labeling. The SCM sets consistent recordkeeping requirements for the coating end user. The SCM also establishes labeling requirements for coating manufacturers which would improve enforcement; and

- Exempts tertiary butyl acetate from the VOC definition to provide compliance flexibility.

A more complete discussion of the requirements of the proposed SCM can be found in Chapter III. The proposed regulatory language is in Appendix A. These proposed changes would provide statewide consistency and increase the enforceability of district rules.

Are any products exempt from the SCM?

Yes. The SCM does not apply to original equipment manufacturer (OEM) automotive coatings that are covered by separate district rules. The SCM also does not apply to aerosol consumer products and aerosol coatings. However, these products are subject to the ARB's statewide consumer products and aerosol coatings regulations, respectively. Products manufactured for use outside of the applicable district, or for shipment to other manufacturers for reformulation or repackaging are also exempt.

Who would be affected by the proposed SCM?

If adopted by the districts, the proposed SCM would apply to anyone who sells, supplies, offers for sale, or manufactures any automotive coatings for use within the applicable district, as well as any person who applies or solicits the application of any automotive coating within the district. The primary impact would be on manufacturers and users of the coatings. Manufacturers would need to reformulate some products. Distributors of automotive coatings would also be impacted.

Distributors and retailers who must ensure that they are selling or supplying products that comply with the new VOC limits will be impacted. Because of the competitive nature of this industry, some distributors may incur additional costs because they elect to absorb some of the cost to transition automotive refinishing facilities to using lower VOC coatings. Suppliers of resins, solvents, and other ingredients may be impacted, depending on whether demand for their products changes. Although determined to be small, the cost to consumers for vehicle refinishing may increase for some automotive coatings.

Which districts are expected to adopt the proposed SCM?

At a minimum, we expect the 20 districts that currently have automotive coatings rules to amend their rules based on the SCM. These districts are listed in Table ES-2 below. SCAQMD is expected to be the first district to adopt the SCM.

We have worked closely with the districts in developing the SCM. As a result, we encourage districts to adopt the SCM without major changes. We recognize that districts have the authority to include limited and specific exemptions to meet local needs. However, we anticipate that VOC limits, definitions, and implementation dates will not be changed. This will help to achieve uniformity across the State.

Districts without specific rules for automotive coatings may want to consider adopting the SCM to help them achieve the State and federal ambient air quality standards. Districts without specific automotive coatings rules will continue to be subject to the VOC limits in the U.S. EPA's National Rule.

Table ES-2 - Districts with Automotive Coatings Rules	
Antelope Valley APCD	Sacramento Metropolitan AQMD
Bay Area AQMD	San Diego County APCD
Butte County APCD	San Joaquin Valley Unified APCD
El Dorado County APCD	San Luis Obispo County APCD
Feather River AQMD	Santa Barbara County APCD
Glenn County APCD	Shasta County AQMD
Imperial County APCD	South Coast AQMD
Kern County APCD	Tehama County APCD
Mojave Desert AQMD	Ventura County APCD
Placer County APCD	Yolo-Solano County AQMD

III. SCM DEVELOPMENT PROCESS AND EVALUATION OF ALTERNATIVES

How did ARB staff develop the proposed automotive coatings SCM?

The SCM was developed in cooperation with districts, the U.S. EPA, the automotive coatings manufacturers, the collision repair industry, and other interested parties. The SCM development process included the following activities: (1) a comprehensive survey of automotive coatings manufacturers; (2) technical analyses of all the coating categories proposed in the SCM; (3) meetings with districts and U.S. EPA Region IX, and industry representatives; (4) an evaluation of potential environmental impacts; and (5) an analysis of the cost impacts. ARB staff also conducted six public workshops and several meetings and conference calls with individual manufacturers and other interested parties. Table ES-3 provides a chronology of the major meetings held during the SCM development process.

Table ES-3 - Chronology of the Automotive Coatings SCM Development		
Date	**Meeting**	**Location**
April 6, 2005	District Working Group	Sacramento
April 27, 2005	District Working Group	Sacramento
May 26, 2005	Industry and District Conference Call	Sacramento
June 8, 2005	Industry Symposium	Contra Costa College
June 11, 2005	Industry Meeting	Anaheim
June 14, 2005	District Working Group	Sacramento
June 28, 2005	Public Workshop	Diamond Bar
June 30, 2005	Public Workshop	Sacramento
August 9, 2005	Public Workshop	Fresno
August 11, 2005	Public Workshop	Oakland
August 23, 2005	Public Workshop	Diamond Bar
October 5, 2005	Public Workshop	Sacramento

Who has participated in the process?

The districts, the U.S. EPA, automotive coatings manufacturers and marketers, trade associations, and representatives of automotive refinishing facilities have been active in the development of the proposed SCM.

What information was gathered in the ARB's 2002 Automotive Coatings Survey?

The ARB's 2002 Automotive Coatings Survey (2002 Survey) collected detailed sales and formulation data from 17 manufacturers that sold automotive coatings in California in 2001. This information was collected by coating category, and was provided either on a product specific basis, or for a group of products in the case of color coatings. The 2002 Survey also requested for each product, or group of products, the complete formulation (the speciation of the VOC ingredients, exempt solvents, and solids). See Appendix B for complete details of the type of information collected as part of the 2002 Survey. The technical information gathered in the 2002 Survey was used, along with other information, to develop the proposed SCM.

Did ARB staff evaluate alternatives to the proposed SCM?

Yes. Under the California Environmental Quality Act (CEQA), project alternatives should be identified in the Environmental Impact Assessment. Alternatives include measures for attaining the objectives of the proposed project. The alternatives analysis provides a means for evaluating the comparative merits of each alternative. An alternative evaluating the merits of not having the project must also be included. The alternatives considered feasible are then evaluated for potential environmental impacts that may result from their implementation.

The following alternatives were considered, but were rejected in favor of the proposed SCM:

1) No project, assuming that the SCM will not be adopted; and
2) Extending the effective date from January 1, 2009 to January 1, 2010;

The no project alternative was rejected because it would not achieve emission reductions necessary to attain the State and federal ambient air quality standards. The extended effective date alternative was rejected because compliant coatings are currently available or will be available before the proposed effective date of January 1, 2009.

How were the proposed VOC limits in the SCM established?

Although some of the VOC limits in the proposed SCM are equivalent to those in SCAQMD's Rule 1151, ARB staff performed an independent analysis of each of the proposed VOC limits. These analyses are included in Chapter IV of the staff report. In proposing each of the VOC limits, ARB staff considered: (1) the results of the ARB's 2002 Survey; (2) the number of complying products currently on the market; (3) discussions with coating manufacturers, marketers and representatives of automotive refinishing facilities; and (4) trade journals and other literature related to the product category. As mentioned previously, the proposed VOC limits are the result of extensive interaction with the affected coatings industry, including discussions during six public workshops and several meetings and conference calls. Although each of the proposed limits is based on factors unique to each individual coating category, the following guiding principles were applied:

- Technological and commercial feasibility - assuring that reformulation technologies will be available by the effective date for each proposed limit, and that the overall performance of complying products will be similar to that of noncomplying products.
- Emission reductions achieved - assuring that our overall proposal will achieve the maximum feasible reduction in emissions.
- Minimize the potential for the use of Toxic Air Contaminants (TAC) - assuring that the proposal can be met without a significant increased use of TACs.

IV. COMPLIANCE WITH THE SCM PROPOSAL

How will manufacturers reformulate their products to comply with the VOC limits?

Manufacturers of coatings above the proposed VOC limits will need to reformulate some of their products to meet the applicable VOC limits. Manufacturers have the flexibility to choose any formulation that meets the applicable VOC limits and the reformulation options vary with each coating category (see Chapter IV of the staff report). In general, VOC solvents will need to be reduced by increasing the amount of water, exempt solvents, or coating solids. In solvent-borne products, VOC solvents may be partially replaced with exempt solvents such as acetone, parachlorobenzotrifluoride (PCBTF) or tertiary butyl acetate (if districts exempt TBAC from their VOC definitions). These changes may also require the use of different resin systems. For example, a higher solids formulation may need to use a less viscous resin system to improve flow and leveling. Solvent-borne products may also be reformulated to a water-borne system. As mentioned previously, ARB staff has proposed VOC limits that can be met without an increase in the use of TACs.

For the color coating category, there are water-borne coatings available that meet the proposed VOC limit. Water-borne color coatings have been used in Europe for about ten years and are being mandated there as of January 1, 2007. Manufacturers' literature for water-borne color coatings indicate that they perform as well as solvent-borne color coatings when applied properly.

Manufacturers have stated that additional color development is required before the water-borne color coatings that are currently marketed in Europe can be fully introduced in California. While manufacturers have indicated that most likely they will meet the color coating limit with water-borne coatings, they do not rule out the possibility of a solvent-borne reformulation option.

Are the VOC limits proposed in the SCM technologically and commercially feasible?

Yes. Most of the VOC limits in the proposed SCM are based on coating technologies that have been available since 2001. ARB staff analyzed our 2002 Survey data, consulted with coating manufacturers, evaluated coatings being used in Europe, and reviewed technical literature to determine appropriate VOC limits. As explained in detail in Chapter IV of the staff report, staff believes all of the VOC limits in the proposed SCM are technologically and commercially feasible by the effective date.

Our 2002 Survey results demonstrate that for nearly all the coating categories proposed in the SCM, products are currently available that comply with the proposed limits. Nine of the twelve categories for which we are proposing VOC limits have products that would meet the proposed limits. The complying marketshares vary with each coating category; however, this is not unexpected since the current VOC requirements also vary throughout the State. The coating category called "any other coating type" has no complying products because it was established as a catch-all category for which no products were reported in the 2002 Survey. Only two coating categories with reported products, adhesion promoters and pretreatment coatings, do not currently have compliant products in the marketplace. However, at least one coating manufacturer has indicated that they will sell compliant coatings in these categories prior to the 2009 effective date. Staff will conduct a technology assessment approximately one year prior to the implementation date for all the VOC limits that are more stringent than existing district limits. This technology review is a standard practice for identifying any unanticipated problems prior to implementation of the proposed VOC limits.

Will the reformulated products perform similar to existing products?

Yes. ARB staff concluded that the performance of the compliant products would be similar to the performance of their higher VOC counterparts. This conclusion is based on:

1) The current availability of complying products in the marketplace;

2) ARB staff's analyses of each product category, as detailed in Chapter IV; and
3) The extended use of complying products both here and in Europe in the case of water-borne color coatings.

What will the automotive refinishing facilities need to do to comply with the proposed SCM?

Automotive refinishing facilities will need to use compliant coatings or use control devices to reduce VOC emissions from their operations. Currently, only a few automotive refinishing facilities use control devices to reduce VOC emissions. If manufacturers comply with the proposed VOC limit for color coatings with water-borne coatings, automotive refinishing facilities may need to purchase air movement equipment and may need to install heaters to accelerate drying. There are several technology options that can be used by automotive refinishing facilities depending on their specific needs and their current equipment configurations. Smaller facilities may be able to purchase less expensive air movement equipment and may not need to install heaters because they have a lower volume of production. Chapter VII and Appendix C present our analysis of the costs automotive refinishing facilities may incur to comply with the proposed SCM.

What are the emission reduction benefits from the automotive coatings SCM proposal?

The *total emission reduction from statewide implementation* of the proposed VOC limits is estimated to be about 13.4 tons per day (tpd) in California. This reduction equates to about a 63 percent reduction in the total VOC emissions from the coating categories in the SCM.

Table ES-4 shows the estimated emission reductions by coating category.

Table ES-4 - Estimated Emission Reductions from Automotive Coatings

Coating Category	**Emission Reduction (tpd)**
adhesion promoter	.02
Clear coating	1.61
Color coating	8.78
Multi-color coating	N/A
Pretreatment coating	.21
Primer	1.01
Single-stage coating	1.68
temporary protective coating	<.01
Truck bed liner coating	<.01
underbody coating	<.01
uniform finish coating	.05
any other coating type	N/A
Total	**13.4**

V. ENVIRONMENTAL IMPACTS

Both CEQA and ARB policies require the ARB to evaluate the potential adverse environmental impacts of proposed projects. The ARB is authorized to prepare a plan or other written document (such as an environmental analysis chapter in the staff report) in lieu of an environmental impact report. Chapter VI presents a detailed analysis of the environmental impacts of the proposed SCM.

What are the expected environmental benefits of the automotive coatings SCM?

The primary environmental benefit of the SCM will be a reduction in the formation of tropospheric (ground level) ozone, PM_{10} and $PM_{2.5}$. It has long been known that exposure to ground level ozone, PM_{10} and $PM_{2.5}$ have adverse impacts on public health. Research has shown that, when inhaled, ozone, PM_{10} and $PM_{2.5}$ can cause respiratory problems, aggravate asthma, and impair the immune system.

In the presence of sunlight, the VOCs from automotive coatings and other sources react with oxides of nitrogen (NO_x) to form ozone. In addition, VOCs have been found to be a source of PM_{10} and $PM_{2.5}$, either through condensation of the VOCs or complex reactions of VOCs with other compounds in the atmosphere. Therefore, districts that adopt the SCM will reduce their VOC emissions and experience a positive impact on air quality and public health. The exact reductions in ozone, PM_{10} and $PM_{2.5}$ cannot be accurately predicted due to the wide variety of factors that impact the formation of ozone, PM_{10} and $PM_{2.5}$. These factors include atmospheric conditions, the ratio of VOCs to NO_x in the atmosphere, and the reactivity (ozone formation potential) of the individual VOCs emitted. However, numerous scientific studies have shown that by reducing VOC emissions, ozone, PM_{10} and $PM_{2.5}$ concentrations are reduced. Therefore, by reducing ozone and PM concentrations, this SCM would reduce the health risks posed by exposure to these pollutants.

Additionally, automotive coatings contain several known TACs such as toluene, xylenes, and methyl ethyl ketone (MEK). To the extent these are reduced by the reformulation to lower VOC coatings, there would be a decrease in TAC emissions. Currently, these compounds account for over 27 percent of the VOC emissions. If districts exempt TBAC from their VOC definitions, it may be used as a substitute for toluene, xylenes and MEK, which would decrease the use of these TACs. The extent of TBAC substitution could vary by coating category, however, it is believed that as much as 50 percent of the toluene, xylenes, and MEK could be replaced with TBAC. Because many automotive refinishing facilities are located in or near low-income residential areas, decreasing TAC emissions from automotive coatings would benefit environmental justice communities.

Are there any potential significant adverse environmental impacts?

No. In Chapter VI, we examined the potential effect of the proposed SCM on air quality, water demand, water quality, public services (public facility maintenance, fire protection), transportation and circulation, solid waste/hazardous waste, and hazards to the public or the environment. Based on our analysis, we do not expect any significant adverse environmental impacts to result from the implementation of the proposed SCM.

There is a slight potential for an adverse environmental impact if districts exempt TBAC from their VOC definitions. The Office of Environmental Health Hazard Assessment has determined that TBAC is a potential carcinogen because it metabolizes to tertiary butyl alcohol. Assuming under a worst-case scenario that TBAC is substituted for 50 percent of the toluene, xylenes, and MEK in automotive coatings, the maximum potential cancer risk is estimated to be 2.8 excess lifetime cancer cases per million for a resident living near the largest known auto body shop (1,100 gallons per year). However, if the VOC limit for color coatings is met with water-borne coatings, the maximum potential cancer risk would be reduced to about 1.4 excess lifetime cancer cases per million.

VI. ECONOMIC IMPACTS

How did ARB staff evaluate the potential economic impacts of the proposed SCM?

ARB staff evaluated the economic impacts of the proposed SCM by: 1) contacting coating manufacturers; 2) comparing the ingredient costs of typical low VOC formulations with higher VOC formulations; and 3) contacting spray booth equipment and air movement equipment manufacturers. The analysis assumes that all districts adopt the proposed SCM, including areas that are now subject to the U.S. EPA National Rule. As detailed below, this information was used to perform a business impacts analysis and a cost-effectiveness analysis for the SCM.

How was the business impacts analysis conducted and what are the results?

In our economic impact analysis, we evaluated the potential impact of the proposed VOC limits on profitability and other aspects of businesses subject to the limits. To conduct our analysis, we relied on information provided by coating manufacturers, ingredient costs for typical complying and noncomplying formulations, and information from manufacturers of spray equipment and air movement equipment. We then evaluated the impact of these costs on typical businesses using a combination of publicly available financial databases (Dun and Bradstreet and Ward's Business Directory of United States Manufacturing Industries), industry journals/literature such as the Chemical Market Reporter, and discussions with industry representatives.

We utilized the change in "return-on-owner's equity" (ROE) as an indicator of the SCM's potential impacts on business profitability. The cost to comply with the proposed SCM, through increased research and development, equipment purchases, and increased ingredients costs is presumed to impact a business' ROE and therefore its profitability. Our analysis indicates that the total annualized cost to comply with the proposed SCM is about $14 million. The average annual cost to automotive coating manufacturers is estimated to be about $320,000. This results in an average estimated change in ROE of 0.07 percent. The average annual cost to automotive refinishing facilities is estimated to be about $3,400 resulting in an average change in ROE of 15 percent. This cost estimate assumes that coating manufacturers pass on all of their costs to the automotive refinishing facilities. The estimated change in ROE for automotive refinishing facilities would be significant if the costs are not passed on to the consumers.

Our ROE analysis for the proposed SCM may overestimate the impact on businesses because it assumes that all of the costs of the proposed SCM will either be absorbed by the coating manufacturers or the automotive refinishing facilities. In reality, we expect that at least some of the investment costs to comply with the proposed VOC limits will be passed on to consumers. For example, an automotive refinishing facility could pass their entire costs on to consumers by adding $11 to an average repair cost. Adding $11 to an average repair cost would increase the repair cost by only 0.5 percent. The analysis also does not quantify the extent of cost mitigation due to "technology-transfer" between product lines.

While we expect that most businesses will be able to absorb the costs of the proposed limits without significant adverse impacts on their profitability, there is the possibility that some individual businesses will be adversely affected when districts adopt the proposed SCM. Therefore, it is possible that the proposed SCM may have a significant adverse impact on some businesses that are not in a market position to invest monies to develop new low VOC products, or to absorb the increased cost resulting from their compliance with the proposed SCM.

Based on our analysis, we do not expect the proposed limits in the SCM to have a significant impact on employment, or business creation, elimination, or expansion. We also do not expect the proposed SCM to have a significant impact on the competitiveness of California businesses compared with those outside of California. This is because all companies that sell these products in the State would have to meet the proposed requirements, whether located in or outside of California.

The VOC limits in the proposed SCM will primarily impact automotive coatings manufacturers and automotive refinishing facilities that use those coatings. However, we recognize that other industries could also be impacted to a lesser amount, which is difficult to quantify. These industries include distributors, retailers, and "upstream" suppliers who supply solvents and other chemicals used in automotive coatings.

Distributors and retailers could be impacted because they need to ensure that noncomplying products are not sold after the implementation date. In addition, the current market dynamics are such that often distributors or manufacturers provide incentives to customers in order to obtain and maintain accounts. While this is the cost of doing business, the changes may require some new equipment that distributors would likely be expected to provide. However, we are unable to quantify the magnitude of such costs because industry wide data are not available nor are the incentives consistent across the industry.

Upstream suppliers could be impacted because manufacturers will be purchasing some different solvents and other materials for their reformulated products. However, we do not expect these changes to result in a major impact on the affected industries because chemical companies generally supply many different industries, and because many of the upstream suppliers also provide the alternative products which will be used in the reformulated products. In fact, we expect some upstream suppliers will benefit since the proposed limits are likely to create new or increased demand for materials to be used in compliant formulations.

Will the proposed SCM be cost-effective?

Yes. Cost-effectiveness is one measure of the SCM's efficiency in reducing a given amount of pollutant (often reported in "dollars (to be) spent per pound of VOC reduced"). The methodology used to determine cost-effectiveness is well established and often used to compare a proposed regulation's cost-efficiency with those of other regulations. To calculate the cost-effectiveness of the SCM, we divided the estimated total annual cost to manufacturers and automotive refinishing facilities by the total emission reduction. To conduct our analysis, we relied on specific formulation data from the 2002 Survey, industry journals/literature such as the Chemical Market Reporter for ingredient unit prices, and discussions with industry representatives. We estimate the cost-effectiveness weighted by emissions reductions across all the proposed limits to be about $1.43 per pound of VOC reduced. This estimated cost-effectiveness value is within the typical range of costs of existing ARB control measures and district rules.

Will automotive refinishing facilities have to pay more for automotive coatings subject to the proposed SCM?

Yes. Automotive refinishing facilities may have to pay more for some products subject to the automotive coatings SCM, depending on the extent to which manufacturers are able to pass along their costs to automotive refinishing facilities. While the raw material costs for compliant coatings is comparable or, in some cases, less costly than that of higher VOC coatings, typically there is a premium charged by paint manufacturers for new coatings. It is not possible to quantify the potential price increase per gallon of coating because most manufacturers did not provide cost data as part of the survey.

Will consumers have to pay more for automotive repairs?

Yes. As discussed in Chapter VII of the staff report, assuming that all the costs of the proposed SCM are passed along to the consumers who need automotive repairs, the average cost of a repair would increase by about $11. The average repair cost is estimated to be about $2,200.

VII. FUTURE PLANS

What happens if the Board approves the proposed SCM?

If the Board approves the proposed SCM, staff will assist the districts, if requested, as they embark in their own rulemakings to incorporate the SCM into their local rules.

Will ARB staff track industry's progress toward meeting the proposed VOC limits?

Yes. Staff plans to conduct technology assessments for all of the proposed VOC limits that are more stringent than existing district limits at least one year prior to the 2009 effective date. We believe that the proposed limits are feasible based on all the evidence available to us. However, it is standard practice for the ARB to conduct these reviews to ensure that unanticipated problems do not arise.

VIII. RECOMMENDATION

Staff recommends that the Board approve the proposed SCM and direct staff to transmit the SCM to the districts for consideration.

I. BACKGROUND

In this staff report, we present the results of an evaluation of automotive coatings which led to our proposal for a Suggested Control Measure (SCM). The assessment included: a survey of automotive coatings sold in California in 2001; an examination of several compliance flexibility options; technical assessments for the various coating categories; an environmental impact assessment; and a cost impact analysis. The proposed SCM for automotive coatings is the first collaborative regulatory effort undertaken by the Air Resources Board (ARB/Board) staff, the air pollution control or air quality management districts (districts), and affected industry representatives for this coating category. The development of the SCM was the direct result of a request from the districts for ARB to provide technical assistance to improve the consistency and enforceability of existing rules.

A. OVERVIEW

Automotive coatings are coatings used, or recommended for use, in motor vehicles or mobile equipment refinishing, repair, or restoration. Typical automotive coatings include primers, color coatings and clear coatings. These coatings are used for refinishing vehicles such as: automobiles, trucks, buses, golf carts, vans, motorcycles, tanks, armored personnel carriers, trains, railcars, truck trailers, mobile cranes, bulldozers and street cleaners. The estimated volatile organic compound (VOC) emissions from automotive coatings in California were about 20.7 tons per day (tpd), on an annual average basis, in 2001. This represents about two percent of the total stationary source VOC emissions.

VOCs are precursors to the formation of ozone and particulate matter (PM). Ozone and PM are two of the most serious air pollutants for which the State and national ambient air quality standards are exceeded in much of California. Ozone is formed from photochemical reaction of oxides of nitrogen and VOCs. Scientific studies show that exposure to ozone can result in reduced lung function, increased respiratory symptoms, increased airway hyperreactivity, and increased airway inflammation. Exposure to ozone is also associated with premature death, hospitalization for cardiopulmonary causes, asthma episodes and restrictions in physical activity. Ozone is a strong oxidizer and exposure to levels of ozone exceeding the current ambient air quality standards lead to a variety of adverse health effects, as well as a reduction of crop and timber production, and damage to plants and property. Emissions of VOCs also react in the atmosphere to form PM_{10} and $PM_{2.5}$. Inhalation of PM_{10} and $PM_{2.5}$ deep into the lungs reduces human pulmonary function. Premature deaths linked to PM_{10} and $PM_{2.5}$ exposure are now at levels comparable to deaths from motor vehicle accidents and second-hand smoke. Attaining the current State ambient air quality standards for PM_{10} and ozone would annually prevent approximately 6,500 premature deaths or three percent of all deaths in California. (ARB, 2002)

B. AUTOMOTIVE COATINGS MANUFACTURERS

The automotive coatings market in California was estimated at approximately 3.7 million gallons in 2001. Approximately 95 percent of the total sales for 2001 were supplied by seven manufacturers. Table I-1 lists the top seven manufacturers based on data reported in the 2002 Survey (ARB, 2005).

Automotive coatings are normally supplied to automotive refinishing facilities through a network of distributors (jobbers). The distributors are generally independent businesses or may be owned by the coating manufacturer (e.g., Sherwin Williams). Most distributors sell coatings locally or regionally.

Table I-1 - Top Seven Coatings Manufacturers

Company	Scope
Akzo Nobel	Global
BASF	Global
DuPont	Global
Ellis Paint	California
PPG	Global
Sherwin Williams	Global
Standox/Spies Hecker	Global

Automotive coatings are formulated using solids and liquids. The solids consist of three main categories: (1) resins (polymers or binders) bind the pigments and additives together and form a film upon drying. Sometimes co-polymers are used to modify the properties of the primary resin. Some resins used in automotive coatings include alkyds, latex, oils, vinyl, acrylics, celluloses, epoxies, urethanes, and polyurethanes; (2) pigments are finely ground powders dispersed in the coating; pigments provide color, hide the underlying surface, and contribute other properties; and (3) additives or specialty chemicals which assist in manufacture and application, may improve the properties of the finished film. Examples of additives include preservatives, wetting agents, coalescing agents, freeze-thaw stabilizers, anti-foam agents, and thickeners. Liquids are usually solvents, which are the volatile carriers used to control the viscosity of the coating and provide application properties. Some typical solvents used are: aromatic or aliphatic hydrocarbons, ketones, esters, alcohols, glycols, glycol ethers, and water.

Most automotive coatings are sold as components with a few available for use in ready-to-use containers. The coating components are mixed in the automotive refinishing facility, as needed, by the painter, prior to use. Mixing ratios of components can vary depending on temperature and other factors. Generally, to make the coating ready to spray, the process requires combining the base product with a VOC solvent, water, or an exempt solvent depending upon the manufacturer's specifications for reaching the correct viscosity for spraying application. Colors normally require inter-mixing various toners in order to achieve the desired color.

Table I-2 is a chronology of the development of automotive coatings technologies (Entec, 2000). Most automotive refinishing facilities have a "mixing bank", and may use an automatic mixing machine to insure precise color formulations. Small operations use ready-to-spray (RTS) coatings or will acquire the mixed coatings from a supplier or jobber.

Table I-2 - Chronology of Development of Coating Technologies

Date	Coating Technology
1920s	Nitrocellulose Resins
1950s	Alkyd Resins
1960s	Thermoplastic Acrylic Resins
1970s	2 Component Polyurethane-Acrylic Resins
1990s	High Solids Urethanes

C. AUTOMOTIVE REFINISHING FACILITIES

Automotive coatings operations are conducted at automotive refinishing facilities which include auto body repair/paint shops, production auto body paint shops, new car dealer repair/paint shops, fleet operator repair/paint shops and custom restoration facilities. Some of these facilities do collision repair and some do commercial vehicle refinish and repair. While we do not have a specific breakdown of facilities doing commercial (fleet) vehicle refinish only, we expect this group to be relatively small. Most of the facilities perform collision repair and refinishing for the passenger car segment with some performing mostly complete paint jobs (i.e., facilities such as MAACO and Earl Scheib).

The total number of facilities involved in the repair and refinishing of vehicles is estimated to range from about 4,000 to over 6,000. (DuPont, 2005; DCA, 2005). Many of these operations do not have a district permit because they use relatively small volumes of coatings. Some districts do not require a permit if a facility uses less than a specified volume of coatings and cleaning solvents, typically one gallon per day. However, most districts require a permit if a facility has a spray booth, regardless of the volume of coatings and cleaning solvents used.

The majority of automotive refinishing facilities are small businesses typically having from one to five employees. Table I-3 lists the number of facilities based on gross annual revenue. Over 70 percent of automotive refinishing facilities are estimated to have one million dollars or less in annual revenue (DuPont, 2005). Some of these facilities may be doing body repair work without painting the vehicle. We are aware that some facilities subcontract the painting portion of the repair job. However, we are unable to quantify the number of facilities involved only in body repair.

