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

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

TO SUBMIT WRITTEN COMMENTS ON AN AGENDA ITEM IN ADVANCE OF THE MEETING GO TO:
http://www.arb.ca.gov/lispub/comm/bclist.php

March 27, 2008
9:00 a.m.

Item #

08-3-1: Health Update: Wildfire Smoke and Respiratory Symptoms in Children

This health update will discuss several recent scientific articles that investigated the health effects of fire smoke. The primary article is an analysis of symptoms reported by children enrolled in the Children's Health Study after the October 2003 wildfires in Southern California. The supporting articles investigated responses in adults exposed to controlled concentrations of smoke from a wood stove. Both adults and children reported respiratory symptoms, such as cough and eye irritation, with smoke exposure.

08-3-5: Public Hearing to Consider Adoption of the 2008 Amendments to the California Zero Emission Vehicle Regulations

Staff is proposing to amend California's existing zero emission vehicle (ZEV) program regulations to address current conditions and trends in zero and near-zero emission vehicle technology development as reported by the Independent Expert Review Panel. The proposed changes also respond to feedback provided by the Board at their May 2007 Board hearing. The proposed changes maintain the pure ZEV requirement and continue pressure to accelerate their development while providing greater flexibility with respect to fuels, technologies, and simplifying compliance pathways.

08-3-2: Report to the Board on the AB 32 Implementation Update on the Electricity and Natural Gas Sector

ARB staff will provide an update on climate change activities in the electricity and energy sector.

08-3-3: Public Meeting to Consider Revisions to the Carl Moyer Incentive Program Guidelines

The Board will consider revisions to the Carl Moyer Program Guidelines to update program administrative requirements, add a new off-road equipment replacement category, update project criteria to address new regulations and improve program implementation, and revise emission calculations to reflect the ARB's latest emission inventory data.

08-3-4: Public Meeting to Consider Revisions to the 2008 Lower-Emission School Bus Program Guidelines and Funding Allocations

The 2008 Guidelines for implementing the Lower-Emission School Bus Program are for the use of the local air districts in implementing the program using Proposition 1B funding primarily, and would also be used by local air districts in distributing AB 923 funds directed at school bus replacement. Staff is proposing to allocate Proposition 1B funds to replace the remaining pre-1977 model year public school buses in California first, and the remaining funding is proposed to be allocated to local air districts based on ZEV model year 1977-1986 school bus population for model year 1977-1986 public school bus replacement and installation of ARB-verified Level 3 diesel retrofit devices on model year 1994-2006 school buses.

CLOSED SESSION – LITIGATION

The Board will hold a closed session as authorized by Government Code section 11126(e) to confer with, and receive advice from, its legal counsel regarding the following pending litigation:

Central Valley Chrysler-Jeep, Inc. et al. v. Goldstene, U.S. District Court (E.D. Cal. - Fresno), No. 1:04-CV-06663-AWI-GWA.

Fresno Dodge, Inc. et. al. v. California Air Resources Board and Witherspoon, Superior Court of California (Fresno County), Case No. 04CE CG03498.

General Motors Corp. et. al. v. California Air Resources Board and Witherspoon, Superior Court of California (Fresno County), Case No. 05CE CG02787.

State of California by and through Arnold Schwarzenegger, Governor of the State of California, and the California Air Resources Board v. U.S. Environmental Protection Agency and Stephen L. Johnson, Administrator, U.S. Court of Appeals (D.C. Cir.), Case No. 07-1457, filed November 8, 2007.

State of California by and through Arnold Schwarzenegger, Governor of the State of California, and the California Air Resources Board v. U.S. Environmental Protection Agency and Stephen L. Johnson, Administrator, U.S. District Court (D.C.) Case No. 07-CV-o2024-RCL, filed November 8, 2007.

State of California by and through Arnold Schwarzenegger, Governor, and the California Air Resources Board v. U.S. Environmental Protection Agency, and Stephen L. Johnson, Administrator, U.S. Court of Appeals (9th Cir.) Case No. 08-70011, filed January 2, 2008.

Green Mountain Chrysler-Plymouth-Dodge-Jeep, et al. v. Crombie , 508 F.Supp.2d 295, U.S. District Court Vermont (2007), appeal to 2nd Circuit Court of Appeals pending, Docket Nos. 07-4342-cv(L) and 07-4360-cv(CON).

OPPORTUNITY FOR MEMBERS OF THE BOARD TO COMMENT ON MATTERS OF INTEREST.

Board members may identify matters they would like to have noticed for consideration at future meetings and comment on topics of interest; no formal action on these topics will be taken without further notice.

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 three minutes to ensure that everyone has a chance to speak.

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http://www.arb.ca.gov/lispub/comm/bclist.php

IF YOU HAVE ANY QUESTIONS,
PLEASE 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:

- **For individuals with sensory disabilities, this document is available in Braille, large print, audiocassette or computer disk. Please contact ARB's Disability Coordinator at 916-323-4916 by voice or through the California Relay Services at 711, to place your request for disability services.**
- **If you are a person with limited English and would like to request interpreter services to be available at the Board meeting, please contact ARB's Bilingual Manager at 916-323-7053.**

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

PUBLIC MEETING AGENDA

LOCATION:
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Byron Sher Auditorium, Second Floor
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Sacramento, California 95814

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TITLE 13. CALIFORNIA AIR RESOURCES BOARD

NOTICE OF PUBLIC HEARING TO CONSIDER ADOPTION OF THE 2008 AMENDMENTS TO THE CALIFORNIA ZERO EMISSION VEHICLE REGULATION

The Air Resources Board (the Board or ARB) will conduct a public hearing at the time and place noted below to consider adoption of amendments to the California Zero Emission Vehicle (ZEV) regulation.

DATE: March 27, 2008

TIME: 9:00 a.m.

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

This item will be considered at a two-day meeting of ARB, which will commence at 9:00 a.m., March 27, 2008, and may continue at 8:30 a.m., March 28, 2008. This item may not be considered until March 28, 2008. Please consult the agenda for the meeting, which will be available at least 10 days before March 27, 2008, 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 1900, 1961, 1962, and 1962.1 and the incorporated "California Exhaust Emission Standards and Test Procedures for 2005 and Subsequent Model Zero-Emission Vehicles, and 2001 and Subsequent Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes;" and the adoption of a new title 13, CCR, section 1962.1 and the incorporated "California Exhaust Emission Standards and Test Procedures for 2009 and Subsequent Model Zero-Emission Vehicles."

Background

In 1990, pursuant to authority granted in Health and Safety Code division 26, part 5, chapter 1, section 43000 et seq., the California Air Resources Board adopted a far-reaching program to significantly reduce the environmental impact of light-duty vehicles through the introduction of zero emission vehicles (ZEVs) into the California fleet. The original program required that at least 2 percent, 5 percent and 10 percent of new vehicles have no direct emissions by 1998, 2001 and 2003, respectively. Although the ZEV program did not require a specific technology, the expectation in the early 1990's was that the requirements would be met through the introduction of battery electric vehicles (BEVs).

The ZEV program has been changed four times since its inception – in 1996, 1998, 2001, and most recently in 2003. While program requirements have been changed to reflect the status of technology, the original objective has not changed. California continues to maintain a strong commitment to the commercialization of zero emission passenger cars and light-duty trucks.

In response to program requirements, automakers have developed and demonstrated a limited number of ZEVs to evaluate their technological and commercial feasibility. In addition, automakers have commercialized near-zero emission advanced technology vehicles that support ZEV program goals and significantly reduce vehicle emissions.

The program was last modified in 2003 to address the state of technology and to focus research and development on fuel cell vehicle technology. Given the uncertainty in the pace of technology development, the Board directed that an independent panel of experts be convened in the 2006 to 2007 time frame to report on the status of ZEV technologies and their readiness for commercialization.

The panel's findings were presented to the Board in May 2007. Subsequent to presentations by the staff and panel, and after hearing public comment, the Board adopted Resolution 07-18 directing ARB staff to return to the Board with proposed changes that address the state of technologies needed to meet the regulation. The Resolution affirmed the Board's support for the program and emphasized that any changes proposed must strengthen the overall objectives of the program.

The panel's report has been central to ARB's assessment of the state of technology. The report, in combination with data presented at an ARB ZEV Technology Symposium held in September 2006 and other information collected, provides the technical basis for the proposed amendments in this rulemaking.

Description of the Proposed Regulatory Action

In response to the Board's direction, and in consideration of the issues related to the commercialization of ZEV technologies, staff proposes to amend the program to reflect the state of technologies and to create an opportunity for new ZEV enabling vehicle technologies to contribute to compliance. In proposing these amendments, staff strives

to sustain the objective of commercialization of ZEV technologies while recognizing the current state of the technologies and the cost implications related to their development.

Utilizing the current regulatory framework that prompts commercialization incrementally through ZEV production phase-in periods and through a credit structure for the production of increasingly more advanced technologies, staff proposes amendments in the following areas:

Creation of the "New Path" for 2012. Combine the Base Path and Alternative Path requirements into a New Path where the ZEV obligation and options to use other vehicle types are expressed as annual percentage of sales. While the Phase III target of 25,000 vehicles is retained, up to 90 percent of the pure ZEV requirement may be met by producing vehicles from a new category called "enhanced" Advanced Technology Partial ZEVs (AT PZEVs). Enhanced AT PZEVs[1] are AT PZEVs with credit allowances[2] totaling more than 1.0 that use fuels that can be used in a ZEV, like electricity or hydrogen. Example Enhanced AT PZEVs are plug-in hybrid electric vehicles (PHEVs) and hydrogen internal combustion engine vehicles. Because vehicles in this category are granted less credit per vehicle than a pure ZEV, manufacturers choosing this option will have to produce a greater number of vehicles than if they complied without this option. The proposed changes act to simplify the regulation while maintaining the overall outcome of the Alternative Path.

Create New ZEV Types. Create new ZEV Types to enable specific vehicle market sector opportunities with both mid range ZEVs and higher range ZEVs.

Establish Carry-Forward and Carry-Back provisions for ZEV credits. Modify the credit provisions under the proposed "New Path" to be consistent with the existing provisions contained in the Alternative Path which allow compliance over a three year window. Additionally, modify the way credits may be used after a specified time to avoid the difficulty experienced now with forecasting regulatory outcomes because of amassed credits.

Provide More Equal Treatment of Battery Electric Vehicles. Eliminate the cap on the use of full-function and city battery electric vehicles within the Alternative Compliance Path. Change the ratio for substitution for each vehicle type to be consistent with the credits earned by each ZEV type.

Adjust Credits for AT PZEVs. Modify the AT PZEV requirements, primarily to address PHEVs. The proposed amendments include addressing deployment of "blended" HEVs through an equivalent all electric range (EAER) credit, adjusting the credits for advanced componentry and fuel cycle emissions, and other conforming changes.

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[1] In discussion papers and conversations with stakeholders, this classification of vehicles has been referred to as Silver+.

[2] Allowances are part of a vehicle's credit calculation and credits are the sum of the allowances given.

Increase Credit for Neighborhood Electric Vehicles. Double the existing credit for neighborhood electric vehicles (NEV) to 0.3 credits per vehicle to reflect the vehicle's positive environmental benefits but limited functionality compared with full function battery or fuel cell EVs.

Extend the "Travel" Provision. Extend the provision that allows certain ZEVs placed in any state that has adopted California's ZEV program to count towards California's ZEV requirement through 2017. Include Type I and II ZEVs within the provision but sunset the application of this provision for these vehicles in 2014.