Table I-3 - Distribution of Automotive Refinishing Facilities Grouped by Total Annual Revenue in 2002		
Total Annual Revenue	**Number of Facilities**	**Percent of Total**
Less than $0.5 Million	2,074	50.4
$0.5 to $1 Million	878	21.3
>$1 to $2.5 Million	883	21.5
> $2.5 Million	278	6.8
Total Statewide	4,113	100

The automotive refinishing facilities vary greatly in size and level of sophistication. Some automotive refinishing facilities are medium to large, well run, relatively automated facilities while others are family-run shops, which may have one or two employees. Table I-4 shows the estimated number of automotive refinishing facilities in the larger districts. (DuPont, 2005)

Table I-4 - Estimated Number of Automotive Refinishing Facilities by District	
District	**Number of Facilities**
South Coast Air Quality Management District (SCAQMD)	1,790
Bay Area Air Quality Management District (BAAQMD)	934
San Joaquin Valley Air Pollution Control District (SJUVAPCD)	330
Sacramento Metropolitan Air Quality Management District (SMAQMD)	171
Other Districts	888
Total Statewide	4,113

D. REGULATORY AUTHORITY

In California, the districts have primary responsibility for controlling emissions from automotive refinishing facilities. In 1988, the districts began to develop regulations for automotive coatings and refinishing operations.

1. District Rules in California

Typically, the districts develop regulations that define coating categories and set VOC limits that affect manufacturers, suppliers, and users of automotive coatings. The rules establish VOC content limits to achieve the maximum feasible emission reductions. Coatings that are high in VOCs are either replaced with an existing low-VOC coating, or are reformulated to meet the VOC limits established in the rules.

The ARB has authority to oversee the districts' activities. In consultation with the districts, the affected industry and the U.S. EPA, ARB staff developed the proposed SCM. The SCM will be used as a model by the districts when adopting or amending their automotive coatings rules. The SCM will provide uniformity and enhance enforcement of district rules. In Chapter III, we provide a detailed description of the proposed SCM.

Twenty of the 35 districts in California have rules regarding automotive coatings. Currently, approximately 95 percent of the State's population is covered by the existing district rules. Most of the rules have been included in the State's Implementation Plan (SIP). Table I-5 lists the districts' rules for this category.

Table I-5 - Existing District Rules			
District	**Rule Number**	**Adopted**	**Last Amended**
Antelope Valley APCD	1151	7-8-88	7-20-99
Bay Area AQMD	8-45	6-7-89	7-1-99
Butte County APCD	235	6-19-97	8-22-02
El Dorado County APCD	230	9-27-94	
Feather River AQMD	3-19	8-6-98	
Glenn County APCD	V-105	5-19-99	
Imperial County APCD	427	9-14-99	
Kern County APCD	410-4A	5-16-91	3-7-96
Mojave Desert AQMD	1116	3-2-92	4-12-99
Placer County APCD	234	11-3-94	4-9-98
Sacramento Metropolitan AQMD	459	12-7-95	10-2-97
San Diego County APCD	67-20	11-13-96	8-13-97
San Joaquin Valley APCD	4602	4-11-91	12-20-01
San Luis Obispo County APCD	423	2-23-88	11-13-02
Santa Barbara County APCD	339	8-13-97	4-17-19
Shasta County AQMD	3-25	4-1-97	
South Coast AQMD	1151	7-8-88	12-11-98
Tehama County APCD	4-35	11-10-98	
Ventura County APCD	74-18	1-28-92	9-10-96
Yolo-Solano County AQMD	2-26	8-13-97	

Although there are some similarities in the district rules, the rules vary from district to district. Some of the differences include: definitions of terms, coating categories, VOC limits, exemptions allowed, and recordkeeping requirements. Table I-6 summarizes the key VOC limits from four district rules.

Table I-6 – Summary of VOC Limits								
	SCAQMD Rule 1151		SJUVAPCD Rule 4602		SMAQMD Rule 459		BAAQMD Rule 8-45	
	Cars*	Large** Vehicles	Cars	Large Vehicles	Cars	Large Vehicles	Cars	Large Vehicles
Category	g/l	g/l	g/l	g/l	g/l	g/l	g/l	g/l
Pretreatment Wash Primer	780	780	780	780	780	780	780	780
Precoat	N/A	N/A	600	600	600	600	580	580
Primer/Primer Surfacer	250	250	250	250	250	250	250	250
Primer Sealer	340	250	420	340	420	250	420	340
Topcoat	420	340	420	420	420	420	420	420
Metallic Iridescent Topcoat	420	340	520	420	520	420	520	420
Multi-stage Topcoat	420	340	540	N/A	540	N/A	540	N/A
Specialty Coating	840	840	840	840	840	840	840	840
Camouflage	N/A	N/A	N/A	420	N/A	420	N/A	420
Multi-Colored	685	685	N/A	N/A	N/A	N/A	N/A	N/A
Multi-Colored Multistage	420	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Rubberized Asphaltic Underbody	N/A	N/A	N/A	N/A	540	540	N/A	N/A
Temporary Protective Coating	N/A	N/A	60	60	60	60	N/A	N/A

* *Passenger cars, small-sized trucks and vans, medium-sized trucks and vans, motor homes and motorcycles.*

** *Large sized trucks, buses and mobile equipment*

2. The National Automotive Coatings Rule

The districts that do not have their own rule for automotive coatings implement U.S. EPA's national rule. In the 1990 Clean Air Act Amendments, the United States Congress enacted section 183(e), which established a new regulatory program for controlling VOC emissions from consumer and commercial products. Section 183(e) directs the U.S. EPA Administrator to determine the ozone forming potential of these products, and to prioritize the need for regulation of these products.

The U.S. EPA promulgated a final rule to control VOC emissions from automotive refinish coatings, such as primers and topcoats on August 14, 1998. The national rule was published in the Federal Register on September 11, 1998 (EPA, 1998). This rule was specifically aimed at manufacturers and importers of automotive coatings. However, the national rule had little effect on the rules already adopted by the districts. The VOC limits in the district rules are generally more stringent than those in the national rule.

3. California Clean Air Act

In addition to the federal planning requirements, the CCAA imposes a separate set of planning requirements on districts. The CCAA was enacted in 1988, and has the fundamental goal that all areas of California are to attain the State ambient air quality standards for ozone by the earliest practicable date. The Board sets the State ozone standards. In March 2005, the Board reviewed California's 1-hour standard for ozone and determined that it alone was not sufficiently protecting human health. Consequently, ARB adopted a new 8-hour standard for ozone and retained the existing 1-hour ozone standard. California's ozone standards are:

- 1-hour average standard at 0.09 ppm, not to be exceeded
- 8-hour average standard at 0.070 ppm, not to be exceeded

California's new 8-hour ozone standard is more stringent than the federal 8-hour ozone standard of 0.08 ppm. The U.S. EPA recently eliminated the national 1-hour ozone standard of 0.12 ppm and replaced it with their 8-hour ozone standard. As specified in the CCAA, the ARB has designated areas of California to be in "attainment" or "nonattainment" for the State ozone standards. The districts that are nonattainment for the State ozone standards are required by the CCAA to prepare plans, which must be designed to achieve and maintain the standards by the earliest practicable date. Each nonattainment district is also required to update their plans every three years to include the latest technical information, and any changes in demographics or other relevant information. In developing their plans, each district determines which measures are necessary to include, as well as the specific details of each included measure. In many of the nonattainment districts, substantial additional emission reductions will be necessary in order to achieve and maintain the State ozone standards. By revising their existing rules to be consistent with the SCM, the districts can achieve greater emission reductions to help them attain the ozone standards.

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II. DEVELOPMENT PROCESS FOR SCM

Development of the SCM was initiated by ARB staff in cooperation with the districts. The key objectives of the SCM are to: (1) improve the overall effectiveness and enforceability of district rules; (2) improve consistency among district rules; and (3) achieve VOC emission reductions.

Development of the SCM included the following activities:

- Conducting a survey of automotive coatings manufacturers;
- Conducting meetings with districts, U.S. EPA Region IX representatives, and representatives of the affected industry;
- Reviewing existing district rules and the National Volatile Organic Compound Emission Standards for Automobile Refinish Coatings;
- Holding public workshops and meetings with individual manufacturers, distributors, automotive refinishing facility owners, and other interested parties;
- Assessing and evaluating existing coatings technologies for the categories; and
- Preparing a comprehensive emissions and cost analysis.

A. AUTOMOTIVE COATINGS 2002 SURVEY (2002 Survey)

In 2001, ARB staff began working with manufacturers and industry groups to develop a new survey of automotive coatings sold in California. In 2002, ARB sent out the Automotive Refinish Survey seeking 2001 product ingredient and sales data. A draft 2002 Survey report was made available to industry in March 2005. Appendix B is a copy of the survey. The 2002 Survey report can be obtained from the SCM webpage at http://www.arb.ca.gov/coatings/autorefin/scm/scm.htm.

B. DISTRICTS AND U.S. EPA

ARB staff formed a working group with districts and U.S. EPA staff to assist in the development of the SCM. The main objectives of the working group meetings were to discuss:

- The needs of the districts regarding the implementation of the SCM;
- The emission reductions achievable from automotive coatings;
- Findings of the 2002 Survey;
- Specific regulatory language; and
- Flexibility options for manufacturers to comply with new automotive coatings regulations.

C. PUBLIC PROCESS

A vital element of the SCM development process is the participation of members of the industry and other affected parties. The ARB staff held a series of public workshops. These workshops were attended by representatives from industry (e.g., manufacturers and suppliers of automotive coatings and components, ingredient manufacturers, automotive refinishing facility owners and trade associations), districts, the U.S. EPA, and other interested parties. In addition to the public workshops, ARB staff held meetings with individual manufacturers and distributors, as well as automotive refinishing facility owners to ascertain their concerns, and accept suggestions and necessary data. Table II -1 lists the public workshops and meetings staff conducted as part of the SCM development process.

Table II-1 - List of Public Workshops and Meetings		
Date	**Type of Meeting**	**Location**
April 6, 2005	District Working Group	Sacramento
April 27, 2005	District Working Group	Sacramento
May 26, 2005	District Working Group	Sacramento
June 8, 2005	Industry Symposium	Contra Costa College
June 11, 2005	Industry Meeting	Anaheim
June 14, 2005	District Working Group	Sacramento
June 28, 2005	Public Workshop	Diamond Bar
June 30, 2005	Public Workshop	Sacramento
August 9, 2005	Public Workshop	Fresno
August 11, 2005	Public Workshop	Oakland
August 23, 2005	Public Workshop	Diamond Bar
October 5, 2005	Public Workshop	Sacramento

During the development of the SCM, a series of documents were created. The documents include: SCM draft regulatory language, working group invitations, public workshop notifications and meeting notices, as well as reports, and other correspondence and communication. In an effort to include all interested parties in the development process, an extensive mailing list of over 6,000 recipients was compiled that included manufacturers, suppliers, automotive refinishing facilities, district contacts, U.S. EPA contacts, trade associations, and other interested parties. Web and list serve pages dedicated to the SCM were developed. The webpage was used to post relevant documents, announcements, and staff contact information. The list serve page assisted in the distribution and assimilation of information regarding the development of the SCM. The function of the list serve was to inform over 165 subscribers of all additions and updates to the SCM webpage.

D. EVALUATION OF THE DISTRICT RULES AND NATIONAL RULE

The motivation for developing the SCM was to provide consistency in district rules, increase rule enforceability, and achieve the maximum feasible reduction in VOC emissions. The national rule applies to manufacturers and importers of automotive coatings. In contrast, the SCM applies to suppliers, sellers, manufacturers, or anyone that distributes any automotive coating, the components, or associated solvent for use within the district, as well as any person who uses, applies, or solicits the use or application of any automotive coating or associated solvent within the district. Since the district rules have limits that are equal to, or lower than, the limits in the national rule, the objective of the SCM is to set limits that are at least or more stringent than those in existing district rules. The national rule specifically allows states or local governments to adopt more stringent emission limits.

E. TECHNOLOGY ASSESSMENT

An essential element of developing the SCM was to assess the technical feasibility of the proposed limits for the coatings categories. Staff conducted a technology assessment for all the coating categories included in the SCM. Some of the sources of information utilized in the technology assessment included:

- The ARB 2002 Survey data;
- Manufacturers' brochures and product technical data sheets;
- Product labels and material safety data sheets;
- Internet websites;
- Books and trade magazines;
- Technical reports and training manuals;
- Discussions with manufacturers, suppliers, and users of coatings;
- District rules and discussions with district staff; and
- Information from trade associations.

The proposed VOC limits for the coating categories in the SCM are based on our assessment of detailed information from manufacturers on coatings sold in 2001. Staff evaluated technical data provided by the manufacturers for coatings in each category. Staff evaluated the coatings, solids content by volume, and VOC content, as well as other characteristics. The technology assessment for the SCM is discussed in Chapter IV.

F. COST ANALYSIS

Although it is not required under the California Administrative Procedure Act (APA), the economic impact of the SCM on affected businesses and consumers was evaluated and quantified. In 2002, the ARB sent a survey to manufacturers of automotive coatings. The formulation data received from this survey was one of the sources of information used to perform a cost-effectiveness analysis and a business impacts analysis. The cost-effectiveness analysis measures how cost-efficient the proposed SCM will be in reducing VOCs relative to other regulatory programs. The business impacts analysis evaluates the impacts on profitability, employment, and competitiveness to California businesses, consumers, and government agencies.

Staff used survey formulation data and performed research to identify typical non-complying and complying formulations for the coating categories, and the relative cost of raw materials were estimated for these formulations. Examples of sources of information for the cost analysis were: the 2002 Survey; material safety data sheets; formulations data provided by coating manufacturers; equipment manufacturers; district staff; trade magazines; and Internet searches. Results of the cost analysis are reported in Chapter VII.

III. PROPOSED SUGGESTED CONTROL MEASURE

In this chapter, we provide a plain English discussion of the staff's proposed SCM for automotive coatings, which is contained in Appendix A. All sections of the proposed SCM are discussed below. Where applicable, key terms or concepts of the proposed SCM are discussed.

Control of emissions from automotive coatings is primarily the responsibility of the districts. The proposed SCM may be used as a model by the districts when adopting and amending their local automotive coatings rules. Accordingly, throughout the staff report references are made to the most common or most restrictive district VOC limits, since the district rules are the enforceable regulations.

A. APPLICABILITY

The proposed SCM applies to manufacturers, distributors, sellers, and users of automotive coatings, but does not apply to aerosol coatings in containers of any size. The proposed SCM applies to coatings that are used to coat any part or component of motor vehicles (such as cars, buses, and golf carts) or mobile equipment (such as railcars and tractors). For the complete definitions of motor vehicle and mobile equipment, please see sections 3.19 and 3.20 of the proposed SCM. The proposed SCM also applies to manufacturers, distributors, sellers, and users of solvents used in cleaning operations.

B. DEFINITIONS

To help clarify and enforce the proposed SCM, section 3 of the proposed SCM provides definitions for terms used which are not self-explanatory. This section also provides equations to determine the VOC content of automotive coatings.

C. STANDARDS

The proposed SCM differs from the U.S. EPA's national rule and current district rules by eliminating the composite VOC limit for basecoat (color) and clear coating systems. The composite VOC limit is being replaced with individual VOC limits for color coatings and clear coatings. A total of 12 VOC limits are proposed, which would become effective on or after January 1, 2009.

The table of standards in the proposed SCM, reprinted below as Table III-1, contains the proposed limits for maximum VOC content in each category of automotive coatings. If the coating is represented in such a way that indicates it can be used in more than one of the coating categories listed in Table III-1, then the lowest, or most restrictive, VOC content limit will apply.

If a coating does not meet any of the definitions for the specific categories listed in Table III-1, that coating will fall into the category labeled "Any other coating type" and the VOC limit of 250 grams per liter (g/l) will apply. Limits are expressed in grams of VOC per liter of coating thinned to the manufacturer's maximum recommendation, excluding the volume of any water and exempt compounds.

Table III-1 - Proposed Coating Categories and VOC Limits

	VOC regulatory limit as applied Effective January 1, 2009	
Coating Category	**grams/liter**	**(pounds per gallon*)**
Adhesion Promoter	540	4.5
Clear Coating	250	2.1
Color Coating	420	3.5
Multi-Color Coating	680	5.7
Pretreatment Coating	660	5.5
Primer	250	2.1
Single-Stage Coating	340	2.8
Temporary Protective Coating	60	0.5
Truck Bed Liner Coating	310	2.6
Underbody Coating	430	(3.6
Uniform Finish Coating	540	4.5
Any other coating type	250	2.1

* English units are provided for information only. VOC limits are expressed in grams VOC per liter of coating, less water and exempt compounds.

The proposed SCM also prohibits anyone from applying, manufacturing, blending, repackaging for sale, supplying, offering for sale, distributing, possessing (at an automotive refinishing facility) or selling any coating that does not meet the VOC limits listed in Table III-1, except when the coating is sold for use with an approved emission control system that is at least 85 percent efficient. It is a violation of the proposed SCM to solicit, require or specify the use of a coating that does not meet the VOC limits set forth in Table III-1, unless the coatings are used at a facility that complies with section 4.3 (alternative compliance provisions).

The standards section specifies the manner in which coatings may be applied. With the exception of underbody coatings, truck bed liner coatings, coatings used in graphic arts and coatings of any type if less than one fluid ounce, the automotive coating must be applied by brushing, dipping, rolling, electrostatic spraying, or spraying with a high-volume, low-pressure spray (HVLP) gun or an approved equivalent.

Section 4.8 of the proposed SCM also prohibits the use of solvents that exceed a VOC content of 25 g/l at an automotive refinishing facility, and specifies that any VOC-containing materials or products must be stored in closed, vapor-tight containers when not in use. Spray guns must be cleaned in a closed system or its approved equivalent.

D. ADMINISTRATIVE REQUIREMENTS

The proposed SCM requires each manufacturer to provide written data for each of their products that includes the physical properties of the coating, coating component, or solvent. For a complete description of what information must be included on the manufacturer data sheets, please see sections 5.1.1, 5.1.2, and 5.1.3 of the proposed SCM. Manufacturers must also clearly label all coatings and coating components with the applicable use categories listed in Table III-1 and the VOC content. Manufacturers must label solvents with the VOC content.

The proposed SCM requires that those who use automotive coatings or solvents at automotive refinishing facilities keep records indicating the name and manufacturer of the coating or solvent, method of applying the coating or solvent, coating type and mix ratio, VOC content of the coating or solvent, and whether the product used is a coating or a solvent. This information, along with manufacturer's data sheets or other written materials that provide the actual and regulatory VOC content and purchase records listing the coating type, name, and volume of coatings or solvents must be kept at the location where the coatings are applied for a minimum of three years. These records are to be made available for inspection upon request.

Anyone using an approved emission control system per section 4.3 instead of using coatings that meet the VOC limits in Table III-1 must keep daily records, to be maintained for a minimum of three years. These records will prove continuous and correct use of the control system during the time that emissions are occurring.

The proposed SCM specifies that no person shall manufacture, blend, repackage for sale, supply, sell, offer for sale, or distribute or apply any automotive coating or automotive coating component that does not meet the VOC limits in the proposed SCM. However, if the coating is for use exclusively within an emission control system or outside the district, a person may manufacture, blend, repackage for sale, supply, sell, offer for sale, or distribute an automotive coating or component that does not meet the VOC limits. In this situation, that person must keep records of the quantity manufactured, blended, repackaged, supplied, sold, offered for sale, or distributed; size and number of containers; VOC content; name, address, phone number, retail tax license number, and valid district permit number for the person to whom or for whom the coating or component was manufactured, blended, repackaged, supplied, sold, offered for sale or distributed; and whether the coating is for use in an approved emissions control system or outside the district. As with all records pertaining to the proposed SCM, this information must be kept for a minimum of three years and be made available for inspection upon request.

E. TEST METHODS

Test methods for automotive coatings and solvents subject to the proposed SCM are provided in this section. These include tests for metallic and acid content, tests for the determination of various exempt compounds, a method for determining VOC content of solvents or coatings, tests to determine control and transfer efficiency, and a method to determine if a spray gun's transfer efficiency is equivalent to that of a HVLP spray gun. Please see section 6 of the proposed SCM for complete descriptions and reference numbers for these test methods.

IV. DESCRIPTION AND TECHNICAL ASSESSMENT OF THE COATING CATEGORIES AND SOLVENTS

A. INTRODUCTION

To ensure that the proposed SCM is technologically and commercially feasible, we considered the following:

1) The results of the 2002 Automotive Coatings Survey;
2) Information from automotive coating manufacturers, solvent suppliers, and other industry groups;
3) The existing VOC limits for automotive coatings and solvents; and
4) The results of our technical analyses of all the coating categories proposed in the SCM.

Based on the technical analyses, we believe that the overall performance of the reformulated products in each category will be similar to the performance of their higher VOC counterparts. Except for the adhesion promoter and pretreatment coating categories, complying products are commonly available and currently being used. However, we will conduct technology reviews for the proposed VOC limits that are lower than the most stringent limits in existing district rules prior to the effective date of those limits.

In this chapter, we provide a discussion of the automotive coating categories and the solvents included in the proposed SCM. The coating categories are adhesion promoter, clear coating, color coating, multi-color coating, pretreatment coating (formerly called pretreatment wash primer), primer, single-stage coating (formerly called topcoat), temporary protective coating, truck bed liner coating, underbody coating, uniform finish coating, and any other coating type.

Appendix D discusses categories that are currently in district rules or the national rule, but which are not specifically listed in the proposed SCM. These coating categories are multi-stage topcoat system, specialty coating, metallic/iridescent, primer sealer, primer surfacer, camouflage, precoat, extreme performance coatings, elastomeric material, anti-glare safety coating, impact resistant coating, water hold-out coating, weld-thru coating, bright metal trim repair, gloss flatteners, heat resistant, and jambing (cut-in) clear coat.

The structure of the proposed SCM differs significantly from existing district rules. Currently, the district rules and the U.S. EPA automotive coatings rule allow for a composite VOC limit for "multi-stage topcoat" systems. The SCM replaces the composite VOC limit with specific VOC limits for clear and color coatings.

Also, the proposed SCM eliminates the distinction between Group I and Group II vehicle categories, and establishes the same VOC limits for coatings used on passenger vehicles, heavy-duty vehicles, and mobile equipment. The SCM will clarify and, where applicable, combine coating categories. The SCM eliminates the specialty coatings category and replaces it with specific category limits as needed. The 2002 Survey data indicated that several of the coating types currently allowed under the specialty coatings category are no longer sold in California.

Most of the coatings have two or more individual components that are combined into one formulation. For example, a color coating may be a combination of up to ten individual toners plus hardeners, reducers, and specialty additives. As such, we cannot determine the volume applied of any single mixture. For an estimate of the emissions from each coating category, we assumed that an equal amount of base material was used in every formulation that could be made with that base material.

ARB staff analyzed the survey data to propose appropriate VOC limits, as listed in Chapter III, Table III-1. Table IV-1 shows the number of companies that reported coatings that meet the proposed VOC limits in the SCM. Table IV-2 shows coating categories found in the existing district rules and their corresponding category in the proposed SCM.

Table IV-1 - Compliance Summary

	Coating Category										
Number of Companies that:	Adhesion Promoter	Clear	Color ***	Multi-color	Pretreat-ment	Primer	Single Stage ***	Temporary Protective	Truck Bed Liner	Under-body	Uniform Finish
Sold type of coating in CA	5	15	12	0	13	15	13	2	1	3	5
Reported mixtures	4	14	11	0	11	14	10	2	1	3	3
Reported valid mixtures *	4	14	11	0	11	14	10	2	1	3	3
Reported compliant mixtures **	0	11	5	0	0	12	1	1	1	2	1

17 companies responded to survey.
* Mixtures are considered valid if ARB has all necessary information for all components of the mixture and the information for each component met ARB standards.
** Mixtures that meet the VOC limits proposed in the SCM.
*** Single-Stage and Color Coatings are reported for systems and not individual mixtures.

Table IV-2 - Comparison of Coating Categories	
Existing District Categories	**SCM Categories**
Camouflage	Color Coating
Extreme Performance	Primer, Color Coating, Clear Coating, Single-Stage Coating, or Underbody Coating
General Topcoat	Single-Stage Coating
Metallic/Iridescent Topcoat	Single-Stage Coating
Multi-Color Multi-stage	Multi-Color Coating
Multi-Color Topcoat	Multi-Color Coating
Multi-stage Topcoat (aka Multi-stage Topcoat System)	Color Coating & Clear Coating
Precoat	Primer
Pretreatment Wash Primer (aka Pretreatment or Pretreatment Coating)	Pretreatment Coating
Primer	Primer
Primer Sealer	Primer
Primer Surfacer	Primer
Rubberized Asphaltic Underbody	Underbody Coating
Single-Stage Nonmetallic/Noniridescent Topcoat	Single-Stage Coating
Single-Stage Metallic/Iridescent Coating	Single-Stage Coating
Solid Color Topcoat	Single-Stage Coating
Temporary Protective Coating	Temporary Protective Coating
Topcoat (aka All Other Topcoats)	Single-Stage Coating
Specialty Coatings	The generic category has been eliminated and replaced with specific categories for the various coatings previously grouped together and are addressed below.
Adhesion promoter	Primer or Adhesion Promoter
Anti-glare Safety Coating (aka Antiglare/Safety Coatings)	Clear Coating, Color Coating, or Single-Stage Coating
Bright Metal Trim Repair Coating	Any Other Coating Type
Camouflage	Color Coating
Elastomeric Materials (aka Elastomeric Coatings)	Primer, Color Coating, Clear Coating, Single-Stage Coating, or Underbody Coating
Extreme Performance	Primer, Color Coating, Clear Coating, Single-Stage Coating, or Underbody Coating
Gloss Flatteners (aka Low-Gloss Coatings)	Clear Coating
Heat Resistant	Primer, Color Coating, Clear Coating, or Single-Stage Coating
Impact Resistant Coating	Single-Stage Coating, Clear Coating,

Table IV-2 - Comparison of Coating Categories	
Existing District Categories	**SCM Categories**
•	Underbody Coating, or Truck Bed Liner Coating
Jambing (Cut-In) Clear Coats	Clear Coating
Multi-Color Coatings	Multi-Color Coatings
Rubberized Asphaltic Underbody Coating	Underbody Coating
Uniform Finish Blenders (aka Finish Blenders)	Uniform Finish Coating
Water Hold-Out Coating	Primer
Weld-Thru Coatings (aka Weld-Thru Primers and Weld-Through Primer)	Primer

B. CATEGORIES THAT ARE IN THE SCM

This section describes each of the categories in the SCM. Chapter V, Table V-3, details the estimated emissions and anticipated emission reductions, in tpd, from each category in the proposed SCM. Table IV-3, at the end of this section, provides basic physical parameters for each coating category in the proposed SCM. Table IV-4 shows the number of compliant mixtures and complying marketshare for each coating category as of 2001. All averages expressed in this chapter are simple, arithmetic averages.

1. Adhesion Promoter

Adhesion promoters are coatings applied directly to uncoated plastic surfaces to facilitate bonding of subsequent coatings. All adhesion promoter mixtures reported in the 2002 Survey are solvent-borne coatings. None of the mixtures reported contain any water or exempt compounds. Other than resins, the solids include pigments and various other compounds. These include proprietary compounds, titanium dioxide, talc, and barium sulfate.

The proposed VOC limit of 540 g/l is technologically and commercially feasible by the January 1, 2009, effective date based on discussions with coating manufacturers. Manufacturers may increase the exempt compound content in order to comply with the proposed VOC limit. Five companies reported selling adhesion promoter coatings in the 2002 Survey. None of the four companies that reported complete and valid information for adhesion promoters have coatings that meet the proposed limit. One coating manufacturer has stated that they expect to have a product that meets the proposed VOC limit in the market by 2008.

Issues:

1. Issue: No product currently meets the proposed limit.

   Response: Manufacturers may add exempt compounds to their coatings to meet the proposed VOC limit.

   Below is a sample formulation of a compliant adhesion promoter. This is intended to illustrate how the VOC content could be lowered to meet the proposed VOC limit. In developing this formulation, we relied on nearly compliant formulations of existing mixtures and increased the amount of exempt compounds. The volume percent is derived from the weight percent and individual densities of compounds in the coating formulation. To protect data confidentiality, the formula below groups various solids and VOCs together.

Ingredient	Wt %	Vol %
resin	19	17.4
solids	18	5.9
TBAC (or other exempts)	29.5	35.5
VOCs	33.5	41.2
total	100	100
solids	37	23.3
exempts	29.5	35.5
VOC	33.5	41.2
overall density (g/cm3)	1.04	
VOC limit	**540**	**g/l**
VOCreg	**539.0**	**g/l**
VOCact	**347.6**	**g/l**

This is a small usage category, about 3,600 gallons in 2001. If compliant products are formulated with TBAC, the emissions of TBAC from this coating category would be only 25 lbs per day statewide. Exempts other than TBAC could be used to achieve the same VOC content.

2. Clear Coating

Clear coatings are coatings that contain no pigments and are applied over a color coating or clear coating. All clear coating mixtures reported in the 2002 Survey are solvent-borne coatings. The coatings employ a variety of solvents that manufacturers mix to vary the rate of evaporation of the carrier (solvent). Many of the mixtures reported contain trace to minor amounts of water.

Over half of the mixtures reported contain exempt compounds. In those mixtures, the exempt content, by weight, ranges from about one-half percent up to sixty-six percent. Overall, the average exempt compound content is about nine percent by weight.

The majority of the solid content of a clear coating is resin. Some clear coatings have materials such as talc and silica to disperse light and create a matted appearance. Other clear coatings have plasticizers or flexiblizing agents added to create an elastomeric coating. Other than resins, the solids include proprietary compounds, silica, ultra-violet light absorbers, light stabilizers, and many other compounds in minor amounts.

The proposed VOC limit of 250 g/l is technologically and commercially feasible by the January 1, 2009, effective date. The SCAQMD Rule 1151 requires that all manufacturers who offer clear coatings for sale in the district offer at least one product line with a VOC content of 2.1 lbs/gal (250 g/l) or less. Fifteen companies reported selling clear coatings in the 2002 Survey. Eleven of the fourteen companies that reported complete and valid information for clear coatings have coatings that meet the proposed limit.

Issues:

1. Issue: Low gloss/matted clears need a higher VOC limit to accommodate the additives that are used to disperse light.

   Response: Manufacturers currently add a flattening agent to a high gloss clear coating to achieve a low gloss coating. This formulation approach results in an unnecessarily high VOC content. The VOC content of low gloss clear coatings could be reduced to 250 g/l if products are formulated directly as low gloss products.

   Issue: Elastomeric clears need a higher VOC limit.

   Response: The ARB has been informed that elastomeric/flex additives are currently available at 1.9 lb/gal (228 g/l) which would enable an elastomeric clear coating to achieve the 250 g/l VOC limit.

3. Issue: Compliant solvent-borne clear coatings have not been tested for compatibility with water-borne color coatings.

   Response: The ARB has found manufacturer data sheets that indicate that at least two companies market 250 g/l clear coatings that are compatible with their respective water-borne color coating systems. The PPG Corporation stated at the fourth public workshop in Oakland that it has a compliant solvent-borne clear coating that is marketed for use with its water-borne color coatings.

3. Color Coating

Color coatings are pigmented coatings, excluding adhesion promoters, primers and multi-color coatings, that require a subsequent clear coating. Color coatings include metallic/iridescent color coatings. These coatings were previously called basecoats and midcoats as part of the multi-stage systems in district rules. These coatings require a subsequent clear coating for protection, durability, and gloss.

Two companies reported sales of water-borne systems in the 2002 Survey. Another company reported three specific water-borne mixtures. All other coatings in this category are solvent-borne. Many mixtures reported contain trace to minor amounts of water. Exempt compounds are in about half of the mixtures reported. In those mixtures with exempt compounds, the amount of exempt compounds ranged from one-tenth of a percent to seventy-three percent by weight. Overall, the average amount of exempt compounds was three percent by weight.

This is the largest emitting category of automotive coatings. Color coatings account for about 60 percent of the VOC emissions from automotive coatings. Other than resins, the solids include pigments and various other compounds. These include titanium dioxide, mica, nickel compounds, iron compounds, rutile, aluminum, silica, carbon black, molybdenum compounds, tin compounds, barium sulfate, copper compounds, and numerous other compounds.

Most of the major manufacturers have water-borne color coatings that have been developed to comply with European Union (EU) emission standards. The EU directive will require all manufacturers to meet a 420 g/l VOC limit for color coatings as of January 1, 2007. The EU does not allow the use of exempt compounds to comply with the VOC content limit. Consequently, manufacturers have developed water-borne technologies to meet the EU VOC limit.

Based on discussions with manufacturers, they intend to use these water-borne systems to comply with the proposed SCM VOC limit. Thus, the proposed VOC limit of 420 g/l is technologically and commercially feasible by the January 1, 2009, effective date. Twelve companies reported selling color coatings in the 2002 Survey. Six of the eleven companies that reported complete and valid information for color coatings have solvent-borne systems that meet the proposed limit currently in use in California. However, these solvent-borne systems are only used for fleet vehicles, not for passenger vehicles that have greater performance demands.

If manufacturers choose to comply with the color coating limit with water-borne coatings, this will be a significant change from the current use of high VOC solvent-borne coatings. It will likely require changes by the end users, including the addition of air movement equipment to quickly dry the water-borne coatings and perhaps heat to maintain current production levels.

4. Multi-Color Coating

Multi-color coatings are coatings that exhibit more than one color in the dried film after a single application, are packaged in a single container, and hide surface defects on areas of heavy use. These coatings are commonly called "splatter" coatings due to their appearance. They are more commonly used in industrial settings and on items such as small fishing boats.

No coatings in this category were reported as being sold in California in 2001. We have found this type of coating marketed on the internet, with one of the listed uses being automotive. We have assumed that everyone who markets this coating is in compliance with the current national limit.

The proposed VOC limit of 680 g/l is technologically and commercially feasible. The proposed limit is the same as the current limit of 680 g/l in the *National Volatile Organic Compound Emission Standards for Automobile Refinish Coatings*, 40CFR59, Sections 59.100 through 59.111, and Table 1 to Subpart B.

5. Pretreatment Coating

Pretreatment coatings contain a minimum of one-half (0.5) percent acid by weight to provide surface etching, and not more than 16 percent solids by weight. They are applied directly to bare metal surfaces to provide corrosion resistance and adhesion. The SCAQMD and Antelope Valley AQMD are the only districts that limit the solids content of pretreatment coatings. Limiting the solids content is intended to reduce film build from a pretreatment coating, thereby reducing the incentive to use a high VOC content material as a primer able to fill large scratches or voids.

All of the reported mixtures in the 2002 Survey are solvent-borne. Of the 57 reported mixtures, 48 mixtures contain negligible to minor amounts of water. Water content ranges up to almost four percent by weight. Of the 57 reported mixtures, 43 mixtures do not contain any exempt compounds. Six mixtures have about one percent exempt compounds by weight and the remainder of mixtures range from two percent up to 15 percent exempt compounds by weight. Of the coatings that meet the solids content provision of the SCM, most do not use any exempts. The maximum exempt content found in the coatings that meet the solids content provision is approximately six percent. Other than resins, the solids include pigments and various other compounds. These include titanium dioxide, talc, zinc compounds, iron oxide, calcium carbonate, zinc phosphate, silica, and numerous other compounds. The primary acid used is phosphoric acid.

ARB staff believes the proposed VOC limit of 660 g/l is technologically and commercially feasible by the January 1, 2009 effective date based on discussions with the coating manufacturers (current limit is 780 g/l). One coating manufacturer has stated that they expect to have a pretreatment coating that meets the proposed limit on the market by the end of 2005.

One mixture reported in the 2002 Survey had a VOC content of 660 g/l, however, its solids content was greater than 16 percent, by weight. We believe it is possible for manufacturers to increase the exempt compound content in order to comply with the proposed VOC limit. Thirteen companies reported selling pretreatment coatings in the 2002 Survey. Eleven companies reported complete and valid information for pretreatment coatings, however, none have coatings that meet the proposed limit.

Issues:

1. Issue: No product currently meets the proposed limit.

   Response: ARB staff believes that the manufacturers have time to reformulate their coatings to meet the proposed limit. Because no products currently meet the proposed VOC limit, we will conduct a technology assessment approximately one year before the effective date of the limit.

   Below is a sample formulation of a compliant pretreatment coating. This is intended to illustrate how the VOC content could be lowered to meet the proposed VOC limit. In developing this formulation, ARB staff relied on nearly compliant formulations of existing mixtures and increased the amount of exempt compounds. The volume percent is derived from the weight percent and individual densities of compounds in the coating formulation. To protect data confidentiality, the formula below groups various solids and VOCs together for display.

Ingredient	Wt %	Vol %
Resin	5.5	4.4
Solids	9.1	2.5
phosphoric acid	1.4	0.8
Acetone (or other exempts)	7.5	8.6
TBAC (or other exempts)	41.5	43.5
VOCs	35	40.3
Total	100	100
Solids	16	7.7
Exempts	49	52.1
VOC	35	40.3
overall density (g/cm3)	0.90	
VOC limit	**660**	**g/l**
VOCreg	**659.4**	**g/l**
VOCact	**316.0**	**g/l**

This is a small usage category, about 45,000 gallons in 2001. If compliant products were formulated with TBAC, the emissions of TBAC from this coating category would be less than 400 lbs per day statewide.

6. Primer

The primer category currently exists in district rules. The SCM retains it and expands it to include the current district coating categories of primer surfacers and primer sealers. Most districts have the same VOC limit for primers and primer surfacers. Currently, the VOC limit for primer sealers is slightly higher (e.g., 340 g/l in SCAQMD). Primers are coatings applied to a substrate to provide:

1) A bond between the substrate and subsequent coats;
2) Corrosion resistance;
3) A smooth substrate surface; or
4) Resistance to penetration of subsequent coats. Some primers are pigmented to allow the painter to use less color coating to achieve the desired color.

The vast majority of primers reported in the 2002 Survey are solvent-borne, with only a small percentage being water-borne. One mixture of primer, four mixtures of sealer, 14 mixtures of surfacer, and one mixture of precoat are water-borne. All other mixtures reported are solvent-borne.

Almost 75 percent of the primers reported contain exempt compounds. For those mixtures with exempt compounds, the exempt content ranges from one-tenth of a percent to almost 64 percent, by weight, with the average exempt content being just under six percent.

The resin content varies widely within the primer category depending upon usage and manufacturer, from a low of 0.2 percent to a high of 57 percent, by weight, both of which are in the surfacer subcategory. Most primers have approximately 20 to 29 percent resin, by weight. Other than resins, the solids include pigments and various other compounds. These include barium sulfate, talc, titanium dioxide, calcium carbonate, zinc phosphate, mica, clay, aluminum, iron oxide, magnesium carbonate, and numerous other compounds.

The proposed VOC limit of 250 g/l is technologically and commercially feasible by the January 1, 2009, effective date. SCAQMD's Rule 1151 already requires all primers, primer surfacers, and primer sealers used on large vehicles and mobile equipment to meet a VOC content of 250 g/l. Fifteen companies reported selling primers in the 2002 Survey. Twelve of the 14 companies that reported complete and valid information for primers have coatings that meet the proposed limit.

Issues:

During the SCM development process, manufacturers requested a 340 g/l VOC limit for sealers. The reasons cited for the need for a higher VOC limit and our responses are discussed below.

1. Issue: Sealers have a lower solids content than surfacers and therefore cannot meet the same limit.

   Response: ARB staff analyzed the solids content of surfacers and sealers and found that while there were differences between the solids contents for any given manufacturer, the differences were insignificant when compared to the differences between manufacturers. The ranges for any given manufacturer overlapped, as well as between manufacturers. One manufacturer has stated that it will not be difficult to meet the proposed limit for sealers using exempts in the solvent mix.

2. Issue: Sealers have less pigment and more resin than surfacers and therefore need a higher limit.

   Response: ARB staff analyzed the types of solids in the sealers and surfacers and found that there is a lot of overlap between the ranges of the types of solids in sealers and surfacers. ARB staff believes that both products can meet the proposed limit. One manufacturer has stated that it will not be difficult to meet the proposed limit for sealers using exempts in the solvent mix.

7. Single-Stage Coating

Single-stage coatings are pigmented coatings, excluding primers and multi-color coatings, for application without a subsequent clear coating. Single-stage coatings include metallic/iridescent single-stage coatings. This is an older coating technology that is diminishing in usage in the collision repair industry. It is being replaced by color coating/clear coating systems that use less material and provide a higher gloss with a more durable finish. Single-stage coatings are used mostly in production shops where the entire vehicle is painted, and a single coating can achieve the desired color, protection and durability in one application.

All but two of the reported mixtures of single-stage coatings in the 2002 Survey are solvent-borne. Only about four percent of reported mixtures contain water. For most of these mixtures, the water content is negligible. Four mixtures contain significant amounts of water, ranging from 25 to 55 percent, by weight.

Over half of the mixtures reported do not contain any exempt compounds. In the remaining mixtures the exempt content, on a mass basis, increases gradually from 0.5 percent up to a maximum exempt content of 61 percent, by weight.

Other than resins, the solids include pigments and various other compounds. These include mica, titanium dioxide, iron oxide, talc, copper compounds, aluminum, barium sulfate, carbon black, silica, nickel compounds, and numerous other compounds.

The proposed VOC limit of 340 g/l is technologically and commercially feasible by the January 1, 2009, effective date. SCAQMD Rule 1151 currently requires all single-stage coatings used on large vehicles and mobile equipment to meet a VOC limit of 340 g/l. The proposed SCM extends the 340 g/l VOC limit in SCAQMD to all vehicles, including passenger cars. Thirteen companies reported selling single-stage coatings in the 2002 Survey. One of the ten companies that reported complete and valid information for single-stage coatings has a complete single-stage system that meets the proposed limit.

Issues:

1. Issue: Metallic single-stage coatings at the proposed limit do not currently exist for the automotive market.

   Response: There were some metallic single-stage coatings sold in 2001 that comply with the proposed VOC limit. One manufacturer has stated that they have a complete single-stage system, including metallics, that complies with the proposed limit.

However, based on discussions with manufacturers, it appears that single-stage coatings are not a good technology for metallic coatings. Currently, pearl or iridescent coatings are only achieved by using a color coating/clear coating technology. It appears that the best way to achieve a metallic coating is to use a color coating/clear coating technology. This is due to the way the paint film is created in single-stage coatings. The metallic flakes are not spread evenly throughout the film and reside only near the surface of the film making them more susceptible to damage, both mechanical and chemical. This would alter the appearance of the paint. Whereas in a color coating/clear coating system, the metallic flakes are fully protected by the clear coating.

8. Temporary Protective Coating

Temporary protective coatings are coatings used to temporarily protect areas from overspray or mechanical damage. These coatings are commonly used instead of taping off an area before painting another area or applied prior to shipping a vehicle. These coatings are removed after a primer or topcoat application, or after a vehicle reaches its destination.

Both of the reported mixtures of temporary protective coatings in the 2002 Survey are water-borne. Neither of the mixtures reported contains any exempt compounds. Other than resins, the solids include pigments and various other compounds.

The proposed VOC limit of 60 g/l is technologically and commercially feasible by the January 1, 2009, effective date. Several district rules currently require temporary protective coatings to meet a VOC limit of 60 g/l. Two companies reported selling temporary protective coatings in the 2002 Survey. One of the two companies that reported complete and valid information for temporary protective coatings has a coating that meets the proposed limit.

9. Truck Bed Liner Coating

Truck bed liner coatings are coatings for application to a truck bed to protect it from surface abrasion. These coatings do not include clear coatings, color coatings, multi-color coatings, or single-stage coatings. These coatings are often a rubbery type of coating that provides traction and keeps materials from dinging or scratching the bed. The one reported mixture of truck bed liner coatings in the 2002 Survey is solvent-borne. It contains no water or exempt compounds. Other than resins, the solids include pigments and various other compounds.

The proposed VOC limit of 310 g/l is technologically and commercially feasible by the January 1, 2009, effective date. One company reported selling truck bed liner coatings in the 2002 Survey. The company reported complete and valid information, and the coating meets the proposed VOC limit.

10. Underbody Coating

Underbody coatings (formerly called "rubberized asphaltic underbody coatings") are applied to wheel wells, the inside of door panels or fenders, the underside of a trunk or hood, or the underside of the motor vehicle itself. The coatings are typically used for sound deadening or protection. ARB staff changed the name of the category to "Underbody Coating" and modified the definition to also include coatings with a similar purpose that do not contain rubberized asphalt.

Only four districts define this type of coating, and some districts do not list it as a specialty coating in their specialty coating definition. Of the four districts that define this type of coating, three districts have it specifically listed as a specialty coating. Sacramento Metropolitan AQMD has a limit of 540 g/l for these coatings.

Five of the six mixtures reported are solvent-borne; the remaining mixture is water-borne. None of the solvent-borne coatings contain any water. None of the reported mixtures, whether solvent-borne or water-borne, contain any exempt compounds.

Other than resins, the solids include pigments and various other compounds. These include talc, calcium carbonate, titanium dioxide, and iron oxide.

The proposed VOC limit of 430 g/l is technologically and commercially feasible by the January 1, 2009, effective date based on data provided by the coating manufacturers. Three companies reported underbody coatings in the 2002 Survey. Three companies reported complete and valid information and two companies have coatings that meet the proposed limit.

11. Uniform Finish Coating

Uniform finish coatings are coatings applied to the area around a spot repair for the purpose of blending a repaired area's color or clear coating to match the appearance of an adjacent area's existing coating. While all districts except for one identify this as a specialty coating, only five districts and the national rule define the coating.

All of the coatings reported as uniform finish coatings in the 2002 Survey are solvent-borne. None of the reported mixtures contain any water. Only two mixtures contain exempt compounds. Both of these mixtures contain about ten percent exempt compounds by weight. The non-resin portion of the solids is composed of pigment and other solids.

The proposed VOC limit of 540 g/l is technologically and commercially feasible by the January 1, 2009, effective date based on data provided by the coating manufacturers. Five companies reported uniform finish coatings in the 2002 Survey. Three companies reported complete and valid information and two of the companies have coatings that meet the proposed limit.

12. Any Other Coating Type

This category is for any coating that does not fit into the specified coating categories. It was created so that if such a coating existed it would not be exempt from the VOC content limits. Currently, we are unaware of any coating that would be in this category. The proposed VOC limit of 250 g/l was set to preserve the emission reductions from the proposed SCM.

Table IV-3 - Basic Physical Parameters

		Minimum	Maximum	Average
Adhesion Promoter	Volume % Solids	1.1	35.8	14.3
	Weight % Solids	1.0	51.8	20.3
	Weight % Resin	1.0	12.5	3.6
	VOC actual (g/l)	579	857	745
	VOC regulatory (g/l)	579	857	745
Clear Coating	Volume % Solids	2.7	72.3	41.5
	Weight % Solids	3.6	76.5	46.9
	Weight % Resin	3.4	73.9	37.4
	VOC actual (g/l)	29	840	429
	VOC regulatory (g/l)	82	840	464
Color Coating	Volume % Solids	0.7	92.8	25.7
	Weight % Solids	2.7	94.0	34.3
	Weight % Resin	0.8	93.2	29.1
	VOC actual (g/l)	62	883	602
	VOC regulatory (g/l)	63	883	626
Multi-Color Coating	No information was reported.			
Pretreatment Coating	Volume % Solids	2.9	17.8	11.6
	Weight % Solids	3.8	34.0	23.9
	Weight % Resin	1.4	13.9	6.2
	VOC actual (g/l)	579	933	721
	VOC regulatory (g/l)	660	933	736
Primer	Volume % Solids	3.8	85.8	38.8
	Weight % Solids	4.5	84.3	56.5
	Weight % Resin	0.2	56.7	25.4
	VOC actual (g/l)	5	831	477
	VOC regulatory (g/l)	12	831	502
Single-Stage Coating	Volume % Solids	7.6	82.0	33.6
	Weight % Solids	10.0	86.4	41.5
	Weight % Resin	8.2	73.2	28.3
	VOC actual (g/l)	69	797	543
	VOC regulatory (g/l)	87	829	561
Temporary Protective Coating	This information is proprietary.			
Truck Bed Liner	This information is proprietary.			

Table IV-3 - Basic Physical Parameters				
		Minimum	Maximum	Average
Coating				
Underbody Coating	Volume % Solids	24.0	41.4	28.7
	Weight % Solids	31.9	55.0	39.7
	Weight % Resin	15.4	20.0	17.5
	VOC actual (g/l)	25	597	466
	VOC regulatory (g/l)	46	597	469
Uniform Finish Coating	Volume % Solids	2.8	35.7	32.4
	Weight % Solids	3.7	41.0	36.9
	Weight % Resin	3.6	38.3	34.3
	VOC actual (g/l)	464	827	573
	VOC regulatory (g/l)	524	827	584
Any Other Coating Type	No information was reported.			

Table IV-4 - Technical Feasibility		
	Number of Currently Complying Mixtures	Estimated Currently Complying Market Share (percent)
Adhesion Promoter	0	0
Clear Coating	33	8 - 26
Color Coating Systems	8 (6 fleet)	8
Multi-Color Coating	NA	NA
Pretreatment Coating	0	0
Primer	99	40 - 45
Single-Stage Coating Systems	1	NR
Temporary Protective Coating	P	P
Truck Bed Liner Coating	P	P
Underbody Coating	P	P
Uniform Finish Coating	P	P
Any Other Coating Type	NA	NA

NA - Information not available
NR - Volumes not reported
P - Proprietary information

C. SOLVENTS

Solvents, as the term is used in the SCM, are cleaning solutions that contain VOCs. While most districts regulate solvents used for cleaning operations in their automotive coating rules, a couple of districts (e.g., SCAQMD) have separate rules for cleaning solvents. ARB is addressing solvents used in automotive coating cleaning operations as part of the SCM.

Most district rules divide solvents into two categories: surface preparation and cleanup, and application equipment cleaning. These solvent categories typically have different VOC limits, with application equipment cleaning being given a higher VOC limit. Some districts further divide surface preparation solvents into those used to clean plastic parts and all other surface preparation solvents. In these cases, the plastic parts cleaners are given higher VOC limits than the non-plastic parts cleaners. A few districts provide a separate and higher VOC limit for solvents applied from hand-held spray containers. A few districts provide a separate and higher VOC limit for solvents used to clean road tar, engine oil, grease, overspray, and adhesives.

The proposed VOC limit of 25 g/l is technologically and commercially feasible by the January 1, 2009, effective date. The SCAQMD Rule 1171, requires all solvents used for cleaning at automotive coatings operations to meet a 25 g/l VOC limit as of July 1, 2005. There are solvents available that meet the 25 g/l VOC limit through the use of exempt compounds. The SCM would extend the existing SCAQMD limit to the rest of the State.

REFERENCES

California Air Resources Board 2002 Automotive Coatings Survey data.

Code of Federal Regulations Title 40 Part 59 – National Volatile Organic Compound Emission Standards for Consumer and Commercial Products, Sections 59.100 through 59.111 and Table 1 to Subpart B.

Antelope Valley Air Quality Management District Rule 1151 – Motor Vehicle and Mobile Equipment Coating Operations.

Bay Area Air Quality Management District Regulation 8 – Organic Compounds, Rule 45 – Motor Vehicle and Mobile Equipment Coating Operations.

Butte County Air Quality Management District Rule 235 – Requirements for Vehicle and Mobile Equipment Coating Operations.

El Dorado County Air Quality Management District Rule 230 – Automotive Refinishing Operations.

Feather River Air Quality Management District Rule 3.19 – Vehicle and Mobile Equipment Coating Operations.

Glenn County Air Pollution Control District Article IV Prohibitions, Section 105 – Vehicle and Mobile Equipment Coating Operations.

Imperial County Air Pollution Control District Rule 101 – Definitions.

Imperial County Air Pollution Control District Rule 427 – Automotive Refinishing Operations.

Kern County Air Pollution Control District Rule 410.4A – Motor Vehicle and Mobile Equipment Refinishing Operations.

Mojave Desert Air Quality Management District Rule 1116 – Automotive Refinishing Operations.

Placer County Air Pollution Control District Rule 234 – Automotive Refinishing Operations.

Sacramento Metropolitan Air Quality Management District Rule 459 – Automotive, Truck & Heavy Equipment Refinishing Ops.

San Diego County Air Pollution Control District Rule 67.20 – Motor Vehicle and Mobile Equipment Refinishing Operations.

San Joaquin Valley Unified Air Pollution Control District Rule 4602 – Motor Vehicle and Mobile Equipment Coating Operations.

San Luis Obispo County Air Pollution Control District Rule 423 – Motor Vehicle and Mobile Equipment Coating Operations.

Santa Barbara County Air Pollution Control District Rule 339 – Motor Vehicle and Mobile Equipment Coating Operations.

Shasta County Air Quality Management District Rule 3:25 – Vehicle and Mobile Equipment Coating Operations.

South Coast Air Quality Management District Rule 1151 – Motor Vehicle and Mobile Equipment Non-Assembly Line Coating Operations.

Tehama County Air Pollution Control District Rule 4:35 – Vehicle and Mobile Equipment Coating Operations.

Ventura County Air Pollution Control District Rule 74.18 – Motor Vehicle and Mobile Equipment Coating Operations.

Yolo-Solano Air Quality Management District Rule 2.26 – Motor Vehicle and Mobile Equipment Coating Operations.

Confidential conversations with paint manufacturers regarding proprietary information related to product development.

V. AMBIENT AIR QUALITY AND EMISSIONS

California's extreme air quality problems require unique strategies for meeting federal and State ambient air quality standards. In this chapter, we provide an overview of these air quality problems and the need for significant emission reductions from all sources of air pollution. We also describe the need for the regulation of automotive coatings and provide a summary of the emissions from the coating categories proposed for regulation.

A. AMBIENT AIR QUALITY AND THE NEED FOR EMISSION REDUCTIONS

VOC emissions contribute to the formation of ozone, and fine particulate matter (PM). PM pollution consists of very small liquid and solid particles in the air. PM includes particles smaller than 10 microns in size (PM_{10}), and particles smaller than 2.5 microns in size ($PM_{2.5}$). Ozone formation in the lower atmosphere results from a series of chemical reactions between VOCs and nitrogen oxides in the presence of sunlight. PM_{10} and $PM_{2.5}$ pollution result from both direct and indirect emissions. Direct sources of PM_{10} and $PM_{2.5}$ include emissions from fuel combustion and wind erosion of soil. Indirect PM_{10} and $PM_{2.5}$ result from the chemical reaction of VOCs, nitrogen oxides, sulfur oxides and other chemicals in the atmosphere. Federal and State ambient air quality standards for these contaminants have been established to protect California's population from the harmful effects of ozone and PM.

1. Ozone

VOCs and nitrogen oxides (NO_x) react in the presence of sunlight to form ozone. The rate of ozone generation is related closely to the amount and reactivity of VOC emissions as well as the amount of NO_x emissions available in the atmosphere (U.S. EPA, 1996; Seinfeld and Pandis, 1998). Ozone is a colorless gas and the chief component of urban smog. It is one of the State's more persistent air quality problems. As shown in Figure V-1, the population-weighted average exposure to ozone concentrations above the 1-hour State ambient air quality standard (of 0.09 ppm) in the South Coast Air Basin has been declining. However, despite this decline and nearly 25 years of regulatory efforts, ozone continues to be an important environmental and health concern.