Modify Transition for Intermediate Automakers. Create a ramp up period of six years for intermediate volume manufacturers who are transitioning to large volume status. During this time, an automaker would be allowed to meet their ZEV requirements for increasing numbers of PZEVs of which a percentage must be AT PZEVs.

Public Availability of ZEV Credit Data. Require that all production data be publicly available and release ZEV credit bank balance information by a specified date.

Additional Conforming and Technical Amendments. Amend the ZEV regulations throughout to make addition modifications that provide for consistency with the above areas and that provide additional technical changes to improve the flexibility and the utility of the regulations. All amendments and additions to the regulations are described in detail in the Staff Report: Initial Statement of Reasons (ISOR) for the proposed regulatory action, whose availability is described below.

COMPARABLE FEDERAL REGULATIONS

Currently, there are no comparable federal regulations mandating auto manufacturers to produce PZEVs, AT PZEVs, and/or ZEVs.

AVAILABILITY OF DOCUMENTS AND AGENCY CONTACT PERSONS

The Board staff has prepared a Staff Report: Initial Statement of Reasons (ISOR) for the proposed regulatory action, which includes a summary of the economic and environmental impacts of the proposal. The report is entitled: "Initial Statement of Reasons for Rulemaking, 2008 Proposed Amendments to the California Zero Emission Vehicle Program Regulations."

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 March 27, 2008.

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

Inquiries regarding the substance of the proposed regulatory action may be directed to the designated agency contact persons, Dr. Elise Keddie, Manager, ZEV Implementation Section at (916) 323-8966 or by e-mail at ekeddie@arb.ca.gov or Mr. Mark Williams, Air Pollution Specialist, at (916) 327-5610 or by e-mail at mwilliam@arb.ca.gov.

Further, the agency representative and designated back-up contact persons to whom nonsubstantive inquiries concerning the proposed administrative action may be directed are Ms. Alexa Malik, Board Administration & Regulatory Coordination Unit, (916) 322-4011, or Ms. 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 http://www.arb.ca.gov/regact/2008/zev2008/zev2008.htm.

COSTS TO PUBLIC AGENCIES AND TO BUSINESSES AND PERSONS AFFECTED

The determinations of the Board's Executive Officer concerning the costs or savings necessarily incurred in reasonable compliance with the proposed regulations are presented below.

Pursuant to Government Code sections 11346.5(a)(5) and 11346.5(a)(6), the Executive Officer has determined that the proposed regulatory action would not create costs or savings to any state agency or in federal funding to the state, costs or mandate to any local agency or school district whether or not reimbursable by the state pursuant to part 7 (commencing with section 17500), division 4, title 2 of the Government Code, or other nondiscretionary 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 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 would not affect the creation or elimination of jobs within the State of California, the creation of new businesses or elimination of existing businesses within the State of California, or the expansion of businesses currently doing business within the State of California. A detailed assessment of the economic impacts of the proposed regulatory action can be found in the ISOR.

The Executive Officer has also determined, pursuant to title 1, CCR, section 4, that the proposed regulatory action may affect small businesses. Any business involved in manufacturing, purchasing or servicing passenger cars and light-duty trucks could be affected by the proposed amendments. Also affected are businesses that supply parts for these vehicles. Some affected businesses may be small businesses. California accounts for only a small share of total nationwide motor vehicle and parts manufacturing. As discussed below, the Executive Officer has determined that the proposed regulatory action will not have a significant cost impact on directly affected persons or businesses.

The cost savings estimated to result from the proposed amendments for model year 2012 through 2014 are $1.3 billion annually, dependent on compliance strategies, due to the reduction in the number of Type III ZEVs required to be produced, and the lower cost of the Enhanced AT PZEVs that would be produced in their place.

Before taking final action on the proposed regulatory action, the Board must determine that no alternative considered by the agency would be more effective in carrying out the purpose for which the action is proposed or would be as effective as and less burdensome to affected private persons or businesses 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, March 26, 2008**, and addressed to the following:

Postal Mail:	Clerk of the Board, Air Resources Board 1001 I Street, Sacramento, California 95814
Electronic mail:	http://www.arb.ca.gov/listpub/comm/bclist.php
Facsimile submittal:	(916) 322-3928

Please note that under the California Public Records Act (Government Code section 6250 et seq.), your written and oral comments, attachments, and associated contact information (e.g., your address, phone, email, etc.) become part of the public

record and can be released to the public upon request. Additionally, this information may become available via Google, Yahoo, and any other search engines.

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 39500, 39600, 39601, 43013, 43018, 43018.5, 43101, 43104, and 43105; and Government Code section 6253.4. This action is proposed to implement, interpret and make specific sections 39002, 39003, 39667, 43000, 43009.5, 43013, 43018, 43018.5, 43100, 43101, 43101.5, 43102, 43104, 43105, 43106, 43107, 43204, 43205, 43205.5, and 43211, Health and Safety Code; and section 6253.4, Government Code.

HEARING PROCEDURES

The public hearing will be conducted in accordance with the California Administrative Procedure Act, title 2, division 3, part 1, chapter 3.5 (commencing with section 11340) of the Government Code.

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

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

CALIFORNIA AIR RESOURCES BOARD

James N. Goldstene
Executive Officer

Date: January 29, 2008

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY
AIR RESOURCES BOARD

STAFF REPORT: INITIAL STATEMENT OF REASONS

2008 PROPOSED AMENDMENTS TO THE CALIFORNIA ZERO EMISSION VEHICLE PROGRAM REGULATIONS



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

Date of Release: February 8, 2008
Scheduled for Consideration: March 27, 2008

EXECUTIVE SUMMARY

In 1990, the California Air Resources Board (ARB or the Board) adopted an ambitious program to significantly reduce the environmental impact of light-duty vehicles through the commercial introduction of zero emission vehicles (ZEV) into the California fleet.