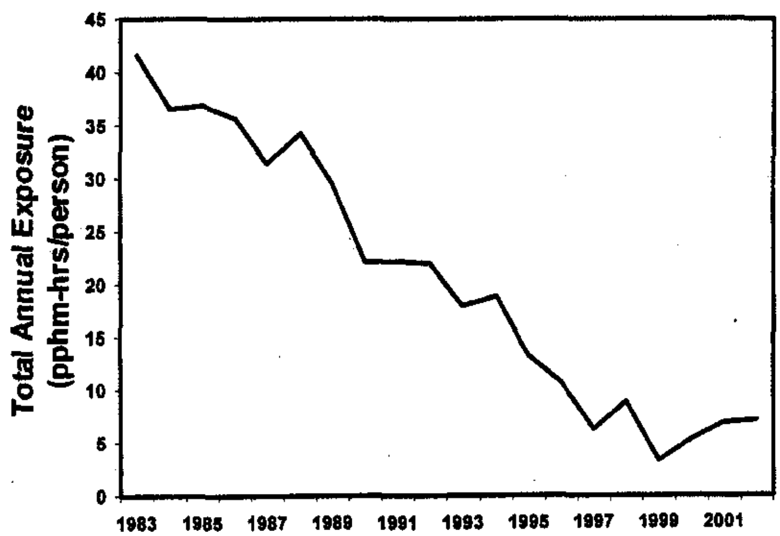
It has been well documented that ozone adversely affects the respiratory functions of humans and animals. Human health studies show that short-term exposure to ozone injures the lung (ARB, 2000b, 1997; U.S. EPA, 1996). In some animal studies, permanent structural changes with long-term exposures to ozone concentrations considerably above ambient levels were noted; these changes remain even after periods of exposure to clean air (U.S. EPA, 1996). Ozone is a strong irritant that can cause constriction of the airways, forcing the respiratory system to work harder in order to provide oxygen to the body. Ozone is a powerful oxidant that can damage the respiratory tract, causing inflammation and irritation, and induces symptoms such as coughing, chest tightness, shortness of breath, and worsening of asthma symptoms

(U.S. EPA, 1996). Ozone in sufficient doses increases the permeability of lung cells, rendering them more susceptible to toxins and microorganisms.

The greatest risk is to those who are more active outdoors during smoggy periods, such as children, athletes, and outdoor workers. Exposure to levels of ozone above the current ambient air quality standard leads to lung inflammation and lung tissue damage, and a reduction in the amount of air inhaled into the lungs. Recent evidence has, for the first time, linked the onset of asthma to exposure to elevated ozone levels in exercising children (McConnell et al., 2002).

One requirement of The Children's Environmental Health Protection Act is that the ARB, in consultation with OEHHA, review all of California's health-based ambient air quality standards by December 31, 2000 (Senate Bill 25, Escutia, 1999). The purpose of the review was to determine whether the standards adequately protect public health, especially the health of infants and children. The findings are summarized in the report, "Adequacy of California Ambient Air Quality Standards: Children's Environmental Health Protection Act" (ARB, 2000b). This report found that the standards for particulate matter, ozone, and nitrogen dioxide are inadequate to protect public health. The standards for particulate matter (PM_{10} and sulfates) were found to have the highest priority for revision. At the December 9, 2000, Public Meeting, the Board approved the report and urged staff to work as expeditiously as possible to present them with recommendations due to the serious impact of these pollutants on the health of Californians. In March 2005, the State adopted a new 8-hour standard for ozone, and retained the existing 1-hour ozone standard.

Figure V-1
Population-Weighted Exposure to Ozone Concentrations Above the State Ambient Air Quality Standard



Not only does ozone adversely affect human and animal health, but it also affects vegetation throughout most of California resulting in reduced yield and quality in agricultural crops, disfiguration or unsatisfactory growth in ornamental vegetation, and damage to native plants. During the summer, ozone levels are often highest in the urban centers in southern California, the San Joaquin Valley, and Sacramento Valley, which are adjacent to the principal production areas in the State's multibillion-dollar agricultural industry. ARB studies indicate that ozone pollution damage to crops is estimated to cost agriculture over 300 million dollars annually (ARB, 1987). Similarly, the U.S. EPA estimates national agricultural losses to exceed 1 billion dollars annually (U.S. EPA, 1996). Elevated levels of ozone also cause damage to materials such as rubber, paints, fabric, and plastics.

In 1997, the U.S. EPA promulgated a new 8-hour ozone ambient air quality standard (U.S. EPA, 1997). On April 15, 2004, U.S.EPA designated nonattainment areas for the new 8-hour ozone standard effective June 15, 2004 (U.S. EPA, 2004a, 2004b). In California, many of these areas are already designated nonattainment for the federal 1-hour standard. New nonattainment areas include a number of rural Sierra foothill counties and additional parts of the Sacramento Valley. This action starts the transition from the 1-hour standard to the 8-hour standard. The federal 1-hour standard was revoked in June 2005.

SIPs showing how each area will meet the federal 8-hour standard are due by 2007. In order to maintain progress towards clean air, the Clean Air Act prohibits backsliding on the control program. Since the federal 8-hour standard is more health-protective than the federal 1-hour standard, ARB expects that California will need to reduce emissions beyond the existing 1-hour SIP targets. All major urban areas in California continue to violate the federal and State ozone standards, and need additional emission reductions in ozone precursors – such as VOCs – to attain these health-based standards.

2. Fine Particulate Matter

PM is prevalent in the urban atmosphere (see, for example, Pandis *et al.*, 1992), and ambient PM, especially $PM_{2.5}$ is known to have negative impacts on human health (Schwartz *et al.*, 1996; Moolgavkar and Leubeck, 1996). Like ozone, PM can be formed via atmospheric oxidation of organic compounds (Finlayson-Pitts and Pitts, 2000). According to the results from several recent studies, photochemically derived PM (i.e. secondary organic aerosol) could contribute up to 80 percent of the fine particle burden observed in severe air pollution episodes (Pandis *et al.*, 1992; Turpin and Huntzicker, 1991, 1995). In urban PM, these secondary organic aerosols (SOA) could produce effects such as visibility degradation and toxicity (see, for example Atkinson and Arey, 1994).

The relative contribution of primary versus secondary PM also varies by region and by season. While only limited information is available on how much of the measured $PM_{2.5}$ organic carbon component is SOAs, available studies suggest that in the South Coast on an annual average basis, SOAs may constitute six to 16 percent of $PM_{2.5}$. In urban areas of the San Joaquin Valley during the winter, SOAs may contribute up to an average of eight percent of $PM_{2.5}$ (ARB 2005c).

Significant advances have been made in the theoretical and the experimental studies of the formation of SOAs (Pankow, 1994a, 1994b; Odum *et al.*, 1996; Seinfeld and Pandis, 1998; Harner and Bidleman, 1998; Kleindienst, *et al.*,1999; Yu *et al.*, 1999). In addition, modeling techniques to determine the amount of ozone, as well as the amount of aerosol formed from a VOC have been established (Bowman *et al.*, 1995), and the concept similar to maximum incremental reactivity is being applied to quantitatively assess the aerosol formation potential of a VOC (i.e. incremental aerosol reactivity) (Griffin *et al.*, 1999). Based on the results of these studies, we now know that there is a mechanistic linkage between the ozone formation and SOA formation of a VOC.

Although most organic compounds contribute to ozone formation (Carter, 2000), SOA is usually formed from photooxidation of organic compounds with carbon numbers equal to seven or more (Grosjean and Seinfeld, 1989; Wang *et al.*,1992). This observation is consistent with the fact that both reactivity and a product's volatility need to be considered for evaluating the aerosol formation potential of a VOC (Odum *et al.*, 1997). It has also been shown that aromatic compounds are more likely to participate in the formation of SOA than are alkenes (Grosjean, 1992; Pandis *et al.*, 1992). Only chemicals which react fast enough in the atmosphere will generate sufficient amounts of low volatility products for forming aerosols.

The federal and State ambient air quality standards for ozone and PM are shown in Table V-1.

Table V-1 - Ambient Air Quality Standards for Ozone, PM_{10} and $PM_{2.5}$

Pollutant	Averaging Time	State Standard	National Standard
Ozone	1 hour	0.09 ppm (180 $\mu g/m^3$)	----------
	8 hour	0.070 ppm (137 $\mu g/m^3$)	0.08 ppm (157 $\mu g/m^3$)
PM_{10}	24 hour Annual Annual Arithmetic Mean	50 $\mu g/m^3$ 20 $\mu g/m^3$	150 $\mu g/m^3$ 50 $\mu g/m^3$
$PM_{2.5}$	24 hour Annual Annual Arithmetic Mean	------- 12 $\mu g/m^3$	65 $\mu g/m^3$ 15 $\mu g/m^3$

The U.S. EPA adopted standards for $PM_{2.5}$ in addition to the PM_{10} standards (U.S. EPA, 1997). $PM_{2.5}$ consists of directly emitted particulate matter, and secondary particulate matter such as nitrates, sulfates and condensables that are formed in the atmosphere from precursors such as NOx, ammonia, SOx and complex hydrocarbons. Because $PM_{2.5}$ is a subset of PM_{10}, these precursors contribute to PM_{10} pollution as well. In 2002, California established an annual average $PM_{2.5}$ standard of 12 $\mu g/m^3$, which is more health-protective than the federal standard (15 $\mu g/m^3$).

U.S. EPA set a February 15, 2004 deadline for states to provide their $PM_{2.5}$ nonattainment designation recommendations based on ambient monitoring data from 2000 through 2002. ARB submitted the data and recommendations on February 11, 2004. (ARB 2004) U.S. EPA finalized the $PM_{2.5}$ designations in January 2005. Nonattainment areas for the federal $PM_{2.5}$ standard include the South Coast Air Basin and the San Joaquin Valley Air Basin. The $PM_{2.5}$ SIPs are due by April 2008.

The vast majority of California's population who live in urban areas breathe unhealthy air. Figures V-2, V-3, and V-4 show that unhealthy levels of ozone, PM_{10}, and $PM_{2.5}$ respectively, are not limited to urban areas, but can be found in nearly every county in California. As shown in these maps for 2004, 46 counties are currently designated as nonattainment (or nonattainment-transitional, which is a subcategory of nonattainment) for the State ozone standard, while 54 counties are designated as nonattainment for the State PM_{10} standard (ARB, 2004). Over 99 percent of California's population lives in areas designated as nonattainment for the State ozone and PM_{10} standards, a clear indication of the magnitude of the air quality problems in California. (ARB, 2005a)

The California Clean Air Act requires districts that have been designated nonattainment for the State ambient air quality standards for ozone, carbon monoxide, sulfur dioxide, or nitrogen dioxide to prepare and submit plans for attaining and maintaining the standards (see Health and Safety Code § 40910 *et seq.*). In addition, the federal Clean Air Act requires that districts designated nonattainment for the federal ambient air quality standards prepare SIPs to demonstrate attainment with the federal standards. In some of these districts, substantial additional emission reductions will be necessary if attainment is to be achieved. In developing their plans, each district determines which measures are necessary to include, as well as the specific details of each included measure.

The plans from various districts underscore the increasing role of pollution from area-wide sources, including consumer products, architectural coatings, and automotive coatings. As emissions from facilities and vehicles are reduced, the area-wide sources become a larger part of the inventory, and are included as a more significant area for potential reductions of VOC emissions. It is estimated that without additional automotive coatings regulations, the inventory for automotive coatings emissions will increase due to population growth.

Figure V-2

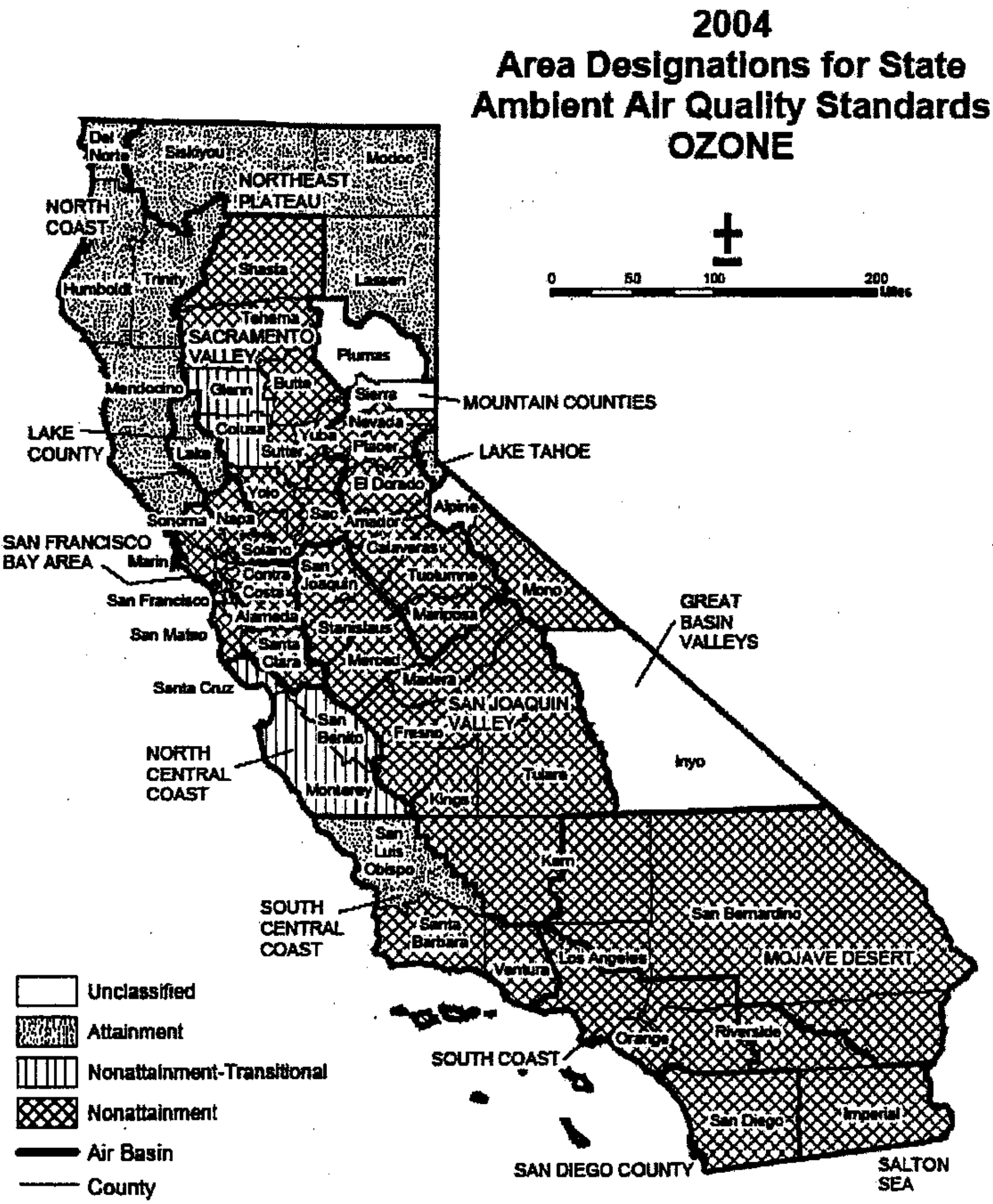

2004
Area Designations for State
Ambient Air Quality Standards
OZONE
0
50
100
200
Miles
Del Norte
Siskiyou
Modoc
NORTHEAST PLATEAU
NORTH COAST
Shasta
Lassen
Humboldt
Trinity
Tehama
SACRAMENTO VALLEY
Plumas
Glenn
Butte
Mendocino
Sierra
MOUNTAIN COUNTIES
Colusa
Nevada
Yuba
LAKE COUNTY
Lake
Sutter
Placer
LAKE TAHOE
El Dorado
Yolo
Alpine
Sonoma
Napa
Sac
Amador
SAN FRANCISCO BAY AREA
Marin
Solano
Calaveras
Contra Costa
San Joaquin
Tuolumne
San Francisco
Alameda
Mono
GREAT BASIN VALLEYS
Mariposa
Stanislaus
San Mateo
Santa Clara
Merced
Santa Cruz
Madera
SAN JOAQUIN VALLEY
San Benito
Fresno
NORTH CENTRAL COAST
Inyo
Tulare
Monterey
Kings
San Luis Obispo
Kern
SOUTH CENTRAL COAST
Santa Barbara
San Bernardino
Los Angeles
MOJAVE DESERT
Ventura
Orange
Riverside
SOUTH COAST
San Diego
Imperial
SAN DIEGO COUNTY
SALTON SEA
Unclassified
Attainment
Nonattainment-Transitional
Nonattainment
Air Basin
County

Figure V-3

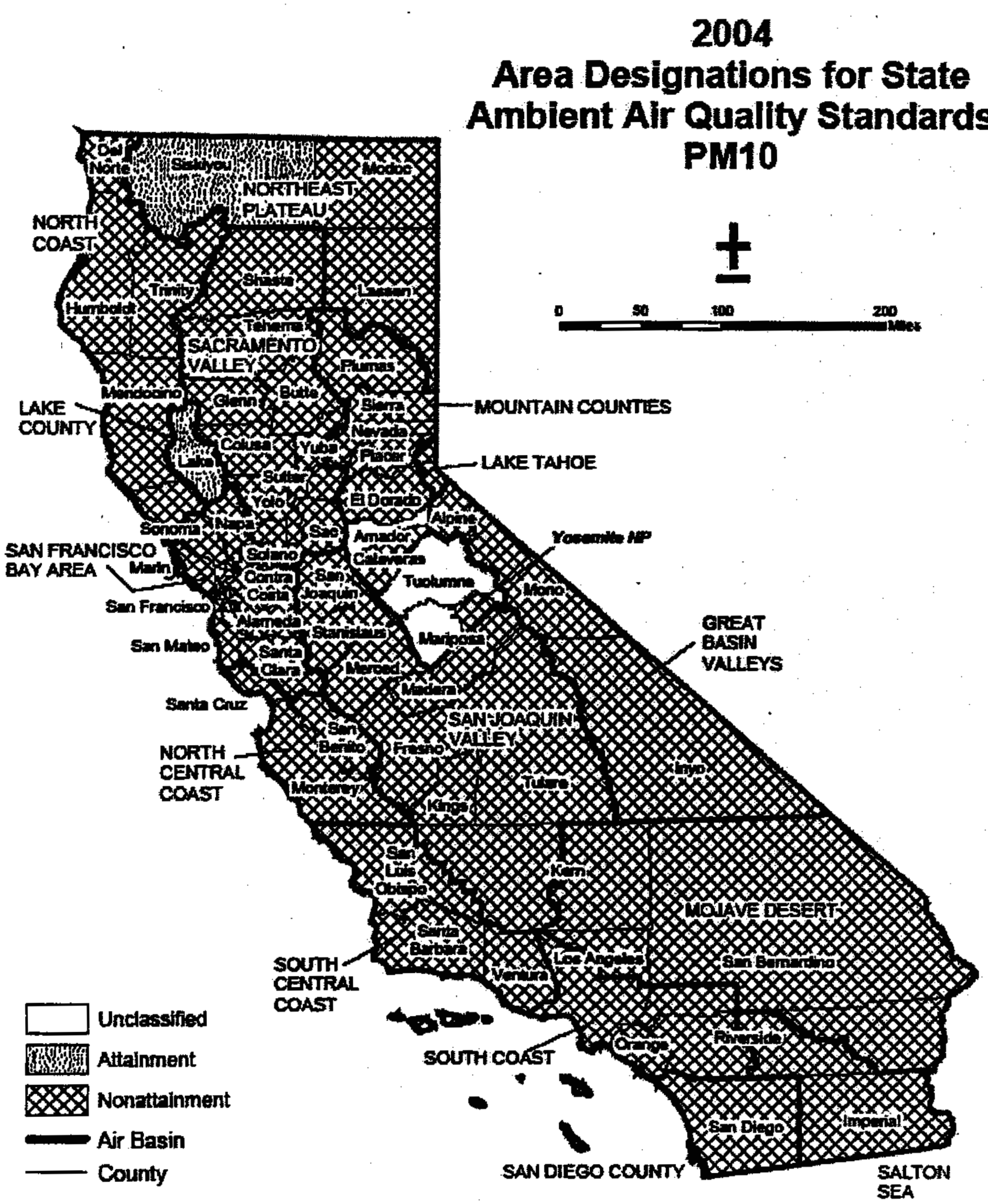
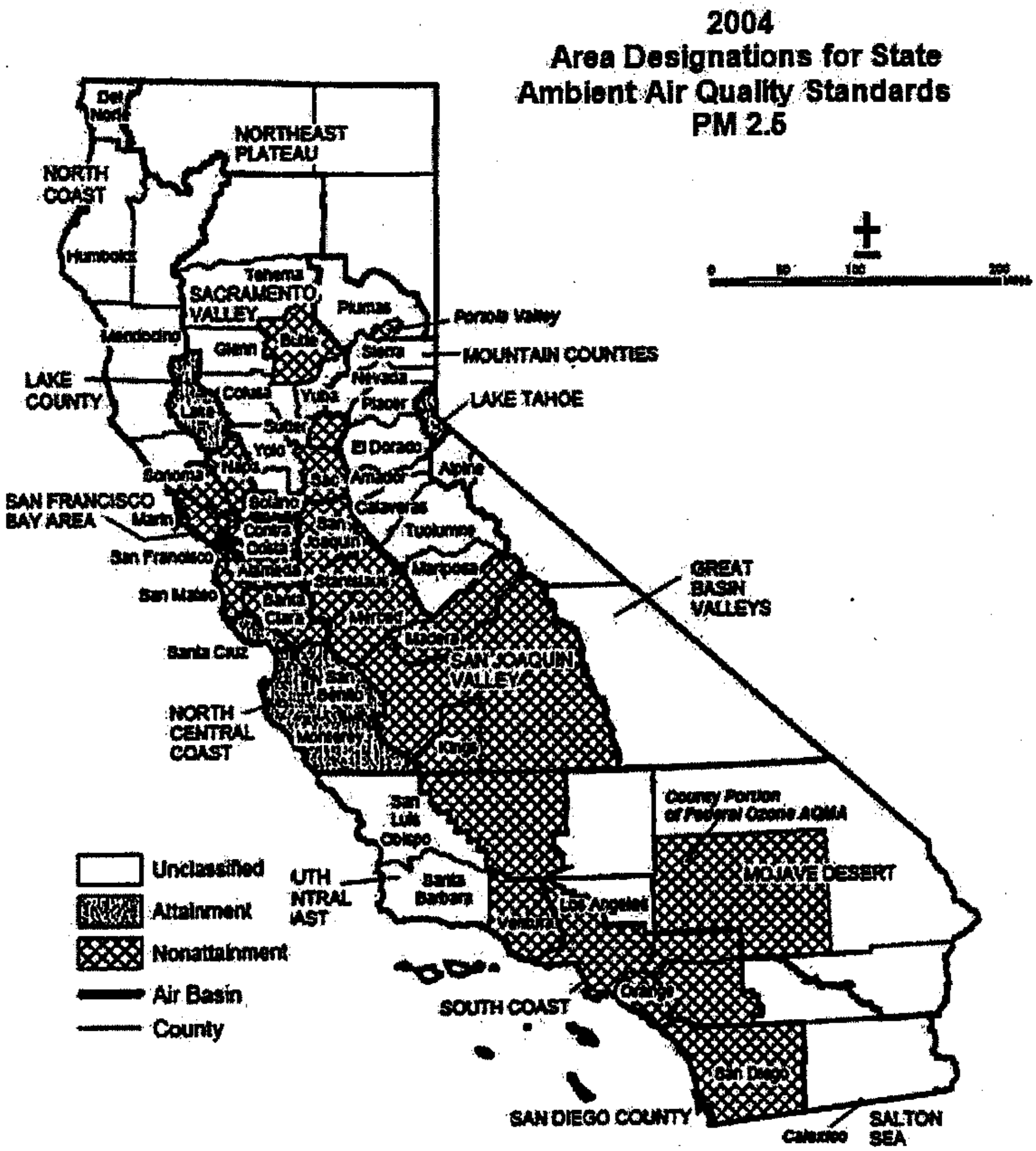

2004
Area Designations for State
Ambient Air Quality Standards
PM10
0
50
100
200
Miles
Del Norte
Siskiyou
Modoc
NORTHEAST PLATEAU
NORTH COAST
Trinity
Shasta
Lassen
Humboldt
Tehama
SACRAMENTO VALLEY
Plumas
Mendocino
Glenn
Butte
Sierra
MOUNTAIN COUNTIES
LAKE COUNTY
Nevada
Colusa
Yuba
Placer
Lake
LAKE TAHOE
Sutter
Yolo
El Dorado
Alpine
Sonoma
Napa
Sac
Amador
Yosemite NP
SAN FRANCISCO BAY AREA
Marin
Solano
Calaveras
San Joaquin
Tuolumne
Contra Costa
Mono
San Francisco
Alameda
Stanislaus
Mariposa
GREAT BASIN VALLEYS
San Mateo
Santa Clara
Merced
Madera
Santa Cruz
SAN JOAQUIN VALLEY
San Benito
Fresno
NORTH CENTRAL COAST
Inyo
Monterey
Tulare
Kings
San Luis Obispo
Kern
MOJAVE DESERT
Santa Barbara
SOUTH CENTRAL COAST
Ventura
Los Angeles
San Bernardino
Unclassified
Attainment
Nonattainment
Air Basin
County
SOUTH COAST
Orange
Riverside
San Diego
Imperial
SAN DIEGO COUNTY
SALTON SEA

Figure V-4


2004
Area Designations for State
Ambient Air Quality Standards
PM 2.5
NORTHEAST PLATEAU
NORTH COAST
Del Norte
Humboldt
Mendocino
LAKE COUNTY
SACRAMENTO VALLEY
Tehama
Glenn
Butte
Plumas
Portola Valley
MOUNTAIN COUNTIES
Sierra
Nevada
Placer
LAKE TAHOE
Colusa
Yuba
Sutter
Yolo
El Dorado
Alpine
Amador
Calaveras
Tuolumne
Mariposa
Sonoma
Napa
Solano
SAN FRANCISCO BAY AREA
Marin
San Francisco
Contra Costa
Alameda
San Mateo
Santa Clara
San Joaquin
Stanislaus
Merced
Madera
Santa Cruz
SAN JOAQUIN VALLEY
NORTH CENTRAL COAST
San Benito
Monterey
Kings
GREAT BASIN VALLEYS
San Luis Obispo
Santa Barbara
County Portion of Federal Ozone AQMA
MOJAVE DESERT
Ventura
Los Angeles
Orange
SOUTH COAST
San Diego
SAN DIEGO COUNTY
Calexico
SALTON SEA
Unclassified
Attainment
Nonattainment
Air Basin
County

B. ESTIMATED EMISSIONS FROM AUTOMOTIVE COATINGS

Emissions from automotive coatings are estimated from the survey of automotive coatings that the ARB conducted in 2002. In June 2002, the ARB mailed survey questionnaires to companies that potentially sold automotive coatings products in California in 2001. A total of 17 companies submitted data. The survey collected data on the VOC contents of products, which were then used to estimate VOC emissions from automotive coatings. Estimated emissions from automotive coatings were 7,631 tons per year or approximately 20.7 tpd in 2001, based on the survey data. These quantities do not include emissions from solvents used for surface preparation and cleanup because the 2002 Survey did not collect this data. Table V-2 summarizes key findings from the 2002 Survey data.

The survey also collected information on speciation of VOCs. The quantity of VOC ingredients reported in the survey is close to the quantity of VOC emissions calculated using sales and VOC content data. This indicates a good correlation between the speciated ingredient data and the data that are used to calculate VOC emissions.

Table V-2 - Summary of the 2002 Automotive Coatings Survey	
Total volume (gallons)	3,685,636
Volume of water-based/solvent-based coatings (percent)	1/99
Estimated emissions (tpd)	20.7
Volume per capita (gallons)	0.11
Emissions per capita (pounds)	0.44

Total VOC emissions from stationary sources (including area-wide sources) in California were estimated to be about 1,336 tpd in 2001. VOC emissions from automotive coatings are estimated to be about 20.7 tpd based on ARB 2002 Survey data (ARB, 2005b). This represents about two percent of the VOC emissions from stationary sources.

Table V-3 presents the estimated emissions and emission reductions by category based on the coating information provided in the 2002 Survey. The emissions estimate accounts for the total volume of products sold. Because the 2002 Survey did not collect data on solvent usage for surface preparation and cleanup, we are unable to quantify the emission reduction from the 25 g/l VOC limit for solvents. However, the emission reduction from the 25 g/l VOC limit has already been accounted for in the SCAQMD under Rule 1171. Although not quantified, extending the 25 g/l VOC limit for solvents statewide would achieve emission reductions outside of the SCAQMD.