The ZEV program is vital in meeting California's environmental goals. Zero-emission technologies can greatly reduce or even eliminate some of the persistent environmental problems with motor vehicles. The ZEV program promotes the use of the cleanest gasoline technologies available, while still encouraging the development of pure zero emission technologies.

The ZEV program has been modified four times since its inception – in 1996, 1998, 2001, and most recently in 2003. While the program requirements have been changed to reflect the status of technology, the original objective has not changed. California continues to maintain a strong commitment to the commercialization of zero-emission passenger cars and light-duty trucks.

In response to the Board's actions, automakers have developed and demonstrated limited numbers of ZEVs to evaluate their technological and commercial feasibility. Parallel to these efforts, automakers have commercialized "near-zero" emission vehicles and hybrid electric vehicles (HEV) that have been supportive of the ZEV program goals and have significantly reduced vehicle emissions.

The ZEV program was last modified in 2003 to resolve legal challenges and to better address the state of technology. Given the uncertainty in the pace of technology development, the Board directed that an independent panel of experts (Panel) be convened to report on the status of ZEV technologies and their readiness for commercialization.

The Panel's findings were presented to the Board in May 2007. Subsequent to presentations by the ARB staff and Panel, and after taking public comment, the Board adopted Resolution 07-18 directing ARB staff to return to the Board with proposed changes that address the state of technologies needed to meet the regulation. In directing that changes were needed, the Board affirmed its support for the program and emphasized that any changes should strengthen the overall objectives of the program.

Proposed Amendments to the Regulations

In response to the Board's direction, ARB staff is now proposing amendments to the program that are designed to better reflect the state of technology and create incentives for new vehicle designs. Other proposed changes are intended to clarify and simplify specific program requirements pertaining to 2009 and subsequent model years (MY). The most significant proposed amendments pertain to Phase III and Phase IV (2012 – 2017), while Phase II (2009 – 2011) requirements remain largely unchanged. The

proposed amendments are expected to maintain pressure on the commercialization of pure ZEV technologies while recognizing the technological limitations and costs of current vehicles. The key elements of staff's proposal are the following:

A. Creation of the "New Path" for 2012. Combine the Base Path and Alternative Path requirements into a New Path where the ZEV obligation and the options to use other vehicle types are expressed as annual percentage requirements. The pure ZEV requirement may be offset by up to 90 percent "Enhanced" Advanced Technology Partial ZEVs (Enhanced AT PZEV), a new classification of vehicle in Phase III (2012 – 2014). In Phase IV (2015 – 2017), 50 percent of the ZEV target requirement could be met with Enhanced AT PZEVs. Enhanced AT PZEVs[1] are AT PZEVs with credit allowances[2] totaling more than 1.0 and which use fuels that can be used in a ZEV, like electricity or hydrogen. Examples of Enhanced AT PZEVs are plug-in hybrid electric vehicles (PHEVs) and hydrogen internal combustion engine vehicles. The proposed changes act to simplify the regulation while maintaining the overall outcome of the Alternative Path. Establish a new Type IV category to recognize longer range ZEVs and adjust ZEV credits such that Type III ZEVs earn 4 credits and Type IV ZEVs earn 5 credits through 2017.

B. Establish Carry-Forward and Carry-Back provisions for ZEV credits. Modify the credit provisions under the proposed "New Path" to be consistent with the existing provisions contained in the Alternative Path which allow compliance over a three year window. Additionally, modify the way credits may be used after a specified time to limit the possibility that amassed credits could cause a black out of ZEV production for an extended period of time and to make the regulatory requirements better reflect the expected outcome in terms of vehicles produced.

C. Provide More Equal Treatment of Battery Electric Vehicles. Eliminate the cap on the use of full-function and city battery electric vehicles (EV) within the Alternative Compliance Path. Change the ratio for substitution for each vehicle type to be consistent with the credits earned by the vehicle rather than a separate ratio established only for pure ZEV obligation compliance. Create a new Type I.5 to recognize opportunity for a marketable longer range city EV.

D. Adjust Credits for AT PZEVs. Modify the AT PZEV requirements, primarily to address PHEVs. The proposed amendments include addressing deployment of "blended" HEVs through an equivalent all electric range (EAER) credit, adjusting the credits for advanced componentry and fuel cycle emissions, and other conforming changes.

E. Increase Credit for Neighborhood Electric Vehicles. Double the existing credit for neighborhood electric vehicles (NEV) to 0.3 credits per vehicle to reflect the vehicle's

[1] In discussion papers and conversations with stakeholders, this classification of vehicles has been referred to as Silver Plus.
[2] Allowances are part of a vehicle's credit calculation and credits are the sum of the allowances given.

positive environmental benefits but limited functionality compared with full function battery or fuel cell EVs.

F. Extend "Travel" Provision. Extend the provision that allows Type III ZEVs placed in any state that has adopted California's ZEV program to count towards California's ZEV requirement through 2017, and include Type IV ZEVs. Include battery EVs within the provision but sunset the application of this provision for these vehicles in 2014.

G. Modify Transition for Intermediate Automakers. Create a ramp-up period of six years for intermediate volume manufacturers (IVM) who are transitioning to large volume status. During this time, an automaker would be allowed to meet its ZEV requirements with increasing numbers of partial ZEV allowance (PZEV) of which a percentage must be AT PZEVs.

H. Public Availability of ZEV Credit Data. Require that all production data be publicly available starting with the 2009 model year and release ZEV credit bank balance information for the 2010 model year and beyond.

Effect of Proposed Amendments

2009 – 2011: The staff proposal is not expected to change the number of pure ZEVs (e.g., fuel cell and battery EVs) in the near term. However, the changes made do allow additional flexibility for the use of battery EVs, should products be available in this timeframe. Since many automakers still retain sufficient banked credits to assist with their compliance plans for this time period, staff expects they will aggressively use banked credits to meet the requirements in this timeframe since ZEV technologies remain very expensive. Thus the actual number of new ZEVs produced is expected to be lower than the 2,500 commonly referred to for this time period. Additionally, the amendments provide a clearer path for the use of PHEVs which are under development.

2012 – 2017: The staff proposal is expected to decrease the number of pure ZEVs (e.g. fuel cell and battery EVs) introduced during this timeframe relative to the existing program. Where the existing program would call for 75,000 ZEVs between 2012 and 2017, the staff proposal could result in as few as 27,500 ZEVs if manufacturers comply using the highest credit earning ZEVs. A mix of ZEV types used for compliance in this time period, including fuel cell vehicles and a range of battery EVs, would result in a higher number of ZEVs. The overall number of advanced technology vehicles should increase as manufacturers are allowed to meet a part of the requirements with a new class of vehicle, referred to as Enhanced AT PZEVs. More than 150,000 Enhanced AT PZEVs could result in the 2012 – 2017 timeframe. The exact number of vehicles that will be placed is unknown; however use of banked credits will not be as significant in this timeframe, meaning that production of ZEVs should more closely match the stated requirements than in previous years of the program.

2018 and subsequent: No changes are proposed to the ZEV requirements for the long term. The current 16% requirement beginning in 2018 remains in place. It is expected that the program will be revisited prior to the implementation of this portion of the regulation to determine if the pace of vehicle introduction is correct or if it can be accelerated.

The proposal is expected to reduce the cost of compliance by reducing the number of vehicles incorporating the most expensive technologies (fuel cell and battery EVs) needed during the 2012 – 2017 timeframe. The estimated annual savings averages $1.3 billion in 2012 – 2014 and nearly $0.9 billion in 2015 – 2017.

The ZEV program continues to provide positive air quality impacts as compared to no program. The changes proposed by staff significantly reduce an automaker's cost of compliance, but still provide increased air quality benefits primarily because they rely upon the proven emissions benefits of commercially viable and increasingly available AT PZEVs. Staff believes that a reduction in the near term production volume of ZEVs is warranted because technological and cost hurdles remain that are best solved through continued lower volume demonstrations of the technologies. In making these changes, the program will reduce criteria pollutant emissions by 7,000 tons over the life of the affected vehicles. The proposed changes further encourage AT PZEV technologies as well as Enhanced AT PZEV technologies, both of which enable pure ZEV technology.

Staff Recommendation

The ARB staff recommends that the Board adopt the amendments as proposed in this Initial Statement of Reasons (ISOR). The proposed amendments respond to the current state of ZEV technology, and reduce the overall cost of compliance to industry, while maintaining the push toward ZEV commercialization.

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APPENDIX A: PROPOSED REGULATION ORDER: AMENDMENTS TO THE ZERO-EMISSION VEHICLE REGULATION

Table of Acronyms

AER ..... All Electric Range
ARB ..... California Air Resources Board
AT PZEV ..... Advanced Technology Partial ZEV Allowance Vehicle
CNG ..... Compressed Natural Gas
EAER ..... Equivalent All Electric Range
EMFAC ..... ARB's mobile emissions inventory modeling program
EV ..... Electric Vehicle
HEV ..... Hybrid-Electric Vehicle
ISOR ..... Initial Statement of Reasons
IVM ..... Intermediate Volume Manufacturers
LDT1 ..... Light Duty Truck with a loaded vehicle weight of 0-3750 pounds
LDT2 ..... Light Duty Truck with a loaded vehicle weight of 3751 pounds to a gross vehicle weight of 8500 pounds, or a "LEV I" light-duty truck with a loaded vehicle weight of 3751-5750 pounds
LEV I ..... First generation Low Emission Vehicle program, adopted in a 1990-1991 rulemaking, and generally applicable in the 1994-2003 model years
LEV II ..... Second generation Low Emission Vehicle program, adopted in a 1998-1999 rulemaking, and generally applicable in the 2004 and subsequent model years
LFCE ..... Low Fuel Cycle Emissions
LVM ..... Large Volume Manufacturers
MY ..... Model Year
NEV ..... Neighborhood Electric Vehicle
NOx ..... Oxides of Nitrogen
PHEV ..... Plug-in Hybrid-Electric Vehicle
PZEV ..... Partial ZEV Allowance Vehicle
ROG ..... Reactive Organic Gases
Type 0 ..... Utility EV, less than 50 mile range
Type I ..... City EV, range of 50 to less than 75 miles
Type I.5..... City EV, range of 75 to less than 100 miles
Type II ..... Full Function EV, range of 100 or more miles
Type III ..... ZEV, range of 100 or more miles plus fast refueling
Type IV ..... ZEV, range of 200 or more miles plus fast refueling
UDDS ..... Urban Dynamometer Driving Schedule
ULEV I ..... Ultra-Low Emission Vehicle, pre-1998 regulations
ULEV II ..... Ultra-Low Emission Vehicle, post-1998 regulations
VMT ..... Vehicle Miles Traveled
ZEV ..... Zero Emission Vehicle

1. INTRODUCTION

In 1990, the California Air Resources Board (ARB or the Board) adopted an ambitious program to dramatically reduce the environmental impact of light-duty vehicles through the gradual introduction of zero emission vehicles (ZEV) into the California fleet. The ZEV program, which affects passenger cars and light-duty trucks (LDT1 and LDT2), has been adjusted four times since its inception: in 1996, 1998, 2001 and 2003. The fundamental goal of the program, however, has not changed. California remains committed to the commercialization of ZEV technologies.

California's strong commitment to the ZEV program reflects the essential need for ZEV technology in order to achieve the State's public health protection goals. Health-based state and federal air quality standards continue to be exceeded in regions throughout California. California's growing population and increasing use of motor vehicles mean continued upward pressure on statewide emissions.