Table V-3 - Estimated Emissions and Emission Reductions from Automotive Coatings			
	Estimated Emission Baseline (tpd)	**Estimated Emission Reductions (tpd)**	**Percent Reduction**
Adhesion Promoter	0.03	0.02	78
Clear Coating	2.70	1.61	60
Color Coating	12.85	8.78	68
Multi-color Coating	0.00	0.00	0
Pretreatment Coating	0.36	0.21	59
Primer	1.78	1.01	56
Single-stage Coating	2.87	1.68	58
Temporary Protective Coating	<0.01	<0.01	43
Truck Bed Liner Coating	<0.01	<0.01	0
Underbody Coating	0.01	<0.01	53
Uniform Finish Coating	0.08	0.05	63
Any Other Coating Type	0.00	0.00	0
Total	**20.7**	**13.4**	**65**

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VI. ENVIRONMENTAL IMPACTS

Both the California Environmental Quality Act (CEQA) and ARB policy require the ARB to evaluate the potential adverse environmental impacts of proposed projects. The intent of the proposed SCM is to protect the public health by reducing the public's exposure to potentially harmful emissions of VOCs. An additional consideration is the impact that the proposed SCM may have on the environment. Based on available information, the ARB has determined that no significant adverse environmental impacts should occur as a result of districts adopting the proposed SCM. This chapter summarizes the potential impacts that the proposed SCM may have on wastewater treatment, air quality, and hazardous waste disposal.

A. ANALYSIS OF REASONABLY FORESEEABLE ENVIRONMENTAL IMPACTS OF THE METHODS OF COMPLIANCE

1. Potential Wastewater Impacts

Wastewater is regulated in California by the Water Resources Control Board. In California, wastewater containing hazardous substances is not allowed to be disposed of in the sewer system. Discharge of wastewater from automotive coatings facilities to a sanitary sewer can result in the solids portion of the coating accumulating in sewage treatment sludge, preventing its beneficial use. Some contaminants "pass through" and are discharged to lakes, rivers, bays, and oceans. Although the practice is illegal, facility operators may introduce hazardous substances to the sewer system by washing down areas containing over spray and allowing that water to enter the sewer system.

Most waste paint is a result of over spray and is collected primarily on the paint booth exhaust filter or in floor sweepings. Coating facilities may also generate paint-contaminated disposable rags, masking tape and paper, disposable mixing cups and sticks, and disposable paint strainers. The dry paint related wastes are typically landfilled. The reduction of VOC content will reduce the amount of VOCs landfilled.

The SCM is also not expected to adversely impact water quality. First, use of exempt solvents (solvents not considered to be VOCs, such as acetone and PCBTF) is expected to result in equivalent or fewer water quality impacts than currently used solvents (such as toluene, xylenes, mineral spirits, and methyl ethyl ketone), since the exempt solvents are less toxic. Second, because currently available compliant color coatings are already using water-based technology, no additional water quality impacts from future compliant water-based coatings are expected, although use of water-based coatings is expected to increase. The current manufacturing and clean-up practices associated with water-based coatings are not expected to change as a result of the SCM. Lastly, the SCM is not expected to promote the use of compliant coatings formulated with hazardous solvents that could create adverse water quality impacts.

Tertiary-Butyl acetate ($CH_3COOC(CH_3)_3$) is the common name for acetic acid, 1,1-dimethylethyl ester. Other names include *t*-butyl acetate, *tert*-butyl acetate, and informally, TBAC or TBAc™. It is an effective viscosity reducer with an intermediate flash point and vapor pressure. Industrially, it can be used in a variety of coatings. ARB staff has recommended that the districts consider exempting TBAC from their VOC definitions. It is anticipated that this exemption will be granted, by some if not all districts, allowing TBAC to be substituted for non-exempt VOCs of higher reactivity when reformulating automotive coatings and potentially cleaning solvents. In ARB's Draft Environmental Impact Assessment of *Tertiary*-Butyl Acetate (ARB, 2005), the staff determined that in automotive coating products, the compounds most likely to be replaced by TBAC are xylenes, toluene, and methyl ethyl ketone (MEK).
(see http://www.arb.ca.gov/research/reactivity/tbac1.pdf)

ARB's assessment of TBAC also examined the potential impact on water of an increased use of TBAC. Based on information provided by the Lyondell Chemical Company and a literature search, the potential risk to surface waters of California is expected to be low, assuming the material is stored, used, and disposed of in accordance with hazardous materials regulations.

2. Air Quality Impacts

There are two basic kinds of air emissions from activities conducted at automotive refinishing facilities: VOCs and particulates (solids). Particulates make up the solid part of the paint that contains the binder, pigment, and other additives. To control particulates, painting should be performed inside a paint spray booth equipped with paint arrestors (filters) and a ventilation system sufficient to draw the air from the booth through the filters. Paint booth air emissions controls are limited to collection of paint particulates. Generally, no control of VOCs from the air exhausted from the paint booth is required or practiced.

The adoption and implementation of the proposed SCM on a statewide basis is expected to produce substantial, long-term, VOC emission reductions. VOCs are regulated because they contribute to the formation of both ozone and PM_{10}. Numerous VOCs have also been identified as toxic air contaminants and are regulated through the ARB's Toxic Air Contaminant (TAC) Control Program. If the proposed VOC content limits in the SCM were implemented statewide, emissions would be reduced by approximately 13 tons per day beginning in 2009, a net air quality benefit.

Based on ARB's 2002 Survey, xylenes, toluene, and MEK account for approximately 27.5 percent of the VOCs used in automotive coatings. As previously mentioned, ARB's Draft Environmental Impact Assessment of *Tertiary*-Butyl Acetate indicates that these compounds are the most likely VOCs to be replaced by the use of TBAC. Assuming a replacement of 25 to 50 percent of these three VOCs, TBAC substitution would result in a potential use of TBAC of 1.4 to 2.9 tpd. However, color coatings account for about 63 percent of the total VOC emissions and about 50 percent of the xylenes, toluene, and MEK emissions from automotive coatings. If, as expected, coating manufacturers choose to meet the VOC limit for color coatings with water-borne coatings, the potential emissions of TBAC would be reduced to about 1.5 tpd (assuming 50 percent substitution for xylenes, toluene and MEK).

The California Department of Industrial Relations, Division of Occupational Safety and Health Administration (Cal/OSHA) regulates the concentration of many TACs in the workplace environment. To protect worker safety, Cal/OSHA has established a permissible exposure limit (PEL) for many of these compounds (the PEL is the maximum, 8-hour, time-weighted average concentration for occupational exposure). The current Cal/OSHA PEL for TBAC is 200 ppm for an 8 hour time-weighted average. If TBAC is substituted for xylenes, toluene, and MEK, the worker's TBAC exposure would not be expected to exceed the current workplace exposure standard.

Workers in the automotive coatings industry are exposed to isocyanates, found in polyurethane sealers and some primers. Paper masks offer no protection against isocyanate exposure, only the most protective respirators should be used for situations involving exposures to isocyanates that have poor warning properties, are potent sensitizers, or may be carcinogenic. These respirators include:

- any self-contained breathing apparatus with a full face piece operated in a pressure-demand or other positive-pressure mode, and
- any supplied-air respirator with a full face piece operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.

A complete respiratory protection program should include:

1) regular training and medical evaluation of personnel,
2) fit testing,
3) periodic environmental monitoring,
4) periodic maintenance, inspection, and cleaning of equipment
5) proper storage of equipment, and
6) written standard operating procedures governing the selection and use of respirators. The program should be evaluated regularly.

Some manufacturers and districts have expressed a concern over the possible increased worker exposure to glycol ethers and TBAC upon reformulation to lower VOC automotive coatings and cleaning solvents. Because of the history of isocyanate exposure in the automotive refinish industry, available personal protection systems are sufficient to protect against worker exposure to glycol ethers and TBAC.

In ARB's Draft Environmental Impact Assessment of *Tertiary*-Butyl Acetate, it is estimated that a large body shop uses 3,000 gallons of automotive coatings per year, and assumes that the average amount of toluene, xylenes and MEK present in automotive coatings is 50 percent of the total VOC content of the coating. Under this worst-case scenario, a large automotive refinishing facility would emit more than 6,500 pounds per year of TBAC if TBAC was substituted for toluene, xylenes, and MEK on a one-for-one basis. However, the SCAQMD has recently indicated that the largest automotive refinishing facility in their district uses no more than 1,100 gallons of coatings per year. Based on ARB's 2002 Automotive Survey, xylenes, toluene, and MEK account for approximately 27.5 percent of the VOCs used in automotive coatings. Under this scenario, which we believe most accurately defines the worst-case scenario for a large automotive refinishing facility, the amount of TBAC emitted annually would be approximately 1,350 pounds if TBAC was substituted on a one-for-one basis for toluene, xylenes and MEK.

The TBAC analysis also assesses the potential cancer risk from TBAC emissions from automotive refinishing facilities. The highest estimated cancer risk for a facility emitting 2,692 pounds per year of TBAC was 11 excess lifetime cancer cases per million. Based on the updated emission estimate for a large facility and the substitution assumption of 50 percent, we estimate the maximum potential risk to be 2.8 excess lifetime cancer cases per million. However, if the VOC limit for color coatings is met with water-borne coatings, the potential cancer risk would be reduced to about 1.4 in a million.

Staff also analyzed the potential for other air quality impacts. During past regulatory efforts affecting coatings, industry representatives have alleged that the use of low VOC coatings may create certain significant adverse air quality impacts. While similar concerns have not been raised during the development of this SCM, we examined the following issues in order to determine if any of these concerns were applicable to automotive coatings:

➢ *Will the use of lower VOC automotive coatings result in a thicker film coating?*

No. In previous rulemakings on coatings, some industry representatives contended that lower VOC coatings are formulated with high solids contents and were therefore difficult to handle during application, tending to produce a thick film when applied. A thicker film supposedly indicates that a smaller surface area is covered with a given amount of material, thereby increasing VOC emissions per unit area covered as compared to higher VOC coatings. Although high solids, low VOC coatings are being used, the recommended film thickness for these coatings is similar to that for higher VOC coatings. Thus, a lower VOC coating would cover the same or larger surface area than a higher VOC coating.

- ***Will the use of lower VOC automotive coatings result in illegal thinning of the product?***

Excessive thinning is not expected to be a problem because many of the coatings already comply with the SCM limits. Additionally, the VOC limit for color coatings is expected to be met with the use of water-borne formulations. Even if some thinning occurs, thinning would likely be done with water or exempt solvents. As a result, the potential for excessive thinning is minor and concerns about significant adverse air quality impacts are unfounded.

- ***Will the use of lower VOC automotive coatings require additional priming for proper adhesion to the substrate?***

No. Automotive coatings primers are currently solvent-borne coatings, and many already meet the VOC limits in the proposed SCM. Manufacturers' data show that substrate preparation for low VOC color coatings is similar to substrate preparation for higher VOC color coatings. No instances of poor adhesion between primers and low VOC color coatings are expected.

- ***Will the use of lower VOC automotive coatings require the use of more topcoats?***

In previous rulemakings on coatings, some industry representatives have claimed that the proposed lower VOC limits would yield products that provide inferior coverage, resulting in the use of more coatings to provide the same coverage as their higher VOC counterparts. This is not the case with automotive coatings. In fact, some low VOC water-borne automotive coatings currently sold and used in the United States provide greater coverage than solvent-borne automotive coatings. Manufacturers and current users of water-borne automotive coatings have indicated that coverage is superior to that of solvent-borne coatings, and therefore do not require the application of additional coats to achieve the necessary coverage.

- ***Will the use of lower VOC automotive coatings require more frequent recoating?***

No. Water-borne automotive coatings have been used successfully by the majority of the automobile manufacturers for several years; they are also used in manufacturer's vehicle processing centers, where cars are touched up prior to distribution in the United States. Data from the automotive coatings sector do not support the claim that lower VOC automotive coatings require more frequent recoating.

> *Will the use of lower VOC automotive coatings result in product substitution by the end-users?*

There are currently available low VOC automotive coatings with performance characteristics comparable to higher VOC automotive coatings, therefore it is not anticipated that spray technicians will substitute a product from a higher VOC category. Typically, manufacturers market coatings as a system and will not warranty the products' performance if the user deviates from the recommended usage. Additionally, the products within each automotive coatings category are specific to certain applications, and do not lend themselves to use in another coating category.

> *Will the use of lower VOC automotive coatings result in coatings with higher reactivity?*

Using the Maximum Incremental Reactivity (MIR) scale as the basis for comparing reactivities of VOCs it is true that, on a per gram basis, some VOCs used in water-borne coatings are more reactive than some VOCs used in solvent-borne coatings (Carter, 1999). For example, using the MIR scale as a basis, a typical VOC used in water-borne coatings, such as propylene glycol, is two to three times more reactive than a typical mineral spirits. However, less reactive solvents such as mineral spirits are not extensively used in automotive coatings. Automotive coatings tend to have solvents with higher reactivity such as xylenes and toluene. The reactivity of propylene glycol is approximately one-third the reactivity, on a gram for gram basis, of xylenes and toluene. Additionally, it is anticipated that manufacturers will incorporate the use of water and exempt solvents when formulating to meet the lower VOC limits of the proposed SCM. We have concluded, based on this information, that the total reactivity of the lower VOC automotive coatings will be less than the reactivity of the higher VOC automotive coatings.

3. Potential Hazardous Waste Impacts

The Department of Toxic Substances Control (DTSC) is the lead agency in California for hazardous waste management. DTSC enforces the California's Hazardous Waste Control laws, issues permits to hazardous waste facilities, and mitigates contaminated hazardous waste sites. In California, all hazardous waste must be disposed of at a facility that is registered with DTSC. Under these programs, automotive coatings may be classified as hazardous waste if they contain substances listed as toxic or if they meet other hazard criteria.

Many counties in California operate a Small Business Waste Program, providing low-cost programs for small businesses that qualify as Conditionally Exempt Small Quantity Generators (CESQG). In order to qualify as a CESQG, as defined in the California Health and Safety Code, section 25218.1, and the Code of Federal Regulations (40

CFR 261.5), the business must generate no more than 100 kilograms (220 pounds or approximately 27 gallons) of hazardous waste, or one kilogram (2.2 pounds) of extremely hazardous waste. The small business considered a CESQG must also store less than 2,200 pounds of all kinds of hazardous waste at any time. In order to encourage businesses to participate in their programs, many cities help subsidize disposal costs. Often times the disposal costs are tax deductible and the long-term liability of the materials is taken over by the county or city agency.

It is difficult to determine the amount of liquid waste paint generated from automotive coatings since the waste paint is usually mixed with waste paint thinner. Waste paint thinner is usually generated when paint guns and other paint equipment are cleaned. The waste paint thinner is usually collected in a 55 gallon drum and is mixed with waste paint. In almost all cases, waste coatings in liquid form must be managed as hazardous waste. The reduction of solvents in automotive coatings is not expected to result in non-hazardous liquid waste coatings. Solvent-based automotive coatings waste will still be classified as hazardous due to ignitability characteristics.

It is anticipated that resin manufacturers and coatings formulators will continue the trend of using less hazardous solvents such as Oxsol 100, and propylene glycol in their compliant coatings. It is expected that future compliant coatings will contain less hazardous materials, or nonhazardous materials, as compared to conventional coatings, resulting in a net benefit. Therefore, hazard impacts associated with the proposed SCM will be negligible.

Coating facilities that have filter-type paint booths also generate paint booth exhaust filters. Paint booth exhaust filters are changed every few weeks to few months depending on the amount of painting being done. Waste paint filters need to be tested for ignitability and toxicity characteristics. The *"Toxicity Characteristic Leaching Procedure"* (TCLP) is used to determine if the filters contain toxic materials. It is rare that a paint booth filter will meet the definition of hazardous waste assuming that only typical automotive coatings have been used. Waste filters are typically thrown into the trash for disposal at the sanitary landfill. It is not anticipated that the proposed SCM will impact the quantity or toxicity of the paint booth exhaust filters currently being landfilled.

4. Reasonably Foreseeable Feasible Mitigation Measures

ARB is required to do an analysis of reasonably foreseeable mitigation measures. We have concluded that no significant adverse environmental impacts should occur from implementation of the proposed SCM. As a result, no mitigation measures would be necessary.

5. Alternatives to the Proposed SCM

As alternatives to the proposed SCM, ARB staff evaluated taking no action and delaying the effective date. ARB staff determined that neither of these alternatives would be as effective at reducing VOC emissions from automotive coatings activities as the proposed SCM. The no action alternative was rejected because it would not achieve emission reductions necessary to attain the State and federal ambient air quality standards. The delayed effective date alternative was rejected because compliant coatings are currently available or will be available before the proposed effective date of January 1, 2009.

B. COMMUNITY HEALTH AND ENVIRONMENTAL JUSTICE

The ARB is committed to evaluating community impacts of proposed regulations, including environmental justice concerns. ARB's goal is to reduce or eliminate any disproportionate impacts of air pollution on low-income and minority populations so that all individuals in California can live, work, and play in a healthful environment. The proposed SCM is not expected to result in significant negative impacts in any community. The result of the proposed SCM will be reduced exposure to VOCs and toxic air contaminants (e.g., xylenes, toluene, and MEK) for California communities, including those with large populations of low-income and minority residents.

As part of our Community Health and Environmental Justice Programs, we assess and reduce the localized impacts of pollution from multiple sources. The cumulative, multi-pollutant focus of this important program compels us to take a more comprehensive, integrated approach to defining the ARB's overall control strategy.

Many communities in California are composed of a mix of residential, commercial, and industrial sites. During and after World War II, these areas experienced tremendous development due to rapid population growth and capital investment in military and industrial complexes. This rapid growth and development did not allow for proper residential planning, therefore, residential areas and industrial zones may be integrated. As a result, parts of these communities exhibit an unhealthy mixture of homes, schools, and environmentally hazardous facilities. Homes within these neighborhoods may be in close proximity to multiple sources of air pollution, such as businesses, industries, storage facilities, and freeways.

Automotive refinishing facilities, whose operations produce VOCs, are often among those types of small businesses located in low-income, minority communities. The higher than average incidence of asthma and other respiratory illnesses in children living in these communities may be related to poor air quality (U.S. EPA, 2000).

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VII. ECONOMIC IMPACTS

A. INTRODUCTION

This chapter discusses the economic impacts ARB staff anticipates from statewide implementation of the SCM. In general, economic impact analyses are inherently imprecise, especially given the unpredictable behavior of companies in a highly competitive market. While we quantified the economic impacts to the extent feasible, some projections are necessarily qualitative or semi-quantitative and based on general observations about the automotive refinishing industry. This analysis, therefore, serves to provide a general picture of the economic impacts that typical businesses subject to the proposed SCM might encounter; we recognize that individual companies within each district may experience impacts different than those projected in this analysis.

The overall projected impacts are summarized first, followed by a detailed discussion of specific aspects of the economic impacts in the sections listed below:

B) Annual Costs and the Cost-Effectiveness of the Proposed SCM;
C) Economic Impacts on California Businesses;
D) Potential Impacts on California State or Local Agencies; and
E) Potential Impacts on California Consumers.

It is important to note that ARB staff conducted the economic impacts analysis, even though the analysis is not required under the Administrative Procedure Act for a SCM, such as the staff's proposal. The analysis uses virtually the same methodology adopted by the Board in approving the 2000 Architectural Coatings SCM (ARB, 2000) and consumer product rulemakings since 1990 (ARB; 1990; ARB, 1991; ARB, 1997; ARB, 1999).

1. Summary of Economic Impact

Our analysis shows that the cost-effectiveness of the proposed limits is similar to the cost-effectiveness of the existing consumer product regulations (Phase I-II and Mid-Term Measures I-II), as well as other existing ARB regulatory programs. We estimate the overall cost-effectiveness of the proposed SCM to be $1.43 per pound of VOC reduced in current dollars. This cost-effectiveness is comparable in magnitude to that reported for other ARB consumer product regulations and measures, which generally have fallen within a range of no cost to about $6.90 per pound of VOC reduced. The architectural coatings SCM had an average cost-effectiveness of $3.20 per pound of VOC reduced.

In this analysis, we considered the impact to manufacturers of automotive coatings and automotive refinishing facilities. Overall, most automotive refinishing facilities and coatings manufacturers would be able to absorb the cost of the proposed SCM with no significant adverse impacts on their profitability. This finding is indicated by the staff's estimated change in "return on owner's equity" (ROE) analysis. The analysis found an average decrease in ROE of about 0.07 percent for coating manufacturers, and 15 percent for automotive refinishing facilities. If all costs of the proposed SCM are absorbed by automotive refinishing facilities, the decrease in ROE exceeds the 10 percent threshold typically used to indicate a potential for adverse impacts on profitability. However, we expect the costs incurred by manufacturers and automotive refinishing facilities to be passed on to consumers. If the entire cost of the proposed SCM were passed on to consumers, the average price for a repair would increase by about $11, which represents an increase of about 0.5% for a $2,200 repair. Because we expect most businesses to pass on their costs to consumers, we do not expect a noticeable change in employment; business creation, elimination or expansion; and business competitiveness in California. We also found no significant adverse fiscal impacts on any local or State agencies.

To project the maximum potential impacts on consumers, we assume the opposite scenario relative to the business impacts analysis. That is, rather than determining whether businesses can absorb all costs incurred and not have a significant impact on their profitability, we assume for the consumer impacts analysis that coating manufacturers and automotive refinishing facilities are able to pass on all the costs to the consumers by raising the price of refinishing a vehicle. If the cost were passed on to consumers, most of the impact would probably be in the form of increased insurance premiums. For the purpose of this analysis, we assume that only consumers who have their vehicle repaired or refinished are impacted. With this assumption, we project an average cost increase of about $11 per vehicle repaired or refinished.

2. General Approach for Cost Estimation

The economic impacts analysis consists of several parts. First, we calculated the total annual costs of the proposal. An analysis was conducted to determine the impacts on the annual costs to manufacturers based on raw material costs of typical complying and noncomplying coatings. In addition, we estimated the cost to market and distribute coatings that comply with the limits of the proposed SCM based on discussions with manufacturers. Because the 2002 Survey did not collect data on cleaning solvents, the analysis does not include the potential costs of complying with the proposed VOC limit for solvents. However, solvent manufacturers marketing in the SCAQMD already incurred the costs to develop 25 g/l cleaning solvents because the limit is already in effect the SCAQMD. We then estimated the annual cost to automotive refinishing facilities to use complying coatings without loss of production. The projected annual costs then become the inputs for determining the three main outputs of the analysis: the cost-effectiveness, the business impacts, and the consumer impacts.

The cost-effectiveness is presented to compare the proposal's cost efficiency in reducing a pound of VOC relative to the cost-efficiency of other rules and control measures adopted by the districts and the ARB. The business impact analysis employs two scenarios under which all costs incurred to meet the proposal are absorbed by the coating manufacturers, and then by assuming that all costs incurred by both the manufacturers and automotive refinishing facilities are absorbed by the automotive refinishing facilities. On the other hand, the consumer impact analysis operates under the hypothetical regime where all costs incurred to meet the proposal are passed on to the consumers in the form of increased cost to refinish a vehicle. These three parts of the analysis represent the boundaries of expected impacts, with the actual regulatory impacts from the proposal probably falling somewhere between these three extremes (i.e., some costs are absorbed by the manufacturer, some costs are absorbed by the automotive refinishing facilities, with the remaining costs passed on to consumers). Thus, the actual business impacts and price increases will likely be less than predicted in this analysis.

Distributors of automotive coatings may also incur some costs if those costs cannot be passed on to the automotive refinishing facilities because of competitive pressures. Potential cost to these operations might include some cost sharing between the manufacturer and distributor to transition customers to new products such as water-borne color coats. Based on discussions with industry representatives, it appears that cost sharing arrangements can vary widely and are not available to all automotive refinishing facilities. Thus, staff is unable to assess the potential impacts to distributors. However, because all coating and solvent manufacturers are subject to the same VOC limits, any impacts to distributors should be similar regardless of what manufacturer's products they market.

3. Sources and Treatment of Cost Data

The cost analysis relied on various sources of information. For cost information specific to manufacturers, we relied on estimates based on discussions with manufacturers of automotive coatings. Most manufacturers already market coatings that would comply with the limits in the SCM, and the estimated cost was primarily based on the cost for all manufacturers to market and distribute those coatings in California (Taylor, 2005). Compliant cleaning solvents are also currently marketed in California.

For industry wide data on automotive refinishing facilities, we relied on the U.S. Census Bureau, industry organizations, the SCAQMD, and information from third party sources. To estimate the cost of equipment, training, and other services automotive refinishing facilities may need to comply with the SCM and maintain sufficient levels of production, we relied on discussions with distributors of automotive coatings, spray booth manufacturers, air movement manufacturers, and automotive refinishing facility operators (US Census, 2005; Henderson, 2005; SCAQMD, 2005; Taylor, 2005; Elders, 2005; Ortiz, 2005; Hagan, 2005; Mac, 2005; Phillips, 2005).

We assumed that operating and maintenance costs for new equipment and waste disposal for water-borne color coatings is five percent of the equipment costs.

B. ANNUAL COSTS AND THE COST-EFFECTIVENESS (C.E.) OF THE PROPOSED SCM

1. Introduction

In the following analysis, we present the anticipated annual costs and cost-effectiveness of the proposed SCM. Determining the proposal's cost-effectiveness allows us to compare the efficiency of the proposed SCM in reducing a pound of VOC relative to other existing regulatory programs. To do this, we applied a well-established methodology for converting compliance costs, both nonrecurring and recurring costs, to an annual basis. We then report the ratio of the annual costs to the annual emission reductions in terms of "dollars (to be) spent per pound of VOC reduced." To put the proposal's cost-effectiveness into proper perspective, we compare the results of our analysis with the cost-effectiveness of other ARB regulations and control measures.

2. Methodology

As noted previously, the cost-effectiveness of a regulation is generally defined as the ratio of total dollars to be spent to comply with the regulation (as an annual cost) to the mass reduction of the pollutant(s) to be achieved by complying with that regulation (in annual pounds). Annual costs include annualized nonrecurring costs (e.g., total research and development (R&D), product and consumer testing, equipment purchases/modifications, one-time distributional/marketing changes, etc.) and annual recurring costs (e.g., increases or decreases in raw material costs, labeling, packaging, recordkeeping & reporting, etc.). Thus, the cost-effectiveness is calculated according to the following general equations:

$$\text{Cost-Effectiveness} = \frac{\text{Annualized Nonrecurring Costs + Annual Recurring Costs}}{\text{Annual Emission reductions}}$$

where,

Annualized Nonrecurring Costs = CRF x ∑ (Nonrecurring Costs)
Annual Recurring Costs = Raw Material Costs + Non Raw Material Costs

The CRF is calculated as follows:

$$CRF = \frac{i(1+i)^n}{(1+i)^n - 1}$$

where,

CRF	=	*Capital Recovery Factor*
I	=	*discount interest rate in real terms (assumed to be four percent)*
n	=	*project horizon or useful life of equipment*

As shown above, we annualized the nonrecurring costs (i.e., one-time fixed costs such as R&D, equipment purchases, etc.) using the Capital Recovery Method, which is the recommended approach under California Environmental Protection Agency (Cal/EPA) guidelines. Using this method, we multiply the estimated total fixed costs to comply with each proposed limit by the Capital Recovery Factor (CRF) to convert these fixed costs into discounted, equal annual payments in current dollars over the selected project horizon (i.e., the projected useful life of the investment) (Cal/EPA, 1996). We then sum the annualized fixed costs with the annual recurring costs and divide that sum by the annual emission reductions to calculate the cost-effectiveness of each limit.

3. Assumptions

There are a number of assumptions made to determine the impact to automotive refinishing facilities. Due to the number and unique needs of automotive refinishing facilities in California, some of these businesses will incur costs which will be different than what we have estimated in this analysis.

In determining the impact to automotive refinishing facilities as a worst case scenario, staff assumed that every facility will need to apply water-borne color coatings. Compliant color coatings may be developed with exempt solvents that would require little modification to existing equipment in automotive refinishing facilities. There are also some automotive refinishing facilities that only use single stage coatings which we expect to remain solvent-borne. We don't expect these facilities to be impacted by the SCM.

Coating manufacturers recommend additional air movement equipment to dry water-borne color coatings quickly. Heating equipment was suggested as an option that would allow automotive refinishing facilities to improve production levels. There are a number of solutions available to automotive refinishing facilities to meet air movement needs. These range from small hand held devices to fully integrated air movement systems. Although each automotive refinishing facility will evaluate the costs and benefits of air movement systems, we assumed that automotive refinishing facilities with high annual revenues will generally install the more expensive upgrades to their spray booths to maintain current production levels. We also assumed that automotive refinishing facilities with low annual revenues will install less expensive equipment to save on overall cost. The specific assumptions are discussed in Appendix C.