Zero-emission technologies can greatly reduce or even eliminate some of the persistent emissions related environmental problems with motor vehicles. Combustion-based engines are prone to deterioration over time and result in higher fuel cycle emissions. Catastrophic failures are also a concern. Older gasoline-powered vehicles, for example, become gross emitters if their emission control systems fail. Combustible fuels also have significant "upstream" impacts. Refining, fuel storage and delivery all have associated emissions. Apart from upset conditions that may occur during electric power generation or hydrogen fuel production and distribution, ZEVs have none of these vulnerabilities.

While ZEVs can provide significant environmental benefits, it is also necessary that they be economically viable. Since the program's inception, substantial technological improvements have occurred. These improvements have raised the level of vehicle performance and have resulted in attractive solutions to personal mobility. However, the cost goals necessary for such technologies to compete successfully in the marketplace have not been met, preventing widespread introduction of the technology.

This rulemaking provides another opportunity for the Board to consider mid-course corrections that address the realities of the state of technologies while encouraging the introduction of new, innovative plug-in hybrid electric vehicle (HEV) designs to reduce the environmental impacts from light-duty vehicles and further support ZEV commercialization through deployment of enabling technologies.

2. BACKGROUND

2.1 ZEV Program Objectives

The ongoing adjustments to the ZEV program are the result of the continuing need to balance the pressure on vehicle manufacturers to develop ZEVs with the recognition of real-world status of the available technologies. Since its adoption, the ZEV program has pushed the boundaries of ZEV development, while taking into account the cost, performance, suitability for volume production and long-term prospects of the technologies. The following are the main objectives of the ZEV program and of staff's proposed changes:

- Maintain the pure ZEV requirement as a technology forcing-element of ARB's overall effort to achieve long term public health and air quality goals
- Take full advantage of technology options and accelerate ZEV development through deployment of advanced vehicles with ZEV enabling technology
- Maximize air quality benefits by allowing automakers the flexibility to meet portions of the regulation with conventional technologies substantially cleaner than required by other motor vehicle requirements
- Simplify the structure of the ZEV program

The program has not yet resulted in the commercial introduction of ZEVs. However, the tremendous progress that has been made in a variety of advanced technologies can, at least in part, be attributed to the existence of the ZEV requirement. Furthermore, ARB staff believes that continued regulatory requirements are needed to push the development of pure ZEVs.

2.2 Air Quality in California

Air quality in California has improved dramatically over the past 30 years, largely due to continued progress in controlling pollution from motor vehicles. Faced with ever more stringent regulations, vehicle manufacturers have made remarkable progress in advancing vehicle technology. Vehicles meeting ARB's most stringent emission certification standards achieve emission levels that seemed impossible when the ZEV program was adopted in 1990.

Despite this progress, air quality in many areas of the state still does not meet federal or state health-based ambient air quality standards. Mobile sources still are responsible for well over half of the ozone-forming emissions in California. The relative contribution of passenger cars and small trucks is expected to decline over time as new standards phase in, but in 2020 such vehicles will still be responsible for approximately 10 percent of total emissions based on the ARB emissions inventory.[1] State and federal law

[1] ARB 2007a, *2007 Almanac Data,* 2007.

requires the implementation of control strategies to attain ambient air quality standards as quickly as practicable and as mandated.

Other programs and legislation, including Assembly Bill 1007 (State Alternative Fuels Plan), require the state to prepare new plans to increase the use of alternative fuels in California. These other programs indicate the need for significant use of the electric drive train as well as other actions to meet California's air quality and emission reduction goals.

2.3 Zero Emission Vehicle Program History

Manufacturers originally pursued the development of battery electric vehicles (EV) to meet the ZEV requirements. In 1996, the ARB eliminated the requirements for the 1998 through 2002 model years (MY) due to cost and performance issues to allow additional time for battery research and development. To ensure a significant market for advanced battery manufacturers, ARB entered into agreements with manufacturers to place in California roughly 1,800 advanced-battery EVs between 1998 and 2000. The agreements were designed to provide battery developers with the necessary initial production volumes to meet the cost and performance goals needed for commercial production.

Contrary to expectations, advanced battery costs have remained too high for commercial viability. For example, research in 2000 showed that full-sized nickel metal-hydride battery packs would cost approximately $7,000 to $9,000 each at production levels exceeding 100,000 battery packs per year, and would cost twice as much at lower production levels. Notwithstanding these costs, several manufacturers continued to place a modest number of battery EVs after meeting their agreement volumes. These vehicles earned ZEV credits that have been used for compliance with the regulation.

Manufacturers began to look seriously at hydrogen fuel cell vehicles in the late 1990's as an alternative to battery EVs. This interest led to cooperative efforts among the ARB, industry and other governmental agencies to create the California Fuel Cell Partnership in 1999. The Partnership demonstrates fuel cell vehicle technology while exploring the paths to commercialization. Changes to the program in 2003 provided new incentives for fuel cell vehicles.

The most recent changes to the ZEV program in 2003 resolved legal challenges and addressed the state of various vehicle technologies. Given these changes and the uncertainty in technology development, the Board directed that an independent panel of experts (Panel) be convened to report on the status of ZEV technologies and their readiness for commercialization prior to 2009.

From the results of the Panel report[2], in May 2007, the Board found that some changes to the program were needed to align the requirements with the state of technology. However, the Board's overall direction was that any changes should be limited in scope to the greatest extent possible and that no "backsliding" of the program should result. The proposed amendments presented in this rulemaking respond to this direction and to the Board's findings contained within Board Resolution 07-18[3].

2.4 Current Program

Shown below in Table 2.1 is the structure of the current ZEV regulation for MY 2009.