ARB staff estimated there are about 4,100 automotive refinishing facilities in California. Staff estimated the average gross annual revenue for an automotive refinishing facility to be about one million dollars (Taylor, 2005).

We assumed that 57 percent of all automotive refinishing facilities have a single spray booth. In the absence of industry wide statistics on the number of spray booths for automotive refinishing facilities in California, we used data from the SCAQMD to estimate the number of facilities with multiple booths (SCAQMD, 2005). Although there may be facilities in all revenue categories that have a single spray booth, staff assumed that only automotive refinishing facilities with annual revenue of less than one million dollars have a single spray booth. We also assumed that 25 percent of the booths have heating equipment, based on data from the SCAQMD. We assumed that all facilities with greater than $2.5 million annual revenue have heating equipment, and all facilities with less than one million dollars annual revenue have no heating equipment.

ARB staff conducted an analysis of raw material costs to manufacturers based on typical ingredients found in complying and noncomplying coatings. Staff determined that the raw material costs of products that comply with the limits of the proposed SCM are generally less than the raw material costs of products that do not comply with the proposed SCM. To be conservative, staff assumed there would be no cost savings to manufacturers or to automotive refinishing facilities from raw material prices.

We also assumed that some small coating manufacturers would cease to sell products in California. According to the 2002 Automotive Coatings Survey, there were 17 manufacturers that sold automotive coatings in California in 2001. Ten of these manufacturers account for about 98 percent of the total volume of automotive coatings sold in California in 2001. We assume that the remaining seven manufacturers that sell very low volumes of coatings in California will cease to sell their products here due to the cost of complying with the SCM.

We also assumed a project horizon of five years and a real discount rate of four percent throughout the project horizon. The five year project horizon is appropriate because that is the generally accepted project horizon used in cost analyses involving chemical processing industries. In addition, five years is the number of years for a project horizon generally recommended by Cal/EPA when conducting a cost-effectiveness analysis (Cal/EPA, 1996, *supra*). With regard to the discount rate, Cal/EPA recommends two percent plus the current yield for a U.S. Treasury note of similar maturity to the project horizon (*Id.*), which in recent years has been about four percent (CNN, 2005). We also assumed a two percent inflation rate.

4. Results

The cost-effectiveness of the SCM is estimated to be $1.43 per pound of VOC reduced, which compares favorably with the cost-effectiveness of measures such as the 2000 Architectural Coatings SCM ($3.20 per pound of VOC reduced). The average annual cost to automotive coating and solvent manufacturers is estimated to be about $320,000. The average annual cost to automotive refinishing facilities is estimated to be about $3,400. The total annualized cost to comply with the proposed SCM is estimated to be about $14 million.

C. ECONOMIC IMPACTS ON CALIFORNIA BUSINESSES

1. Legal Requirements

ARB staff conducted an economic impacts assessment although it is not legally required for the proposed SCM. Section 11346.3 of the Government Code requires State agencies to assess the potential for adverse economic impacts on California business enterprises and individuals when proposing to adopt or amend any administrative regulation. The assessment shall include a consideration of the impact of the proposed regulation on California jobs, business expansion, elimination or creation, and the ability of California business to compete with businesses in other states. Because the staff's proposal is a SCM rather than an administrative regulation, the business impacts assessment is not required. However, ARB staff conducted the normally required business impacts assessment to provide the Board and districts a comprehensive evaluation of the potential cost impacts. Similarly, we also evaluated the SCM's potential impacts to State and local agencies. Normally, State agencies are required to estimate the cost or savings to any State or local agency and school district in accordance with instructions adopted by the Department of Finance. The estimate shall include any nondiscretionary cost or savings to local agencies and the cost or savings in federal funding to the State. A major regulation is defined as a regulation that will have a potential cost to California business enterprises in an amount exceeding ten million dollars in any single year.

2. Potential Impact on California Businesses

Only one company, Ellis Paint, currently manufactures automotive coatings in the State. The impact on this company is expected to be minimal since they have coatings that meet the proposed limits in most categories. Additionally, Ellis Paint does not produce color coatings, which will require the most reformulation under the proposed SCM. Ellis Paint also manufactures cleaning solvents that meet the proposed VOC limit of 25 g/l.

3. Affected Businesses

Any person that uses, supplies, sells, offers for sale, manufactures, distributes, blends, or repackages for sale automotive coatings or associated solvents or performs automotive refinishing would potentially be affected by the proposed SCM. Also, potentially affected are businesses that manufacture air movement or heating equipment for spray booths; or supply resins, exempt solvents, or other ingredients and equipment to these manufacturers or marketers.

The focus of this analysis, however, will be on coating manufacturers and automotive refinishing facilities because these businesses would be directly affected by the proposed SCM. Distributors of automotive coatings may also incur some cost if those costs cannot be passed on to the automotive refinishing facilities because of competitive pressures. However, ARB staff is unable to quantify these impacts. Potential costs to distributors might include some cost sharing between the manufacturer and distributor to transition automotive refinishing facilities to new products such as water-borne color coatings. Staff does not have data on the extent to which such cost sharing might occur.

Automotive coatings are manufactured or marketed by 17 companies nationwide, of which one is based in California, according to the 2002 Survey. The bulk of the sales volume in California was generated by a few companies; three manufacturers account for 65 percent of the volume, with the remaining 14 companies accounting for the other 35 percent (ARB, 2005). The automotive coating manufacturers marketed about 3.7 million gallons of coatings in California in 2001, of which an estimated one million gallons were compliant and 2.7 million gallons were noncompliant with the proposed SCM (*Id.*).

Staff estimates there are approximately 4,100 automotive refinishing facilities in California. These businesses generated about $2.4 billion in annual revenue in 1997 (U.S. Census, 2005). About half of these facilities have an annual revenue of less than $500,000 per year (Taylor, 2005).

a. Study Approach

Sixteen of the 17 manufacturers of automotive coatings who responded to ARB's 2002 Survey sold coatings in California in 2001 that did not meet the proposed SCM limits. Staff did not have information on the 17th manufacturer to make this determination. In addition, for purposes of determining worse-case potential economic impact, staff assumes that all automotive refinishing facilities in California will need to incur costs to comply with the proposed SCM. This is a conservative estimate because facilities that use only single-stage color coatings would not need to invest in air movement equipment or heat because they would continue to use currently available, compliant solvent-borne coatings. The approach used in evaluating the potential economic impact of the proposed SCM on these businesses is outlined as follows:

1) Compliance cost was estimated for manufacturers and automotive refinishing facilities;
2) Estimated cost was adjusted for federal and State taxes; and
3) The three-year average ROE was calculated for businesses by averaging the median ROEs for 2002 through 2004. Actual financial data were used for coating manufacturers where such data were available publicly. In case of the automotive refinishing facilities, however, actual financial data were not available publicly. Thus, we developed a financial profile of a typical California automotive refinishing facility with an annual revenue of $1 million using the Dun and Bradstreet financial ratios for the industry.

ROE is calculated by dividing the net profit by the net worth. The adjusted cost was then subtracted from the net profit data. The results were used to calculate an adjusted three-year average ROE. The adjusted ROE was then compared with the ROE before the subtraction of the adjusted cost to determine the potential impact on the profitability of the businesses. A reduction of more than 10 percent in profitability is considered to indicate a potential for significant adverse economic impacts.

The threshold value of 10 percent has been used consistently by the ARB staff to determine impact severity (ARB, 1990; ARB, 1991; ARB, 1995; ARB, 1998). This threshold is consistent with the thresholds used by the U.S. EPA and others.

b. Assumptions

The ROEs before and after the subtraction of the adjusted compliance costs were calculated for a typical business using financial data for 2002 through 2004. The calculations were based on the following assumptions:

1) Selected businesses are representative of affected businesses;
2) All affected businesses were subject to the highest federal and State corporate tax rates of 35 percent and 9.3 percent respectively; and
3) Affected businesses are not able to increase the prices of their products, nor can they lower their costs of doing business through short-term cost-cutting measures.

Given the limitation of available data, staff believes these assumptions are reasonable for most businesses at least in the short run. However, they may not be applicable to all businesses.

c. Results

Table VII-1 shows the estimated change in ROE on affected industry groups.

Table VII-1 Changes in Return on Owner's Equity (ROE) for Typical Businesses in the Automotive Refinishing Industry

SIC Code and Category	Change in ROE
2851 Manufacturing - Paints, Varnishes, Lacquers, Enamels, And Allied Products	0.07 percent
7532 Automotive Repair - Top, Body, and Upholstery Repair facilities and Paint facilities	15 percent

The estimated average decline in profitability of businesses is about 0.07 percent for manufacturers, and about 15 percent for automotive refinishing facilities. If the automotive refinishing facilities absorbed all costs, they would be adversely impacted by the proposed SCM. However, we expect automotive refinishing facilities to pass on the costs of the proposed SCM to consumers. If the entire cost of the proposed SCM were passed on to consumers, the average price for a repair or refinish would increase by about $11, which represents an increase of about 0.5% for a $2,200 repair.

The performance of businesses may differ from year to year. Hence, the average financial data used may not be representative of an average year performance for some businesses. The estimated changes to ROEs may be high because affected businesses probably would not absorb all of the increase in their costs of doing business. They might be able to either pass some of the cost on to consumers in the form of higher prices, reduce their costs, or do both.

4. Potential Impact on Employment

The paint or body repair facilities (NAICS 811121/SIC 7532) are defined as establishments engaged in repairing or customizing automotive vehicles, such as passenger cars, trucks, and vans, and all trailer bodies and interiors; and/or painting automotive vehicles and trailer bodies. It is estimated that there are 27,665 paid employees involved in the automotive body repair and refinishing services (U.S. Census, 2005).

We expect the proposed SCM to have minimal impact on most employees that do automotive refinishing. While it is possible that some automotive refinishing facilities may experience higher costs than those estimated above, we believe that most will not be impacted adversely if districts adopt the proposed SCM.

Cost impacts on coating manufacturers will be minimal. Most coating manufacturers are global companies and the proposed SCM would have minimal impact on their operations as indicated by the change in ROE. Thus, we do not expect any significant impact in the employment at these companies.

5. Potential Impact on Business Creation, Elimination, or Expansion

The proposed SCM should have no noticeable impact on the status of California businesses. This is because the costs are not expected to impose a significant impact on the profitability of businesses in California. However, some small automotive refinishing facilities with little or no margin of profitability may lack the financial resources to modify their facilities in a timely manner. Should the proposed measures impose a significant hardship on these businesses, temporary relief in the form of a compliance date extension under the local districts' variance provision may be warranted.

While some individual businesses may be affected adversely, the proposed SCM may provide business opportunities for existing California businesses or result in the creation of new businesses. California businesses that produce air movement equipment for spray booths or provide consulting services to affected businesses may benefit from increased industry spending.

6. Potential Impact on Business Competitiveness

The proposed SCM is not expected to have a significant impact on the ability of automotive refinishing facilities in California to compete with businesses from another state. Most automotive refinishing facilities are independent operations that compete for local business within their region and rarely seek business from outside the State.

The proposed SCM should have no significant impact on the ability of California manufacturers of automotive coatings to compete with businesses in other states. Because the proposed measures would apply to all businesses that manufacture or market automotive coatings for sale in California regardless of their location, the staff's proposal should not present any economic disadvantages specific to California businesses. Of the 17 companies involved in manufacturing or marketing of automotive coatings in California, only one company is located in California.

D. POTENTIAL IMPACTS ON CALIFORNIA STATE OR LOCAL AGENCIES

We have identified no State or local agency that would be adversely affected by the proposed SCM. One State agency, the California Department of Transportation, performs touch-up work on their fleet vehicles with single-stage color coatings. Since many single-stage color mixtures already comply with the limits of the proposed SCM, we do not expect them to be adversely affected. Additionally, we expect single-stage color coatings to remain solvent-borne, thus there would not be a need for air movement equipment. There are cleaning solvents already available that meet the proposed VOC limit in the SCM. Thus, the solvent requirement is not expected to have an adverse impact on State or local agencies.

E. POTENTIAL IMPACTS ON CALIFORNIA CONSUMERS

The potential impact of the SCM on consumers depends upon the extent to which affected businesses are able to pass on the increased cost to consumers in terms of higher prices for their services. Given the small impact of the proposed SCM on the profitability of most automotive refinishing facilities, we do not expect a noticeable change in the price of services provided by these businesses. Since most repairs are paid directly by insurance companies, consumers may be impacted by higher insurance premiums. We anticipate the impact, if any, on consumers to be negligible. If the annual cost of the proposed SCM were divided among the total number of repairs in California per year, the average cost of a repair would increase by about $11. This represents a 0.5% increase in cost for a typical repair of $2,200. If the consumer is paying for the refinishing directly, he or she would have to absorb the entire cost.

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Appendix A

Proposed Suggested Control Measure for Automotive Coatings

California Air Resources Board
Proposed Suggested Control Measure for Automotive Coatings

1. Purpose

The purpose of this rule is to limit volatile organic compound (VOC) emissions from coatings and solvents associated with the coating of motor vehicles, mobile equipment, and associated parts and components.

2. Applicability

2.1 Except as provided in section 2.2, this rule is applicable to any person who supplies, sells, offers for sale, manufactures, or distributes any automotive coating or associated solvent for use within the District, as well as any person who uses, applies, or solicits the use or application of any automotive coating or associated solvent within the District.

2.2 This rule does not apply to:

2.2.1 Any automotive coating or associated solvent that is offered for sale, sold, or manufactured for use outside of the District or for shipment to other manufacturers for reformulation or repackaging.

2.2.2 Any aerosol coating product.

2.2.3 Any automotive coating that is sold, supplied, or offered for sale in 0.5 fluid ounce or smaller containers intended to be used by the general public to repair tiny surface imperfections.

2.2.4 Any coating applied to motor vehicles or mobile equipment, or their associated parts and components, during manufacture on an assembly line.

3. Definitions

3.1 "Adhesion promoter" means a coating, which is labeled and formulated to be applied to uncoated plastic surfaces to facilitate bonding of subsequent coatings, and on which, a subsequent coating is applied.

3.2 "Aerosol Coating Product" means a pressurized coating product containing pigments or resins that dispenses product ingredients by means of a propellant, and is packaged in a disposable can for hand-held application, or for use in specialized equipment for ground traffic/marking applications.

3.3 "Assembly Line" means an arrangement of industrial equipment and workers in which the product passes from one specialized operation to another until complete, by either automatic or manual means.

3.4 "Associated Parts and Components" means structures, devices, pieces, modules, sections, assemblies, subassemblies, or elements of motor vehicles or mobile equipment that are designed to be a part of motor vehicles or mobile equipment but which are not attached to motor vehicles or mobile equipment at the time of coating the structure, device, piece, module, section, assembly, subassembly, or element. "Associated parts and components" does not include circuit boards.

3.5 "Automotive Coating" means any coating or coating component used or recommended for use in motor vehicle or mobile equipment refinishing, service, maintenance, repair, restoration, or modification, except metal plating activities. Any reference to automotive refinishing or automotive coating made by a person on the container or in product literature constitutes a recommendation for use in motor vehicle or mobile equipment refinishing.

3.6 "Automotive Coating Component" means any portion of a coating, including, but not limited to, a reducer or thinner, toner, hardener, and additive, which is recommended by any person to distributors or end-users for use in an automotive coating, or which is supplied for or used in an automotive coating. The raw materials used to produce the components are not considered automotive coating components.

3.7 "Automotive Refinishing Facility" means any shop, business, location, or parcel of land where motor vehicles or mobile equipment or their associated parts and components are coated, including autobody collision repair shops. "Automotive Refinishing Facility" does not include the original equipment manufacturing plant where the motor vehicle or mobile equipment is completely assembled.

3.8 "CARB" means the California Air Resources Board.

3.9 "Cleaning Operations" means the removal of loosely held uncured adhesives, inks, coatings, or contaminants, including, but not limited to, dirt, soil, or grease, from motor vehicles, mobile equipment, associated parts and components, substrates, parts, products, tools, machinery, equipment, or general work areas.

3.10 "Clear Coating" means any coating that contains no pigments and is labeled and formulated for application over a color coating or clear coating.

3.11 "Coating" means a material which is applied to a surface and forms a film in order to beautify, preserve, repair, or protect such a surface.

3.12 "Color Coating" means any pigmented coating, excluding adhesion promoters, primers, and multi-color coatings, that requires a subsequent clear coating and which is applied over a primer, adhesion promoter, or color coating. Color coatings include metallic/iridescent color coatings.

3.13 "Electrostatic Spray Application" means any method of spray application of coatings where an electrostatic attraction is created between the part to be coated and the paint particles.

3.14 "Emission Control System" means any combination of capture systems and control devices used to reduce VOC emissions from automotive coating operations.

3.15 "Exempt Compounds" means, for the purposes of this rule, the compounds listed in sections 3.34.1 and 3.34.2.

3.16 "Graphic Arts Operation" means the application of logos, letters, numbers, or graphics to a painted surface by brush, roller, or airbrush.

3.17 "High-Volume, Low-Pressure (HVLP)" means spray equipment permanently labeled as such and which is designed and operated between 0.1 and 10 pounds per square inch, gauge, (psig) air atomizing pressure measured dynamically at the center of the air cap and at the air horns.

3.18 "Metallic/Iridescent Color Coating" means any coating that contains more than 0.042 pounds per gallon (5 grams per liter) of metal or iridescent particles as applied, where such particles are visible in the dried film.

3.19 "Mobile Equipment" means any device that may be drawn and/or driven on rails or a roadway including, but not limited to, trains, railcars, truck trailers, mobile cranes, bulldozers, street cleaners, and implements of husbandry or agriculture.

3.20 "Motor Vehicle" means any self-propelled vehicle, including, but not limited to, cars, trucks, buses, golf carts, vans, motorcycles, tanks, and armored personnel carriers.

3.21 "Multi-Color Coating" means any coating that exhibits more than one color in the dried film after a single application, is packaged in a single container, and hides surface defects on areas of heavy use, and which is applied over a primer or adhesion promoter.

3.22 "Person" shall have the same meaning as defined in Health and Safety Code section 39047.

3.23 "Pretreatment Coating" means any coating that contains a minimum of one-half (0.5) percent acid by weight and not more than 16 percent solids by weight necessary to provide surface etching and is labeled and formulated for application directly to bare metal surfaces to provide corrosion resistance and adhesion.

3.24 "Primer" means any coating, which is labeled and formulated for application to a substrate to provide 1) a bond between the substrate and subsequent coats, 2) corrosion resistance, 3) a smooth substrate surface, or 4) resistance to penetration of subsequent coats, and on which a subsequent coating is applied. Primers may be pigmented.

3.25 "Single-Stage Coating" means any pigmented coating, excluding primers and multi-color coatings, labeled and formulated for application without a subsequent clear coat. Single-stage coatings include single-stage metallic/iridescent coatings.

3.26 "Solvent" means a VOC-containing fluid used to perform cleaning operations.

3.27 "Spot Repair" means repair of an area on a motor vehicle, piece of mobile equipment, or associated parts or components of less than 1 square foot (929 square centimeters).

3.28 "Temporary Protective Coating" means any coating which is labeled and formulated for the purpose of temporarily protecting areas from overspray or mechanical damage.

3.29 "Transfer Efficiency" means the amount of coating solids adhering to the object being coated divided by the total amount of coating solids sprayed, expressed as a percentage.

3.30 "Truck Bed Liner Coating" means any coating, excluding clear, color, multi-color, and single stage coatings, labeled and formulated for application to a truck bed to protect it from surface abrasion.

3.31 "Underbody Coating" means any coating labeled and formulated for application to wheel wells, the inside of door panels or fenders, the underside of a trunk or hood, or the underside of the motor vehicle.

3.32 "Uniform Finish Coating" means any coating labeled and formulated for application to the area around a spot repair for the purpose of blending a repaired area's color or clear coat to match the appearance of an adjacent area's existing coating.

3.33 "U.S. EPA" means the United States Environmental Protection Agency.

3.34 "Volatile Organic Compound (VOC)" means any volatile compound containing at least one atom of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, and excluding the following:

3.34.1 methane;
methylene chloride (dichloromethane);
1,1,1-trichloroethane (methyl chloroform);
trichlorofluoromethane (CFC-11);
dichlorodifluoromethane (CFC-12);
1,1,2-trichloro-1,2,2-trifluoroethane (CFC-113);
1,2-dichloro-1,1,2,2-tetrafluoroethane (CFC-114);
chloropentafluoroethane (CFC-115);
chlorodifluoromethane (HCFC-22);
1,1,1-trifluoro-2,2-dichloroethane (HCFC-123);
2-chloro-1,1,1,2-tetrafluoroethane (HCFC-124);
1,1-dichloro-1-fluoroethane (HCFC-141b);
1-chloro-1,1-difluoroethane (HCFC-142b);
trifluoromethane (HFC-23);
pentafluoroethane (HFC-125);
1,1,2,2-tetrafluoroethane (HFC-134);
1,1,1,2-tetrafluoroethane (HFC-134a);
1,1,1-trifluoroethane (HFC-143a);
1,1-difluoroethane (HFC-152a);
cyclic, branched, or linear completely methylated siloxanes;
the following classes of perfluorocarbons:
(A) cyclic, branched, or linear, completely fluorinated alkanes;
(B) cyclic, branched, or linear, completely fluorinated ethers with no unsaturations;
(C) cyclic, branched, or linear, completely fluorinated tertiary amines with no unsaturations; and
(D) sulfur-containing perfluorocarbons with no unsaturations and with the sulfur bonds only to carbon and fluorine; and

3.34.2 the following low-reactive organic compounds which have been exempted by the U.S. EPA:
acetone;
ethane;
parachlorobenzotrifluoride (1-chloro-4-trifluoromethyl benzene);
perchloroethylene;
methyl acetate; and
tertiary butyl acetate (tBAc).

3.35 VOC Content

3.35.1 "VOC regulatory for Coatings" means VOC in grams per liter of coating, excluding water and exempt compounds, and shall be calculated by the following equation:

$$\text{VOC regulatory content} = \frac{Wv - Ww - Wec}{Vm - Vw - Vec}$$

3.35.2 "VOC actual for Coatings" means VOC in grams per liter of material shall be calculated using the following equation:

$$\text{VOC actual content} = \frac{Wv - Ww - Wec}{Vm}$$

3.35.3 "VOC content for Solvents" means VOC in grams per liter of material shall be calculated by the following equation:

$$\text{VOC content} = \frac{Wv - Ww - Wec}{Vm}$$

Where:

VOC content = amount of volatile organic compounds in grams/liter

Wv = weight of volatiles in grams

Ww = weight of water in grams

Wec = weight of exempt compounds in grams

Vm = volume of material (coating or solvent, as applicable) in liters

Vw = volume of water in liters

Vec = volume of exempt compounds in liters

4. Standards

4.1 **Coating Limits.** No person shall apply to any motor vehicle, mobile equipment, or associated parts and components, any coating with a VOC regulatory content, as calculated pursuant to section 3.35.1, in excess of the following limits, except as provided in section 4.3:

Coating Category	VOC regulatory limit, as applied, effective January 1, 2009 in grams/liter (pounds per gallon*)
Adhesion Promoter	540 (4.5)
Clear Coating	250 (2.1)
Color Coating	420 (3.5)
Multi-Color Coating	680 (5.7)
Pretreatment Coating	660 (5.5)
Primer	250 (2.1)
Single-Stage Coating	340 (2.8)
Temporary Protective Coating	60 (0.5)
Truck Bed Liner Coating	310 (2.6)
Underbody Coating	430 (3.6)
Uniform Finish Coating	540 (4.5)
Any *other coating type*	250 (2.1)

*English units are provided for information only.

4.2 **Most Restrictive VOC Limit.** If anywhere on the container of any automotive coating, or any label or sticker affixed to the container, or in any sales, advertising, or technical literature supplied by a person, any representation is made that indicates that the coating meets the definition of or is recommended for use for more than one of the coating categories listed in section 4.1, then the lowest VOC content limit shall apply.

4.3 **Alternative Compliance.** Instead of complying with the VOC content limits specified in section 4.1, a person may use an emission control system that has been approved, in writing, by the Executive Officer or Air Pollution Control Officer of the District and which achieves an overall control efficiency of at least 85 percent as determined pursuant to sections 6.5 and 6.6. Any approved system emission control must be maintained and used at all times in proper working condition.

4.4 **Prohibition of Possession.** No person shall possess at any automotive refinishing facility, any automotive coating that is not in compliance with section 4.1 or 4.3, as applicable, or any solvent with a VOC content greater than 25 grams per liter.

4.5 **Prohibition of Sale or Manufacture.** No person shall manufacture, blend, repackage for sale, supply, sell, offer for sale, or distribute within the District any coating with a VOC content in excess of the limits specified in section 4.1.

Notwithstanding the provisions of this section, a person may manufacture, blend, repackage for sale, supply, sell, offer for sale, or distribute a coating with a VOC content in excess of the limits specified in section 4.1 under the following circumstances and provided all of the requirements of section 5.6 are also met:

4.5.1 The coating is for use exclusively within an emission control system as allowed in section 4.3, or

4.5.2 The coating is for use outside the District.

4.6 **Prohibition of Specification.** No person shall solicit or require the use of, or specify the application or use of any coating or solvent on a motor vehicle or mobile equipment, or associated parts and components, if such use or application results in a violation of this rule. This prohibition shall apply to all written or oral contracts, including, but not limited to, job orders, under the terms of which any coating or solvent that is subject to the provisions of this rule is to be used or applied. This prohibition shall not apply to coatings that meet the criteria specified in section 4.5.

4.7 **Coating Application Methods.** No person shall apply any coating to any motor vehicle, mobile equipment, or associated parts and components unless one of the following application methods is used:

4.7.1 Brush, dip, or roller.

4.7.2 Electrostatic spray.

4.7.3 High-Volume Low-Pressure (HVLP) spray equipment.

4.7.4 Use of a spray gun: If a spray gun is used, the end user must demonstrate that the gun meets the HVLP definition in section 3.17 in design and use. A satisfactory demonstration must be based on the manufacturer's published technical material on the design of the gun and by a demonstration of the operation of the gun using an air pressure tip gauge from the manufacturer of the gun.

4.7.5 Any alternative method that achieves a transfer efficiency equivalent to, or higher than, the application methods listed in sections 4.7.1, 4.7.2, or 4.7.3 as determined per section 6.9. Written approval from the Executive Officer or Air Pollution Control Officer of the District shall be obtained for each alternative method prior to use.

section 4.7 does not apply to underbody coatings, graphic arts operations, truck bed liner coatings, or any coating use of less than one (1) fluid ounce (29.6 milliliters).

4.8 Solvent Limits and Evaporative Loss Minimization

4.8.1 Each solvent present at any automotive refinishing facility shall not exceed a VOC content of 25 grams per liter as calculated pursuant to section 3.35.3.

4.8.2 Solvent-laden materials shall be stored in closed containers.

4.8.3 All automotive coating components, automotive coatings, and solvents shall be stored in closed vapor-tight containers.

4.8.4 No person shall clean spray equipment unless a closed system is used. However, equivalent control equipment can be used if the Executive Officer or Air Pollution Control Officer of the District approves it in writing prior to use.

4.8.5 All waste automotive coating components, automotive coatings, and solvents shall be stored in closed vapor-tight containers, except while adding to or removing them from the containers.

5. Administrative Requirements

5.1 Compliance Statement Requirement

5.1.1 For each individual automotive coating or automotive coating component, the manufacturer and repackager shall include the following information on product data sheets, or an equivalent medium:

5.1.1.1 The VOC actual for coatings and VOC regulatory for coatings, expressed in grams per liter;

5.1.1.2 The weight percentage of volatiles, water, and exempt compounds;

5.1.1.3 The volume percentage of water and exempt compounds; and,

5.1.3.4 The density of the material (in grams per liter).

5.1.2 For each individual ready to spray mixture (based on the manufacturer's and repackager's stated mix ratio), the manufacturer and repackager shall include the following information on product data sheets, or an equivalent medium:

5.1.2.1 The VOC actual for coatings and VOC regulatory for coatings, expressed in grams per liter;

5.1.2.2 The weight percentage of volatiles, water, and exempt compounds;

5.1.2.3 The volume percentage of water and exempt compounds; and,

5.1.2.4 The density of the material (in grams per liter).

5.1.3 The manufacturer and repackager of solvents subject to this rule shall include the VOC content as supplied, calculated pursuant to section 3.35.3, expressed in grams per liter, on product data sheets, or an equivalent medium.