Table 2.1: 2009 ZEV Program Requirements - Base Path

Certification Standards				
% Requirement	% of Total Vehicle Sales[1]	Vehicle Type	Category	Technical Description
2.5	< 1	Zero Emission Vehicle (ZEV)	Gold	Zero tailpipe emissions: battery electric vehicles and hydrogen fuel cells.
2.5	5	Advanced Technology PZEV (AT PZEV)	Silver	Vehicles certified to PZEV standards and employing ZEV-enabling technologies: e.g. hybrids or compressed natural gas vehicles.
6	30	Partial Zero Emission Vehicle (PZEV)	Bronze	Conventional vehicles certified to the most stringent tailpipe emission standards, zero evaporative emissions, and extended warranty.
11	35	Total ZEV Requirement		

[1] Percent of total California sales differs from percentage requirement because credits per vehicle type vary.

The three categories of vehicles used to meet the ZEV regulation are referred to as ZEV or "gold," advanced technology partial zero emission vehicles (AT PZEV) or "silver," and partial ZEV allowance vehicles (PZEV) or "bronze." To date, approximately 4,500 ZEVs have been demonstrated, while over 100,000 AT PZEVs and nearly 700,000 PZEVs have been commercially introduced, resulting in significant emissions reductions. An example of an AT PZEV is the Toyota Prius HEV while examples of a PZEV are the Ford Focus and BMW 325.

The Board's 2003 amendments increased the requirements for ZEVs to 11 percent starting in 2009 and ultimately increasing to 16 percent in 2018. Large volume manufacturers (LVM – those with annual California sales exceeding 60,000 vehicles) are allowed to comply using either the Base Compliance Path with the percentage ZEV requirements shown in Table 2.1 or the Alternative Path shown in Table 2.2 below. The

[2] Kalhammer, et al. *Status and Prospects for Zero Emission Vehicle Technology: Report of the ARB Independent Expert Panel 2007*, April 13, 2007
[3] ARB 2007b, *Board Resolution 07-18,* May 24, 2007

Alternative Compliance Path was included in the ZEV program in 2003 to promote the commercialization of fuel cell vehicles and to ensure that new ZEVs continued to be produced. The Alternative Compliance Path also allows AT PZEVs to fulfill a greater share of the top five percent of obligations (the gold and silver commitments), provided that the manufacturer meets the requirements specified below.

Table 2.2: Alternative Compliance Path Fuel Cell Requirements

Phase	During Model Years	Manufacturer's Market Share of:
I	2005 – 2008	250 fuel cell vehicles
II	2009 – 2011	2,500 fuel cell vehicles
III	2012 – 2014	25,000 fuel cell vehicles
IV	2015 – 2017	50,000 fuel cell vehicles

As illustrated in Table 2.2, the requirement for ZEVs, e.g., fuel cell vehicles, increases by factors of ten for Phases II and III and then doubles for Phase IV, as the technology was expected to make the transition from demonstration to full commercialization. Volumes in Phases I and II reflected the early development process, with further technological changes expected prior to ramp-up toward commercialization. Phases III and IV were designed to establish new commercial markets for the technology.

2.5 Manufacturer Compliance Status

Twenty-two auto manufacturers are subject to the ZEV regulation. Six are defined as LVMs: General Motors, Toyota, Ford, Honda, Chrysler LLC and Nissan. The remaining 16 are intermediate volume manufacturers (IVM). IVMs can meet the regulation entirely with PZEVs.

All manufacturers are currently in compliance with the ZEV regulation. The product plans and technology development strategies vary from manufacturer to manufacturer. Most manufacturers have enough banked credits from ZEVs already produced and placed to comply with the regulation through approximately 2009. It should be noted however, that while all of the large manufacturers have active fuel cell vehicle demonstrations, some of these manufacturers have chosen to comply using the Base Path and not need to produce any additional fuel cell vehicles between now and the end of 2008 to comply with the regulation.

To meet the AT PZEV portion of the regulation, manufacturers are either producing AT PZEVs (primarily HEVs) or using banked credits from previously produced neighborhood electric vehicles (NEVs). Four of the six large manufacturers have commercialized AT PZEVs; two of these manufacturers, Toyota and Honda, dominate the volumes produced to date. On aggregate, manufacturers have sufficient banked AT PZEV and NEV credits to meet the AT PZEV portion of the regulation for the next four to five years.

Regardless of the method with which manufacturers are meeting the AT PZEV portion of the program, the number of AT PZEVs produced to date is beyond what is required by the ZEV regulation. In 2005, twice as many AT PZEVs were produced as required to meet AT PZEV portion of the program due mostly from production from two manufacturers. Over-compliance will change within the next model year or so as the optional volume of AT PZEVs increases to 8 percent of the total fleet for those manufacturers on the Alternative Path.

Table 2.3 presents the approximate total number of gold, silver and bronze vehicles placed as of MY 2006. Manufacturers have been producing PZEVs at a rate greater than needed in aggregate (in 2005, manufacturers produced 40 percent more PZEVs than the industry-wide PZEV option).

Table 2.3: Vehicle Placements by Type

Vehicle Type		Quantity[1]
ZEV	Fuel cell	160
ZEV	Battery electric	4,400
ZEV	Neighborhood electric	26,000
AT PZEV	Hybrid/Compressed Natural Gas	109,000
PZEV	Conventional	672,000

[1] Estimates of total vehicle placements from 1994 through 2006.

Table 2.4 shows the current aggregate ZEV credit balances by vehicle type for the six LVMs. The balances reflect compliance with the AT PZEV and PZEV requirements in 2005 and 2006. However, for manufacturers on the Alternative Path, gold credits have not yet been spent since Phase I does not end until the end of the 2008 MY.