5.2 **Labeling Requirements**

5.2.1 The manufacturer and repackager of automotive coatings or automotive coating components shall include on all containers the applicable use category(ies), and the VOC actual for coatings and VOC regulatory for coatings, as supplied, expressed in grams per liter.

5.2.2 The manufacturer and repackager of solvents subject to this rule shall include on all containers the VOC content for solvents, as supplied, expressed in grams per liter.

5.3 **Maintenance of Records.** Records required by this rule shall be retained for a minimum of three years and made available for inspection by District personnel upon request.

5.4 **Record Keeping Requirements.** Any person who uses coatings or solvents subject to this rule shall maintain and have available at all times, on site, the following:

5.4.1 A current list of all coatings and solvents used that are subject to this rule. This list shall include the following information for each coating and solvent:

5.4.1.1 material name and manufacturer

5.4.1.2 application method

5.4.1.3 coating type (as listed in section 4.1) and mix ratio specific to the coating

5.4.1.4 VOC actual for coatings and VOC regulatory for coatings, as applied, or VOC content for solvent.

5.4.1.5 whether the material is a coating or solvent.

5.4.2 Current manufacturer specification sheets, material safety data sheets, technical data sheets, or air quality data sheets, which list the VOC actual for coatings and VOC regulatory for coatings of each ready-to-spray coating (based on the manufacturer's stated mix ratio) and automotive coating components, and VOC content of each solvent.

5.4.3 Purchase records identifying the coating type (as listed in section 4.1), name, and volume of coatings and solvents.

5.5 **Record Keeping Requirements for Emission Control Systems.** Any person using an emission control system shall maintain daily records of key system operating parameters which will demonstrate continuous operation and compliance of the emission control system during periods of VOC emission producing activities. "Key system operating parameters" are those parameters necessary to ensure or document compliance with section 4.3, including, but not limited to, temperatures, pressure drops, and air flow rates.

5.6 **Record Keeping Requirements for Prohibition of Sale.** Any person claiming an exception specified in section 4.5 shall keep a detailed log of each automotive coating component and automotive coating manufactured, blended, repackaged for sale, supplied, sold, offered for sale, or distributed showing:

5.6.1 The quantity manufactured, blended, repackaged for sale, supplied, sold, offered for sale, or distributed, including size and number of containers;
5.6.2 The VOC regulatory for coatings;
5.6.3 The VOC actual for coatings;
5.6.4 To whom they were supplied, sold, offered for sale, or distributed, or for whom they were manufactured, blended, or repackaged for sale including the name, address, phone number, retail tax license number, and valid district permit number; and,
5.6.5 The specific exception being utilized under section 4.5.

6. **Test Methods.** The following test methods are incorporated by reference herein, and shall be used to test coatings and solvents subject to the provisions of this rule. A source is in violation of this rule if any measurement by any of the listed applicable test methods exceeds the standards of this rule.

6.1 **Methyl Acetate, Acetone, t-Butyl Acetate, and PCBTF Content.** The quantity of methyl acetate, acetone, t-butyl acetate, and parachlorobenzotrifluoride (as specified in sections 3.15, 3.34, and 3.35) shall be determined by using ASTM Method D6133-02: "Standard Test Method for Acetone, *p*-Chlorobenzotrifluoride, Methyl Acetate or *t*-Butyl Acetate Content of Solventborne and Waterborne Paints, Coatings, Resins, and Raw Materials by Direct Injection Into a Gas Chromatograph" (February 2003).

6.2 **Acid Content.** Measurement of acid content (as specified in section 3.23) shall be determined by using ASTM D1613-03 "Standard Test Method for Acidity in Volatile Solvents and Chemical Intermediates Used in Paint, Varnish, Lacquer, and Related Products" (October 2003).

6.3 **Alternative Test Methods.** The use of other test methods which are determined to be equivalent or better and approved, in writing, by the Executive Officer or Air Pollution Control Officer of the District, CARB, and U.S. EPA may be used in place of the test methods specified in this rule.

6.4 **VOC Content of Coatings or Solvents.** VOC content (as specified in sections 3.35, 4.1, and 4.8.1) shall be determined by U.S. EPA Method 24 as set forth in Appendix A of Title 40 of the Code of Federal Regulations (40 CFR) Part 60, "Determination of Volatile Matter Content, Water Content, Density, Volume Solids, and Weight Solids of Surface Coatings".

6.5 **Control Efficiency.** When either U.S. EPA Method 25, 25A, or 25B is used to determine VOC emissions, control device equivalency (as specified in section 4.3) shall be determined as specified in U.S. EPA's "Guidelines for Determining Capture Efficiency," (January 9, 1995) and 40 CFR 51, Appendix M, Methods 204 –204f as applicable.

6.6 **Determination of Alternative Compliance.** Alternative compliance (as specified in section 4.3) shall be determined by U.S. EPA Method 25, 25A, or 25B, Title 40 Code of Federal Regulations, Part 60, Appendix A as applicable. A source is in violation if the measured VOC emissions, as measured by any of the test methods, exceed the standards specified in section 4.3.

6.7 **Metallic Content.** The metallic content of a coating (as specified in section 3.18) shall be determined by South Coast Air Quality Management District Method 318-95, "Determination of Weight Percent Elemental Metal in Coatings by X-ray" (July 1996).

6.8 **Exempt Compound Content.** Exempt compound content, other than as determined pursuant to section 6.1, (as specified in sections 3.15, 3.34 and 3.35) shall be determined by using CARB Method 432, "Determination of Dichloromethane and 1,1,1-Trichloroethane in Paints and Coatings"(September 12, 1998); CARB Method 422, "Determination of Volatile Organic Compounds in Emissions from Stationary Sources" (January 22, 1987); or, South Coast Air Quality Management District *(SCAQMD) Method 303-91, "Determination of Exempt Compounds"* (February 1993).

6.9 **Transfer Efficiency.** Spray equipment transfer efficiency (as specified in *sections 3.29 and 4.7.5)* shall be determined by using South Coast Air Quality Management District "Spray Equipment Transfer Efficiency Test Procedure for Equipment User" (May 24, 1989).

6.10 **HVLP Equivalency.** Spray equipment HVLP equivalency (as specified in section 4.7.4) shall be determined by using South Coast Air Quality Management District "Guidelines for Demonstrating Equivalency with District Approved Transfer Efficient Spray Guns" (September 26, 2002).

7. **Construction of Headings.** Section and subsection headings do not in any manner affect the scope, meaning, or intent of the provisions of this Suggested Control Measure.

8. **Severability.** Each part of this Suggested Control Measure shall be deemed severable, and in the event that any part of this Suggested Control Measure is held to be invalid, the remainder of this Suggested Control Measure shall continue in full force and effect.

Appendix B

2002 Automotive Coatings Survey

(Refinish Coatings Only)

2002 Automotive Coatings Survey

(Refinish Coatings Only)

California Environmental Protection Agency

Air Resources Board

TABLE OF CONTENTS

2002 AUTOMOTIVE COATINGS SURVEY

SUBMITTAL OF FORMS

Please return the completed survey to the following address:

Regular Mail

California Air Resources Board
P.O. Box 2815
Sacramento, CA 95812
ATTN: SSD / Measures Assessment Branch
Automotive Coatings Survey

Overnight

California EPA Headquarters Building
Air Resources Board (6th Floor)
1001 I Street
Sacramento, CA 95814
ATTN: SSD / Measures Assessment Branch
Automotive Coatings Survey

ELECTRONIC SUBMITTAL OPTIONS

Electronic submittal options are available. Details can be obtained by contacting the ARB or by visiting our web site at "www.arb.ca.gov/coatings/auto/survey/2002survey.htm." Additional survey packages can also be downloaded from this site.

QUESTIONS

If you have any questions or other requests please contact any of the following staff:

Name	Phone	Email
Jose Gomez, Manager	916-324-8033	jgomez@arb.ca.gov
Dave Mehl, Survey Lead	916-324-8177	dmehl@arb.ca.gov
Gary Mouradian	916-324-8175	gmouradi@arb.ca.gov
Mark Watkins	916-323-9687	mwatkins@arb.ca.gov

2002 Automotive Coatings Survey

PART A

**SURVEY FORMS
AND
INSTRUCTIONS**

DUE DATE: SEPTEMBER 30, 2002

2002 California Automotive Coatings Survey		
Air Resources Board, P.O. Box 2815 - Sacramento, CA 95812 - Attention: Stationary Source Division, Measures Assessment Branch		
Phone: 916.324.8023	FAX: 916.324.8026	www.arb.ca.gov/coatings/auto/survey/2002survey.htm

CONFIDENTIAL INFORMATION SUBMITTAL FORM

If you wish to designate any information contained in your survey data as **CONFIDENTIAL INFORMATION**, please provide the data requested below and return it with your completed survey forms.

In accordance with Title 17, California Code of Regulations (CCR), sections 91000 to 91022, and the California Public Records Act (Government Code Section 6250 et seq.), the information that a company provides to the Air Resources Board (ARB) may be released: (1) to the public upon request, except trade secrets which are not emission data or other information which is exempt from disclosure or the disclosure of which is prohibited by law; (2) to the Federal Environmental Protection Agency (EPA), which protects trade secrets as provided in Section 114(c) of the Clean Air Act and amendments thereto (42 USC 7401 et seq.) and in federal regulation; and, (3) to other public agencies provided that those agencies preserve the protections afforded information which is identified as a trade secret, or otherwise exempt from disclosure by law (Section 39660(e)).

Trade secrets as defined in Government Code Section 6254.7 are not public records and therefore will not be released to the public. However, the California Public Records Act provides that air pollution emission data are always public records, even if the data comes within the definition of trade secrets. On the other hand, the information used to calculate air pollution emissions may be withheld from the public if the information is a trade secret.

If any company believes that any of the information it provides is a trade secret or otherwise exempt from disclosure under any other provision of law, **it must identify the confidential information as such at the time of submission to the ARB and must provide the name, address, and telephone number of the individual to be consulted** if the ARB receives a request for disclosure or seeks to disclose the data claimed to be confidential. The ARB may ask the company to provide documentation of its claim of trade secret or exemption at a later date. Data identified as confidential will not be disclosed unless the ARB determines, in accordance with the above referenced regulations, that the data does not qualify for a legal exemption from disclosure. These regulations establish substantial safeguards before any such disclosure.

In accordance with the provisions of Title 17, California Code of Regulations, sections 91000 to 91022, and the California Public Records Act (Government Code Sections 6250 et seq.),

Company Name: ______________________________ declares that only those portions ***specifically identified*** and submitted in response to the California Air Resources Board's information request on the survey are confidential "**trade secret**" information, and requests that it be protected as such from public disclosure. All inquiries pertaining to the confidentiality of this information should be directed to the following person:

Name (please print): ______________________________

Signature: ______________________________

Title: ______________________________

Telephone #: ______________________________

Mailing Address: ______________________________

____

2002 California Automotive Coatings Survey		
Air Resources Board, P.O. Box 2815 - Sacramento, CA 95812 - Attention: Stationary Source Division, Measures Assessment Branch		
Phone: 916.324.8023	FAX: 916.324.8026	www.arb.ca.gov/coatings/auto/survey/2002survey.htm

FORM 1

General Information – Reporting Year 2001

Company Name:		Web Site:
Division:		
Address:		
City:	State:	Zip:
Contact Person:	Position:	
Phone:	FAX:	e-mail:

1) Did your company manufacture and distribute coatings in 2001 (for use in California) for motor vehicles or mobile equipment, or coatings that you know to be used in those types of applications? **YES NO**

2) Did your company distribute coatings in 2001 (for use in California) manufactured by another company, which are for motor vehicles or mobile equipment, or that you know are used in those types of applications? **YES NO**
If yes, please list these companies along with a mailing address and contact person. (Please use a separate sheet of paper labeled as question 2.)

3) Did your company manufacture coatings for another company to distribute in 2001 that are for motor vehicles or mobile equipment, or that you know are used in those types of applications? **YES NO**
If yes, please list these companies along with a mailing address and contact person. (Please use a separate sheet of paper labeled as question 3.)

4) Is your company a wholly owned subsidiary of another company? **YES NO**
If yes, please list the name of the parent company along with a contact person's name and position, complete mailing address, telephone and facsimile numbers, and an e-mail address for the contact person. (Please use a separate sheet of paper labeled as question 4.)

If you answered "Yes" to question 1, 2 or 3 please complete the remainder of the survey prior to returning it to the ARB. If you answered "No" to all these questions, please return only this form.

CERTIFICATION by Authorized Official

I hereby certify that, to the best of my knowledge and belief, all information entered on Form 1 – General Information, Form 2 – Company Information, Form 3 – Product Information, Form 4 – Ingredient Information, and Form 5 Ready-To-Spray Information is complete and accurate.

Name:	Position:
Signature:	Date:

2002 California Automotive Coatings Survey		
Air Resources Board, P.O. Box 2815 - Sacramento, CA 95812 - Attention: Stationary Source Division, Measures Assessment Branch		
Phone: 916.324.8023	FAX: 916.324.8026	www.arb.ca.gov/coatings/auto/survey/2002survey.htm

FORM 2
Company Information – Reporting Year 2001

Type of Business (check all that apply)
- ❑ Manufacturer
- ❑ Importer
- ❑ Retail Distributor
- ❑ Wholesale Distributor
- ❑ Private Label Manufacturer
- ❑ Toll Manufacturer
- ❑ Other (Specify):

Company Marketing Classification (check one)
- ❑ International
- ❑ National
- ❑ Regional (e.g., western U.S.) list:
- ❑ California Statewide
- ❑ California Region (e.g. Southern California) list:

Company – Gross Annual Receipts ($) for Calendar Year 2001 (check one)
- ❑ Less than 500,000
- ❑ 500,000 to 1 million
- ❑ >1 million to 2 million
- ❑ >2 million to 5 million
- ❑ >5 million to 10 million
- ❑ >10 million to 100 million
- ❑ >100 million to 1 billion
- ❑ >1 billion

Company – California Gross Annual Receipts ($) for Calendar Year 2001 (check one)
- ❑ Less than 500,000
- ❑ 500,000 to 1 million
- ❑ >1 million to 2 million
- ❑ >2 million to 5 million
- ❑ >5 million to 10 million
- ❑ >10 million to 100 million
- ❑ >100 million to 1 billion
- ❑ >1 billion

Automotive Coatings – Gross Annual Receipts ($) for Calendar Year 2001 (check one)
- ❑ Less than 500,000
- ❑ 500,000 to 1 million
- ❑ >1 million to 2 million
- ❑ >2 million to 5 million
- ❑ >5 million to 10 million
- ❑ >10 million to 100 million
- ❑ >100 million to 1 billion
- ❑ >1 billion

Automotive Coatings – California Gross Annual Receipts ($) for Calendar Year 2001 (check one)
- ❑ Less than 500,000
- ❑ 500,000 to 1 million
- ❑ >1 million to 2 million
- ❑ >2 million to 5 million
- ❑ >5 million to 10 million
- ❑ >10 million to 100 million
- ❑ >100 million to 1 billion
- ❑ >1 billion

Employees for Calendar Year 2001 (check one)
- ❑ Less than 10
- ❑ 10 to 99
- ❑ 100 to 249
- ❑ 250 to 499
- ❑ 500 or more

Employees – California for Calendar Year 2001 (check one)
- ❑ Less than 10
- ❑ 10 to 99
- ❑ 100 to 249
- ❑ 250 to 499
- ❑ 500 or more

Automotive Coatings Employees for Calendar Year 2001 (check one)
- ❑ Less than 10
- ❑ 10 to 99
- ❑ 100 to 249
- ❑ 250 to 499
- ❑ 500 or more

Automotive Coatings Employees – California for Calendar Year 2001 (check one)
- ❑ Less than 10
- ❑ 10 to 99
- ❑ 100 to 249
- ❑ 250 to 499
- ❑ 500 or more

How did you determine California Year 2001 Sales Volume? (check all that apply)
- ❑ Direct California retail sales
- ❑ Prorated from national retail sales
- ❑ Direct California wholesale distribution
- ❑ Prorated from national wholesale distribution
- ❑ Other (explain):

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FORM 3
Product Information – Reporting Year 2001

Entry # : *	
Product Code:	
Product Name:	
Brand and Product Line(s):	

Physical And Other Data					
Type Code (10 – 60)	Specify (for codes 10, 20, 40 and 60 only)	Coverage (ft^2/gal)	Recommended Thickness (mil)	Water or Solvent Borne (W or S)	Density (lbs/gal)

Weight Percent					Volume Percent			
Solids	Volatile Material	Water	Exempts		Solids	Volatile Material	Water	Exempts

As Packaged	
VOC Actual (g/l)	VOC Regulatory - Less Water & Exempts (g/l)

2001 California Sales (gallons)

* Note: This entry # must also appear on your corresponding FORM 4.

Page ______ of ______ Enter the current page # out of the total pages submitted.

NOTE: Each FORM 3 must have a corresponding FORM 4.

Photocopy this page as necessary

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FORM 4
Ingredient Information – Reporting Year 2001

Entry # from FORM 3:

#	Ingredient	Bin # *	CAS #	wt %**
	Aggregated ingredients < 0.1 wt. %	N/A	N/A	
		Total of All Ingredients (Must Equal 100%)		

* For hydrocarbon solvents only. Refer to page 25 or contact solvent supplier for bin #.

** Enter the weight percent for each ingredient that is at least 0.1% of the total mass of the product. Toxic air contaminants (e.g., lead and nickel) should be reported to lower than 0.1% if known.

Page ______ of ______ Enter the current page # out of the total pages submitted.

NOTE: Each FORM 4 must have a corresponding FORM 3.

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FORM 5
Ready-To-Spray (RTS) Information – Reporting Year 2001

Note: RTS mixtures within a single product line may be grouped if the mixing ratios remain constant and all possible combinations are viable products.

For each combination of products listed in Form 3 that requires mixing to be RTS please list the following:

Ready-To-Spray Mixture #				
Mixing Components Entry #: (from Form 3)				
Mixing Ratio:				
Recommended Thickness (mil)				

Production Cost ($/gal)		
Minimum	Sales Weighted Average	Maximum

If grouping 4 or more RTS mixtures from the top table please complete both of the following tables. If reporting one RTS mixture or grouping 3 or less RTS mixtures, please complete just the appropriate number of columns of the first table.

	low	median	high
VOC regulatory			
Color			
Density			
Coverage			
VOC actual			

	Low	median	high
VOC actual			
Color			
Coverage			
Density			
VOC regulatory			

Page ______ of ______ Enter the current page # out of the total pages submitted.

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Form 1 Instructions
General Information – Reporting Year 2001

The information requested on Form 1 will be used by the California Air Resources Board to determine what companies distribute motor vehicle and mobile equipment coatings (automotive coatings) for sale in California. These companies will be required to complete the survey, based on the coatings sold in calendar year 2001. If your company is not a paint manufacturer, but is listed as "manufactured for" or "distributed by" on the product label, you are responsible for completing the requested information in this survey. You are encouraged to coordinate your responses with the appropriate manufacturer of your product to avoid double reporting of data. Holding companies or subsidiaries may also need to complete this survey.

Company Name: The legal business name of your company. If you are completing this survey for more than one company, please submit different surveys for each company.
Web Site: The company web site address, for example, www.paintcompany.com.
Division: If the company has multiple divisions, please specify which division this survey was completed for.
Address: Enter street address or post office box of your company where mail is received.
City: The city where mail is received.
State: The state where mail is received.
Zip: Enter the postal zip code at which mail is received
Contact Person: Name of the person to be contacted if there are questions about survey responses.
Position: Business position of the contact person.
Phone: Telephone number of the contact person.
Fax: Fax number of the contact person.
e-mail: e-mail address of the contact person.

Please answer questions 1 through 4. List requested information where appropriate.

If you answered yes to question 1, 2 or 3, please also complete Forms 2, 3, 4 and 5. If you answered no to these questions, please return only the completed Form 1 to the ARB at the address listed on page 2.

Certification: Please have a responsible company officer (President, Treasurer, Secretary, or Vice-President of a principle business function) certify that the General Information (Form 1), Company Information (Form 2), Product Information (Form 3), Ingredient Information (Form 4), and Ready-To-Spray Information (Form 5) is complete and accurate. This person is to clearly print or type his name and business position, and sign and date the form where indicated.

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Form 2 Instructions
Company Information – Reporting Year 2001

Type of Business: Check all boxes that describe the types of business conducted by your company.

Manufacturer – A company that produces, packages, or repackages motor vehicle or mobile equipment coatings for sale or distribution in California.

Importer – A company that brings motor vehicle or mobile equipment coatings into the United States for sale or distribution within California.

Retail Distributor – A company who sells or supplies motor vehicle or mobile equipment coatings at the retail level.

Wholesale Distributor - A company who sells or supplies motor vehicle or mobile equipment coatings for the purpose of resale or distribution in commerce at the wholesale level.

Private Label Manufacturer – A company that manufactures motor vehicle or mobile equipment coatings for sale under another company's name.

Toll Manufacturer – A company that manufactures motor vehicle or mobile equipment coatings based on the formula of another company and places that company's name on the product label.

Company Marketing Classification: Check the box that best describes your company's primary marketing classification.

International – Two or more nations. For example, United States, Canada, and Mexico.

National – All of the United States.

Regional – A portion of the United States. For example, California, Oregon, and Arizona.

California Statewide – All of California.

California Local – A portion of California. For example, Southern California or the San Francisco Bay Area.

The information on annual receipts and employees should be provided for both the company and the automotive coatings unit, as appropriate.

Gross Annual Receipts: Check the box which identifies the gross annual receipts generated by your company. This means the total income of the company before expenses are deducted.

Gross Annual Receipts - California: Check the box which identifies the gross annual receipts generated by your company in California.

Employees: Check the box that indicates the total number of full-time equivalent employees of the company.

Employees - California: Check the box that identifies the number of full-time equivalent employees in California.

How did you determine California Year 2001 Sales Volume?: Check the box that best identifies the method used to determine California sales volume for use on Form 3.

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Form 3 Instructions
Product Information – Reporting Year 2001

Entry # : Each Form 3 completed must be numbered sequentially, beginning with "1." This entry # must also appear on your corresponding Form 4 and will be used in completing Form 5.
Product Code: Enter product code.
Product Name: Enter the product / label name for the product code above.
Product Line(s): Enter the product line(s) which the coating is used in.

Type Code: Enter the code from the Type Code table, on page 11 that best describes the coating.
Specify: If the Type Code entered was 10, 20, 40 or 60, please clarify/specify what type of coating it is.
Coverage: Specify the coverage of the coating when applied at the recommended thickness, in terms of square feet per gallon of coating.
Recommended Thickness: Specify the recommended thickness used in determining the coatings' coverage, in mils.
Water or Solvent Borne: Note if the coating is solvent (by marking "S") or water (by marking "W") borne.
Density: Density of the coating in pounds per gallon (lbs/gal).

Weight Percent of Solids: Solids content of the coating expressed as a percentage of total coating weight.
Weight Percent of Volatile Material: Volatile material (VOC+water+exempts) content expressed as a percentage of total coating weight. See page 22 for the definition of VOC (volatile organic compound) and VOC content.
Weight Percent of Water: Water content as a percentage of total coating weight.
Weight Percent of Exempts: Exempt compounds content expressed as a percentage of total coating weight. See page 18 for definition of exempt compounds.
Volume Percent of Solids: Solids content of the coating expressed as a percentage of total coating volume.
Volume Percent of Volatile Material: Volatile material (VOC+water+exempts) content expressed as a percentage of total coating volume. See page 22 for the definition of VOC (volatile organic compound) and VOC content.
Volume Percent of Water: Water content expressed as a percentage of total coating volume.
Volume Percent of Exempts: Exempt compounds content expressed as a percentage of total coating volume. See page 18 for definition of exempt compounds.

VOC Actual: Also known as Material VOC. VOC content of coating, as supplied, in grams of VOC per liter of coating. This is the weight of all volatile materials less the weight of water and exempt compounds per the entire volume of the coating. This is NOT the same as VOC Regulatory. See "VOC Calculations" page 23.
VOC Regulatory (Less Water & Exempts): Also known as Coating VOC. VOC content of the coating, as supplied, in grams of VOC per liter of coating less water and exempt compounds. This may be determined from the formulation data or previously determined by EPA Method 24, 40 CFR Part 60, as amended in Federal Register Vol. 57, No. 133, July 10, 1992, or ASTM D 3960-92. See "VOC Calculations" page 23.

2001 California Sales: The volume, in gallons, of the coating sold in California in 2001.

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Form 3 Instructions, Continued
Type Codes

Coating Type	Code
Undercoat (specify)	10
primer	11
primer sealer	12
primer surfacer	13
pretreatment wash primer	14
precoat	15
ground coat	16
flexible primer	17
plastics primer	18
Color coat (specify)	20
single-stage	21
single-stage multicolor	22
multi-stage color coat	23
multi-stage multicolor coat	24
camouflage	25
metallic/iridescent	26
Clearcoat	30
Additive (specify)	40
reducer	41
hardener	42
catalyst	43
activator	44
extender	45
flattener	46
plasticizer	47
fish eye eliminator	48
accelerator	49
Truck bed coating	51
Underbody coating	52
Temporary protective coating	53
Uniform finish coating	54
Anti-glare/safety coating	55
Other (specify)	60

Please use the major category code if a coating does not fall within one of the more specific codes. For example, if a coating is an additive (uniform finish blender) which is not one of the specific additives listed, use code 40. "Uniform finish blender" would then be listed under "Specify."

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Form 4 Instructions
Ingredient Information – Reporting Year 2001

Form 4 requests product ingredient information. In this table provide all ingredients which are part of the product formulation. Complete one Form 4 for each Form 3 completed.

Entry # From Form 3: Enter the Entry # from corresponding Form 3.

#: Number each ingredient sequentially, beginning with "1."

Ingredient: Enter the standard (IUPAC) chemical name of the ingredient. Chemical names must be distinguished from trade names, by labeling trade names with an asterisk prior to the name . For example, the desired chemical name of SD 40 Alcohol or ethyl alcohol is ethanol. Only enter the trade name of the ingredient if the chemical name is unknown. If the ingredient is proprietary or a mixture (e.g., petroleum distillates) identify the trade name and manufacturer / primary supplier.

Resin entries should be grouped by resin type instead of listing each specific resin composition. Report only the total weight percentage for each resin group. Please choose from the resin types in the table below. If the resin does not fit within one of these categories, please contact Dave Mehl at (916) 361-0342 or dmehl@arb.ca.gov to help you determine a resin type, for data consistency.

Resin Types		
Acrylic	Epoxy	Silicone, Silane, Siloxane
Acrylic Copolymer	Oleoresin	Styrene-butadiene
Alkyd	Phenolic	Urethane, Polyurethane
Amines, Amides	Polyester (Not Alkyd)	Polyvinyl Chloride (PVC)
Cellulosic	Polyvinyl Acetate (PVA)	Vinyl Toluene
Chlorinated Rubber	Shellac	Vinyl Acrylic Copolymer

NOTE: The volatile portions of resin solutions, colorants or additives must be listed as separate ingredient entries. For example, do not include the volatile portion of a resin solution as a solid.

Bin #: For aliphatic or aromatic hydrocarbon solvents enter the bin number that best represents the nature of the solvent from page 25.

CAS#: Enter the Chemical Abstract Service (CAS) number for the ingredient.

Weight % (of total material): Enter the percent by weight for each ingredient in the final product that is at least 0.1% of the total mass of the product. Toxic air contaminants (e.g., lead and nickel) should be reported to lower than 0.1% if known. If an ingredient is a mixture of known components, list the components separately with their individual weight percentages in the final product. If the components of a mixture cannot be determined, list the ingredient as a single entity. For example, you may not know the weight percentage of individual ingredients of petroleum distillates, resins, or biocides. In cases such as these identify the weight percent of the mixture.

Total of All Ingredients: The sum of all ingredients in the table must equal 100.00 percent by weight. If this value does not sum to 100.00, please recheck the information.

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Form 5 Instructions
Ready-To-Spray Information – Reporting Year 2001

Ready-To-Spray Mixture#: Number entries sequentially, beginning with "1."

Mixing Components: List entry #s from Form 3 for all components to be mixed together to create a Ready-To-Spray (RTS) coating, in the same order as the mixing ratio. RTS mixtures within a single product line may be grouped if the mixing ratios remain constant and all possible combinations are viable products.

Tints from within a product line can be grouped together for reporting ready-to-spray mixtures, instead of reporting for each individual color combination. When grouping tints within a product line, the mixing component listed would be the name of the product line and "tints," e.g. "Supernova tints." Please identify the relevant Form 3 entry #s for the "grouped" tints.

Example:

Ready-To-Spray Mixture #	2			
Mixing Components Entry #: (from Form 3)	Supernova tints, 4 – 53 & 56 – 60	92		
Mixing Ratio:	2	1		

Other components of a RTS coating can also be grouped, i.e. reducers, hardeners, or even a main component, such as primers. More than one category can be grouped on one form. For example, if the first column is a clear coat, the second column could be the various hardeners and the third column the reducers, similar to the example below. However, every possible combination represented in the grouping matrix must be an actual marketed RTS product. Please remember that it is only possible to have grouping on this form if the mix ratios are identical for every possible combination.

Example:

Ready-To-Spray Mixture #	3			
Mixing Components Entry #: (from Form 3)	5	10, 11, 12	20, 21, 22	
Mixing Ratio:	4	1	1	

The above table would yield 9 different post-mixing combinations: 5-10-20, 5-10-21, 5-10-22, 5-11-20, 5-11-21, 5-11-22, 5-12-20, 5-12-21, and 5-12-22.

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If not all of the above combinations are actual marketed combinations, then it cannot be grouped as above. For example if 5-11-20 and 5-11-21 are not marketed combinations then at least 2 Form 5s would need to be submitted, such as

Ready-To-Spray Mixture #	3			
Mixing Components Entry #: (from Form 3)	5	10, 11, 12	22	
Mixing Ratio:	4	1	1	

and

Ready-To-Spray Mixture #	4			
Mixing Components Entry #: (from Form 3)	5	10, 12	20, 21	
Mixing Ratio:	4	1	1	

Mixing Ratio: The relative ratio, by volume, of each component to be mixed to create a ready-to-spray coating, in the same order as the mixing components.

Recommended Thickness: Specify the recommended thickness used in determining the RTS coatings' coverage, in mils.

Production Cost, Minimum: Indicate the lowest production cost for a RTS mixture from the form, in dollars per gallon ($/gal). Production cost includes the cost of materials plus labor.

Production Cost, Sales Weighted Average: Indicate the sales weighted average production cost of the RTS mixtures from the form, in dollars per gallon ($/gal). Production cost includes the cost of materials plus labor.

Production Cost, Maximum: Indicate the highest production cost for a RTS mixture from the form, in dollars per gallon ($/gal). Production cost includes the cost of materials plus labor.

For VOC actual and VOC regulatory report your lowest, median, and highest color. For each color reported, report the corresponding information on the coverage, density, and either VOC actual or VOC regulatory as appropriate. If grouping 4 or more RTS mixtures from the first table, complete both of the tables. If reporting one RTS mixture or grouping 3 or less RTS mixtures, complete just the appropriate number of columns of the first table.

Coverage: Specify the coverage of the coating when applied at the recommended thickness, in terms of square feet per gallon of coating.

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Density: Density of the coating in pounds per gallon (lbs/gal).

VOC Actual: Also known as Material VOC. VOC content of coating, as supplied, in grams of VOC per liter of coating. This is the weight of all volatile materials less the weight of water and exempt compounds per the entire volume of the coating. This is NOT the same as VOC Regulatory. See "VOC Calculations" page 23.

VOC Regulatory (Less Water & Exempts): Also known as Coating VOC. VOC content of the coating, as supplied, in grams of VOC per liter of coating less water and exempt compounds. This may be determined from the formulation data or previously determined by EPA Method 24, 40 CFR Part 60, as amended in Federal Register Vol. 57, No. 133, July 10, 1992, or ASTM D 3960-92. See "VOC Calculations" page 23.

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Submitting Survey Forms or Data

Option 1: For each form type, assemble the pages in numerical entry order, beginning with Form 1 and continuing through Form 5.

Option 2: Same as Option 1, except group each Form 4 with its corresponding Form 3.

Option 3: Submit Data Electronically.

Survey data may be submitted electronically. The file formats, in order of preference, are:

1. Microsoft Access
2. Microsoft Excel
3. ASCII tab delimited file

If you wish to submit survey data in any other electronic format, please contact us for additional information.

To obtain information on file formats visit www.arb.ca.gov/coatings/auto/survey/2002survey.htm

Appendix C

Summary of Cost Analysis Methodology

Summary

The total cost of the proposed SCM to affected businesses is estimated to be $65 million in nonrecurring costs and $5.7 million per year in recurring costs. This equates to $13.9 million dollars annually over the useful life of the control equipment. This represents the cost of raw materials, research and development, and changes to distribution for the manufacturers, and the cost of new equipment, training, and energy costs to automotive refinishing facilities. The annual average cost to a typical automotive coatings manufacturer is estimated to be $320,000. The annual average cost to a typical automotive refinishing facilities is estimated to be about $3,400.

Methodology

For this analysis, we considered the impact on two groups of businesses; coating manufacturers and automotive refinishing facilities. The total cost of the proposed SCM represents the combined costs to these two groups. Distributors of automotive coatings may also incur some costs if those costs cannot be passed on to the automotive refinishing facilities because of competitive pressures. However, we are unable to quantify these impacts. Potential costs to distributors include some cost sharing between the manufacturer and distributor to transition customers to new products such as water-borne color coatings. Staff does not have data on the extent to which such cost sharing might occur.

Cost to Businesses

The total cost to coating manufacturers is estimated to be $14.4 million in non-recurring costs. This equates to $3.2 million in annual cost. This estimate includes the cost to market and distribute compliant coatings in California, and is based on discussions with manufacturers (Taylor, 2005).

The total cost to automotive refinishing facilities is estimated to be $65 million in non-recurring costs and $5.7 million per year in recurring costs, assuming coating manufacturers pass on all their costs to automotive refinishing facilities. This equates to $13.9 million dollars annually. The non-recurring costs include the cost of obtaining air movement and heating equipment which may be necessary to use water-borne coatings and maintain the level of production, and equipment and training costs associated with switching from solvent-borne to water-borne coatings.

Staff estimates there are about 4,100 automotive refinishing facilities in California. Since the large number of facilities makes it impractical to determine the impact on each facility, staff divided these facilities into general categories based on their annual revenue. Also, based on SCAQMD data, staff estimated the statewide number of heated spray booths and automotive refinishing facilities with multiple spray booths. Staff acknowledges that some facilities will experience cost impacts that differ from these estimates, but based on discussions with industry, the general assumptions are valid for typical facilities within each category. Table C-1 provides an overall summay of costs. Tables C-2 through C-4 summarize the estimated breakdown of costs for automotive refinishing facilities (Elders, 2005; Decker, 2005; Phillips, 2005; SCAQMD, 2005; Taylor, 2005; Hagan, 2005; Mac, 2005; Phillips, 2005).

Table C-1
Summary of Costs

Annual Revenue Category	Less Than 1 Million	Between 1 Million and 2.5 Million	Greater Than 2.5 Million	**Total**
Number of Facilities	**2,952**	**883**	**278**	**4,113**
Facilities with One Booth/No Heat	2,332			
Non-Recurring Cost per Facility	6,600			
Annualized Cost	1,648			
Facilities with Two Booths/No Heat	620	503		**1,123**
Non-Recurring Cost per Facility	8,200	42,000		
Annualized Cost	1,871	7,966		
Facilities with Two Booths/Existing Heat		380	69	**449**
Non-Recurring Cost per Facility		16,000	48,000	
Annualized Cost		4,327	9,685	
Facilities with Three Booths/Existing Heat			209	**209**
Non-Recurring Cost per Facility			68,000	
Annualized Cost			12,484	
Total Cost	20,475,200	27,206,000	7,524,000	**65,205,200**
Total Annualized Cost	5,002,416	5,651,032	3,277,324	**13,930,772**

Table C-2
Estimated Cost for Facilities with Annual Revenue Less Than 1 Million

Category	Item	Non-Recurring Costs	Recurring Costs	Annualized Cost*
Single Booth with No Heating Equipment	Air Movement Equipment	1,600		144
	Other Equipment	1,500		185
	Training	1,000		225
	Material Loss	2,500		562
	Operating and Maintenance Costs		155	155
	Increased Cost of Coatings		378	378
	Total	**6,600**		**1,648**
Two Booths with No Heating Equipment	Air Movement Equipment	3,200		288
	Other Equipment	1,500		185
	Training	1,000		225
	Material Loss	2,500		562
	Operating and Maintenance Costs		235	235
	Increased Cost of Coatings		378	378
	Total	**8,200**		**1,871**

Table C-3
Estimated Cost for Facilities with Annual Revenue Between 1 Million and 2.5 Million

Category	Item	Non-Recurring Costs	Recurring Costs	Annualized Cost*
Two Booths with No Heating Equipment	Air Movement Equipment	10,000		899
	Heating Equipment	26,000		2,338
	Other Equipment	1,500		185
	Training	2,000		449
	Material Loss	2,500		562
	Operating and Maintenance Costs		1,875	1,875
	Increased Cost of Coatings		1,657	1,657
	Total	**42,000**		**7,966**
Two Booths with Existing Heating Equipment	Air Movement Equipment	10,000		899
	Other Equipment	1,500		185
	Training	2,000		449
	Material Loss	2,500		562
	Operating and Maintenance Costs		575	575
	Increased Cost of Coatings		1,657	1,657
	Total	**16,000**		**4,327**

Table C-4
Estimated Cost for Facilities with Annual Revenue Greater Than 2.5 Million

Category	Item	Non-Recurring Costs	Recurring Costs	Annualized Cost*
Two Booths with Existing Heating Equipment	Air Movement Equipment	40,000		3,598
	Other Equipment	1,500		185
	Training	4,000		899
	Material Loss	2,500		562
	Operating and Maintenance Costs		2,075	2,075
	Increased Cost of Coatings		2,367	2,367
	Total	**48,000**		**9,685**
Three Booths with Existing Heating Equipment	Air Movement Equipment	60,000		5,396
	Other Equipment	1,500		185
	Training	4,000		899
	Material Loss	2,500		562
	Operating and Maintenance Costs		3,075	3,075
	Increased Cost of Coatings		2,367	2,367
	Total	**68,000**		**12,484**

Impact on Businesses

In evaluating the impact of the SCM on businesses, we assumed that all costs were either completely absorbed by coating manufacturers or by automotive refinishing facilities. This gives us a worst-case scenario for coating manufacturers and automotive refinishing facilities. In reality, it is likely that coating manufacturers and automotive refinishing facilities will absorb and pass on some of the cost, making the actual impact to businesses less than what is estimated here.

To determine the maximum possible impact on coating manufacturers, we assumed they would absorb all costs relating to producing and marketing compliant coatings when calculating the change in "return on owner's equity "(ROE). ROE is calculated by dividing the net profit by the net worth.

To calculate the change in ROE, we subtracted the cost to manufacturers from profit data. The results were used to calculate an adjusted three-year average ROE. The adjusted ROE was then compared with the ROE before the subtraction of the adjusted cost to determine the potential impact on the profitability of the businesses. A reduction of more than 10 percent in profitability is considered to indicate a potential for significant adverse economic impacts. The analysis found an average decrease in ROE of about 0.07 percent for coating manufacturers and 15 percent for automotive refinishing facilities.

To determine the maximum impact on automotive refinishing facilities, we assumed that manufacturers would pass on all costs from the SCM to the automotive refinishing facilities. To project a worst-case scenario, we assumed the automotive refinishing facilities would absorb all costs that they directly incur, as well as all costs passed on by the manufacturers. As with the manufacturers, staff calculated the change in ROE for these automotive refinishing facilities.

To determine the maximum impact on consumers, staff assumed that all costs from both the manufacturers and automotive refinishing facilities would be passed on to the consumers. If costs were passed on to the consumer, the impact would generally be in the form of higher insurance premiums and the total cost would be spread out among several million insured drivers in California. The impact to an individual consumer would be based on a number of factors such as type of insurance, driving history, and demographics. For this analysis, we assume costs would be directly passed on to consumers who need automotive refinishing. In this case, the average cost of having a vehicle refinished would increase by about $11. If the consumer is paying for the refinishing directly, he or she would have to absorb the entire cost.

Annualized Costs

We annualized non-recurring fixed costs using the Capital Recovery Method. Using this method, we multiplied the non-recurring fixed costs by the Capital Recovery Factor

(CRF) to convert these costs into equal annual payments over a project horizon at a discount rate. The Capital Recovery Method for annualizing fixed costs is recommended by Cal/EPA (Cal/EPA, 1996), and is consistent with the methodology used in previous cost analyses for ARB regulations (ARB, 2000a; ARB, 2000b).

The CRF is calculated as follows:

$$CRF = \frac{i(1+i)^n}{(1+i)^n - 1}$$

where,

CRF = *Capital Recovery Factor*
i = *discount interest rate in real terms (assumed to be 4%)*
n = *project horizon or useful life of equipment*

The costs of air movement and heating equipment for automotive refinishing facilities were annualized over 15 years, and all other equipment costs were annualized over 10 years. These values are based on an estimate of the expected lifetime of the equipment. All other costs were annualized over 5 years. The total annualized cost was obtained by adding the annual recurring costs to the annualized fixed costs derived by the Capital Recovery Method. With regard to the discount rate, Cal/EPA recommends 2% plus the current yield for a U.S. Treasury Note of similar maturity to the project horizon. Treasury yields have been around 4% in recent years and when adjusted for an inflation rate of 2%, the corresponding discount rate is 4%. (CNN, 2005).

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Appendix D

Categories that are not in the SCM

The following district and U.S. EPA national rule categories have been reclassified into one or more of the categories included in the proposed SCM (see Table IV-1).

Multi-Stage Topcoat System

The proposed SCM restructures the current district rules and establishes individual limits for the color and clear coatings. This restructuring is designed to enhance enforcement of district rules. Currently, most multi-stage systems consist of two stages, a color coating and a clear coating. The first stage of the finish, the basecoat or color coating, contains the pigments that give the finish the desired color. In the case of metallic finishes, the basecoat also contains the "metallic" flakes. The second stage of the finish is the clear coating, a durable finish that protects the basecoat.

The purpose of the basecoat is to achieve the desired color tint and metallic appearance. Color coatings do not contain the additives needed to withstand chemical and ultraviolet deterioration, or the chemicals necessary to achieve a high gloss surface. Basecoats typically contain acrylic enamel, polyester, or urethane resins, and are designed to be easy spraying and quick drying to keep the base free of dirt and other contaminants. The quick-drying effect also locks the metallic flakes in position to achieve a mottle-free finish.

To protect the basecoat, a durable clear coating is applied. This clear coating can often be applied over the color coating after only 15 to 30 minutes of cure time. Clear coatings typically contain acrylic urethane or polyurethane resins, although acrylic enamel and lacquer clears are also available. Clear coatings are designed to flow upon application, resulting in a smooth, glass-like finish in as few as two coats.

Most districts allow for two- and three-stage systems, with some having a four-stage system as well. A two-stage system consists of a basecoat and a clear coating. Three-stage systems are a two-stage system with either a midcoat or groundcoat. Four stage systems are two stage systems with both a midcoat and a groundcoat.

The basecoat is the main color coating. The clear coating provides gloss and durability. Groundcoats are typically tinted primers, however district definitions vary. Midcoats can be translucent color coatings (achieved by adding filler to a color coating to reduce the pigment density) or tinted clear coatings.

ARB staff's evaluation of the multi-stage topcoat system indicates that up to three of the four stages in a four-stage system may be color coatings. Alternatively, two stages of a three-stage system may consist of a clear coating and a modified clear coating.

The composite VOC system was created to provide manufacturers flexibility in complying with lower VOC limits. To comply with the lower VOC limits, manufacturers have formulated lower VOC clear coatings and retained high VOC color coatings.

The methodology for calculating the composite VOC limit for multi-stage systems assumes that the volume of clear coating applied is twice the volume of the color coating. The 2002 Survey data indicate this is not the case. The volume of color coating sold was about 2.5 times the volume of clear coating sold. Consequently, in consultation with the districts, ARB staff split the multi-stage system into two categories for analysis – color coatings and clear coatings.

Most district rules currently specify a multi-stage system limit of 420 or 540 g/l. Because the composite VOC calculation method assumes two gallons of clear coating are applied for every gallon of color coating, manufacturers have focused on lowering the VOC content of the clear coatings. This compliance approach has enabled color coatings to retain a VOC content ranging from 600 to 800 g/l. The proposed SCM sets separate VOC limits for color coatings and clear coatings.

Metallic/Iridescent

Metallic/Iridescent coatings are either a single-stage or multi-stage coating that contains more than 0.042 pounds per gallon (5 g/l) of metal or iridescent particles as applied, where such particles are visible in the dried film.

Metallic colors contain various sizes of aluminum flakes. These flakes have reflective properties and when used in various combinations and/or amounts, modify the optical characteristics of the color. Metallic pigment consists of thin opaque aluminum flakes (made by ball milling either a disintegrated aluminum foil or a rough metal powder and then polishing to obtain a flat, brilliant surface on each particle) or copper alloy flakes (known as bronze pigments). These coatings produce silvery and other metal-like effects. Iridescent coatings contain mica in various sizes to create what is called a pearlescent effect.

Either a metallic or iridescent pigment is mixed with a base color to create the metallic or pearl color. There is no difference between the base color for a solid color and a metallic/iridescent color. They are mixed from the same tint bank at the auto body shop. Thus, metallic/iridescent coatings are included in the color and single-stage coating analyses above.

Primer Sealer

Primer sealers are applied prior to the topcoat, if necessary. Sealers provide adhesion between the topcoat and the surface, provide a neutral colored base for easy coverage, seal sanded surfaces to prevent solvent penetration, and fill minor surface imperfections. Sealer types include lacquer sealers, enamel sealers, and urethane sealers. These sealers are intended to be coated by lacquer, enamel, and urethane topcoats, respectively, and generally require only one coat prior to application of the topcoat. In addition to general sealers, there are specialty sealers available for use on specific problem surfaces.

Some sealers reported in the 2002 Survey comply with the proposed VOC limit. However, some manufacturers have stated that the 250 g/l sealers are intended for the fleet vehicle market and are not suitable for the collision repair industry. Other manufacturers have stated that that they can formulate sealers for the collision repair industry that comply with the proposed limit of 250 g/l. One manufacturer has marketed a compliant sealer to the collision repair industry for almost a year. Primer sealers are included in the primer category. We believe that primer sealers can be formulated to be in compliance with the proposed primer limit. We have included primer sealer in the primer analysis above.

Primer Surfacer

Primer surfacers are typically high-solids automotive coatings applied over prep coats, such as pretreatment coatings, precoat, or adhesion promoters. Primer surfacers function to provide adhesion between the prep coat and the material to be applied over the primer surfacers. They provide corrosion protection, act as a filling material to cover minor surface flaws, and provide a surface that can be easily sanded to a smooth surface. District rules currently establish the same VOC limit for primer surfacers and primers. We propose to continue this in the proposed SCM. We have included primer surfacers in the primer category.

Precoat

Precoats are coatings that are applied directly to bare metal primarily to deactivate the metal surface prior to application of a subsequent coating. Precoats commonly dry by oxidation or chemical polymerization. The SCAQMD treats these coatings as primers. Most other district rules allow for precoat usage at a higher VOC content than primers, but limit the amount of precoat that can be used.

Approximately 65 percent of the coatings reported in the survey as precoats were also listed as plastic primers, which is in conflict with its defined purpose. Another nine percent were listed as surfacers and three percent were listed as ground coats.

Based on this information, the precoat category is included in the primer category. The precoats were included in the primer analysis above.

Camouflage

Camouflage is a pigmented coating used primarily by the military to make it more difficult for vehicles and equipment to be visually located by enemy forces. Camouflage coating can also be applied to hide vehicles and equipment from game by hunters. Camouflage is applied in patterns with different shades of a color.

One district lists camouflage as a specialty coating. Some districts list camouflage as a distinct coating category. The districts that list it as a distinct category only do so for mobile equipment and not for motor vehicles, which are also painted by the military with camouflage. The districts that have this category give it the same VOC limit as their general topcoat limit. For motor vehicles they treat camouflage as any other topcoat. There is nothing in these districts' definitions regarding any special physical properties for camouflage as opposed to any other color coating. Thus, camouflage coatings are included in the color coat analysis above.

Extreme Performance Coatings

Eight districts list extreme performance coatings as a distinct coating category. These districts allow a VOC content of either 420 g/l or 750 g/l. There are four different definitions used in these eight districts. Five districts define extreme performance coatings as coatings which are exposed to extreme environmental conditions such as high temperatures, corrosive or erosional environments, during principal use. One district defines extreme performance coatings as coatings that are intended, during use, to be exposed to: 1) industrial grade detergents, cleaners, or abrasive scouring agents; 2) unprotected shipboard conditions; or 3) corrosive environmental conditions. Another district defines these products as coatings which during intended use are exposed to any of the following conditions: a) industrial grade detergents, cleaners, or abrasive scouring agents; b) extreme environmental conditions as determined by the Air Pollution Control Officer during the vehicle's principal use; c) chronic exposure to corrosive, caustic or acidic agents, chemicals, chemical fumes, chemical mixtures or solution; d) repeated exposure to temperatures in excess of 250 degrees Fahrenheit; or e) repeated heavy abrasion, including mechanical wear and repeated scrubbing with industrial grade solvents, cleaners, or scouring agents. The last district defines these coatings as coatings which during intended use are exposed to any of the following conditions: a) chronic exposure to corrosive, caustic or acidic agents, chemicals, chemical fumes, chemical mixtures or solutions; b) repeated exposure to temperatures in excess of 250 degrees Fahrenheit; c) repeated heavy abrasion, including mechanical wear and repeated scrubbing with industrial grade solvents, cleansers, or scouring agents; or d) exterior exposure of steel and non-ferrous metal structures.

Only one district lists this type of coating as a specialty coating. This district defines extreme performance coatings as coatings that encounter acute or chronic exposure to salt water, corrosives, caustics, acids, oxidizing agents, wind- or ocean-driven debris, or electromagnetic pulses.

No coatings in this category were reported as being sold in California in 2001. We have no knowledge of anyone applying these coatings to vehicles in California.

Specialty Coating

Specialty coatings are high VOC coatings (up to 840 g/l) that have historically been necessary due to unusual job performance requirements. Specialty coatings include, but are not limited to, truck bed liner coating, adhesion promoter, elastomeric materials, anti-glare/safety coatings, impact resistant coatings, rubberized asphaltic underbody, water hold-out coatings, weld-thru coatings, bright metal trim repair, camouflage, and extreme performance coatings. The U.S. EPA automotive coatings rule defines specialty coatings to include only adhesion promoters, low-gloss coatings, bright metal trim repair coatings, jambing (cut-in) clear coats, elastomeric coatings, impact resistant coatings, underbody coatings, uniform finish blenders, and weld-through primers.

Three districts' (SCAQMD, Antelope Valley AQMD, and Sacramento Metropolitan AQMD) definitions of specialty coating do not contain the "but not limited to" clause or an equivalent phrase. For these districts, only the listed coatings can be used as specialty coatings. One district, Sacramento Metropolitan AQMD, requires manufacturers to specifically designate their specialty coatings as such. For all other districts the definition is not specific.

Specialty coating usage at body shops is limited to either five to ten percent of total coating usage depending upon the district. Some districts have a volume usage as an alternative to the percentage usage. These districts allow one gallon per day or three gallons per month of specialty coating use per facility.

Because of the variability in district requirements, we evaluated each category listed in district rules as a specialty coating individually. ARB staff evaluated what special attributes or function each coating type provides, and what VOC content was necessary to provide said attributes or function. ARB staff then set individual category definitions and higher VOC content limits for categories as necessary.

Elastomeric Material

Elastomeric materials are coatings that are formulated for application over flexible substrates such as plastic parts, elastomeric bumpers, and spoilers. All districts, except for one, and the national rule identify elastomeric materials as specialty coatings. However, only five districts and the national rule have a definition for "elastomeric materials." Two types of products were listed in the 2002 Survey as elastomeric materials. They are elastomeric primers and elastomeric clears. The elastomeric primer mixtures reported in the survey had a slightly higher VOC content than the 250 g/l VOC limit proposed for primers in the SCM. The elastomeric clear mixtures reported in the survey had a VOC content ranging from about 480 to 550 g/l.

Many elastomeric materials are created by using plasticizing additives mixed with another mixture, as opposed to using an elastomeric base component. This allows for a wide variety of elastomeric materials while keeping the number of components to a minimum.

Based on discussions with manufacturers, ARB staff determined that elastomeric additives have a VOC content less than 250 g/l. Therefore, addition of these additives to clear coatings or primers will not result in exceedances of the 250 g/l VOC limits proposed for these categories. Elastomeric clears are included in the clear coating category and elastomeric primers are included in the primer category.

Anti-Glare Safety Coating

Anti-glare safety coatings are coatings that minimize light reflection for safety purposes. The commonly used standard is a reflectance of 25 or less on a 60 degree gloss meter. Some districts restrict usage to the interior of a vehicle. All districts except one identify this as a specialty coating, however the district definitions vary regarding reflection allowed and vehicle application.

No coatings in this category were reported as being sold in California in 2001. We have no knowledge of these coatings being used in California. If these coatings are used in the future, they will be included in the clear coating, color coating, or single-stage coating category, as is appropriate, based on usage.

Impact Resistant Coating

Impact resistant coatings are coatings designed to resist chipping caused by road debris. Typical usage for impact resistant coatings would be on rocker panels. While all districts except one identify this as a specialty coating, only four districts and the U.S. EPA national rule define these coatings.

No coatings in this category were reported as being sold in California in 2001. We have no knowledge of these coatings being used in California. If these coatings are used in the future, they will be included in the clear coating or single-stage coating category, as is appropriate, based on usage.

Water Hold-Out Coating

Water hold-out coating is a coating applied to the interior cavity of doors, quarter panels, and rocker panels for the purpose of corrosion resistance to prolonged water exposure. While all districts and the U.S. EPA national rule include this as a specialty coating, only three districts and the U.S. EPA national rule define the coating. This definition meets the existing district definition of a primer. Therefore, water hold-out coatings are included in the primer category.

No coatings in this category were reported as being sold in California in 2001. We have no knowledge of anyone applying these coatings to vehicles in California.

Weld-Thru Coating

Weld-thru coatings are primers applied to metal immediately prior to welding to provide corrosion resistance. While all districts allow this as a specialty coating, only ten districts and the U.S. EPA national rule define these coatings. This definition meets existing districts' definitions of a primer. Therefore, weld-thru coatings are included in the primer category.

No coatings in this category were reported as being sold in California in 2001. We have no knowledge of anyone applying these coatings to vehicles in California.

Bright Metal Trim Repair

Bright metal trim repair is a coating applied directly to a metal-plated surface to restore the luster and texture of the plated surface. While districts include these products in the specialty coating category, only five districts have a definition for these coatings. The U.S. EPA national rule does not define this type of coating. Four of the five districts with definitions restrict the usage to chrome-plated metal surfaces.

No products were reported in the 2002 Survey as bright metal trim repair. We have no knowledge of anyone applying these coatings to vehicles in California.

Gloss Flattener

Low-gloss coatings, also called gloss flatteners, are coatings that exhibit a gloss reading less than or equal to 25 on a 60 degree gloss meter. The U.S. EPA national rule and 15 district rules include these products in the specialty coating category. However, only the U.S. EPA national rule defines these coatings.

No coatings in this specific category were reported as being sold in California in 2001. As discussed in the clear coating category section above, these coatings can comply with the clear coating VOC limit and do not need a higher VOC limit.

Heat Resistant

Heat resistant coatings are coatings which, during normal use, must withstand temperatures of at least 400 degrees Fahrenheit. Only one district lists this type of coating as a specialty coating.

No coatings in this category were reported as being sold in California in 2001. We have no knowledge of anyone applying these coatings to vehicles in California.

Jambing (Cut-In) Clear Coat

Jambing, or cut-in, clear coats are fast-drying, clear coatings applied to surfaces such as door jambs and trunk and hood edges to allow for quick closure. This coating is only referenced in the U.S. EPA national rule. No districts list this type of coating in their specialty coating definitions.

No coatings in this category were reported as being sold in California in 2001. We have no knowledge of anyone applying these coatings to vehicles in California.

No written material available at time of electronic Board Book creation.