Table 2.4: Current Aggregated ZEV Bank Credits

Vehicle Type	Vehicle Credit
ZEV "Gold"	43,726
ZEV from NEVs[1]	123,271
AT PZEV "Silver"	110,839
PZEV "Bronze"	113,734

[1]NEV credits can only meet the PZEV or AT PZEV portion of the regulation

3. SUMMARY OF PROPOSED AMENDMENTS

In response to the Board's direction, and in consideration of the issues related to technology commercialization, staff is now proposing amendments to the program that are designed to reflect the state of technology and create an opportunity for new emerging vehicle technologies to count towards the pure ZEV requirement. Other proposed changes are intended to clarify and simplify specific program requirements. The areas identified in this section represent the most significant changes being proposed.

3.1 Creation of the "New Path" (2012 onward)

Staff Proposal: Merge the existing compliance paths into a single path beginning in 2012 and allow high-scoring AT PZEVs to meet up to 90 percent of the pure ZEV requirement in 2012 – 2014, and 50 percent in 2015 – 2017.

This set of changes is aimed at accomplishing a number of goals and includes a number of different elements. The goals include:

- Establish an appropriate volume of ZEVs given the state of the technologies
- Acknowledge new ZEV Types that hold promise for commercialization including mid-range battery EVs and longer range fuel cell vehicles
- Establish an appropriate relationship between ZEV types by adjusting the number of credits awarded
- Incentivize production of certain AT PZEV technologies that facilitate the commercialization of pure ZEVs
- Simplify the regulation

3.1.1 Adjustment of ZEV Volumes

Based on the projections of the Panel, production of thousands of fuel cell vehicles per year globally is achievable within the next five years given the pace of effort underway by manufacturers and suppliers. This projection is generally consistent with the existing requirements for Phase II (2,500 over a three year period). Maintaining Phase II is also important as manufacturers struggle to engage hydrogen fueling partners to seriously respond to the need for infrastructure, since greater use of stations is necessary for further investment by fuel providers. Staff, therefore, believes that the current Phase II requirements which represent a ten fold increase of Phase I requirements should remain unchanged.

However, the Panel found the Phase III and Phase IV requirements to be significantly higher than what is reasonable to expect in the 2012 – 2017 timeframe given the state of fuel cell technologies. According to the Panel, high costs and continuing challenges with durability and life expectancy of the technology could be prohibitive to manufacturers significantly growing the production volumes of vehicles. Similarly, the Panel found that battery technology, while making progress, has yet to reach a point

where significant ramp up of vehicle volumes could be mandated as costs remain high and some battery chemistries have yet to prove lifetime durability. The Board accepted these findings from the Panel at their May 2007 Board Hearing and directed that adjustments be made to address these issues while still embracing the overall objectives of the ZEV program to the greatest feasible extent.

In response, staff is now proposing changes that are more in line with the findings of the Panel. The proposal creates a more feasible program by adjusting the number of pure ZEVs downward beginning in 2012. The existing ZEV production floor for Phase III and Phase IV are 25,000 and 50,000 ZEVs respectively. Staff proposes to reduce this floor to 2,500 ZEVs in Phase III and 25,000 ZEVs in Phase IV.

3.1.2 New ZEV Types and Adjustments to Existing ZEV Types

As staff assessed the types of ZEVs that may be used to meet the ZEV regulation in the coming years, two new types emerged. The first, described as a Type 1.5 ZEV falls between a Type I ZEV (generally described as a City EV with minimum range of 50 miles) and a Type II ZEV (generally described as a full function battery EV with minimum range of 100 miles). The second, described as a Type IV ZEV is a ZEV with 200 miles range that is fast refuel capable.

The Type I.5 ZEV is proposed because staff learned that an optimal, cost effective, and marketable BEV may soon evolve, but that these might offer a driving range that is short of the 100 mile requirement for Type II but greatly exceeds the 50 mile requirement for Type I. Several manufacturers have indicated a strong interest in the creation of this new tier. To recognize this new BEV and provide appropriate incentives, staff proposes to award them with credit of 2.5.

The definition of the Type IV would be a ZEV that has a range of at least 200 miles and fast refueling capabilities. This would likely be an advanced fuel cell vehicle. It is proposed that the Type IV be given 5 credits per vehicle. This additional credit, compared to battery EVs and lower range fuel cell vehicles would be available in the near term to reflect the greater challenges for fuel cell vehicles to reach marketability and their higher development costs. Credit for these vehicles would become consistent with Type II and Type III vehicles beginning in 2018.

Type III ZEVs are defined as ZEVs with range greater than 100 miles and fast refueling capabilities. Staff is proposing to broaden that definition to allow ZEVs with range greater than 200 miles, but not fast refuel capable to be Type III ZEVs. This would mean that a battery EV with range greater than 200 miles would earn the same credit as a fuel cell vehicle with range less than 200 miles; the differentiation being the fast refueling capability.

3.1.3 Adjustment of Credits for ZEVs

With the addition of the two new ZEV types, and in consideration of the state of development of each vehicle type involved, staff has adjusted the credits for several ZEV types to establish distinction between them. As described above, Type I.5 ZEVs are assigned 2.5 credits and Type IV ZEVs are assigned 5 credits. Staff is also proposing that the 4 credits currently earned by a Type III ZEV (typically a fuel cell vehicle with less than 200 miles) in 2009 – 2011 be continued through 2012 – 2017 timeframe. This recognizes the state of development and continued high cost of fuel cell technology in this timeframe. Table 3.1 presents the credits for both existing and proposed ZEV categories. Expanding the vehicle types provides greater flexibility and opportunities for manufacturers to comply with the regulation.

Table 3.1: Credits for ZEVs 2009 to 2017

Tier	Expected Technology	Range	Existing	Proposed
Type I	Battery EV	50 – 74 miles	2	2
Type I.5 (new)	Battery EV	75 – 99 miles	NA	2.5
Type II	Battery EV	> 100 miles	3	3
Type III	Fuel Cell or Battery EV	Fuel Cell – 100 – 199 miles Battery EV > 200 miles	4	4
Type IV (new)	Fuel Cell	> 200 miles	NA	5

3.1.4 Incentives for Enhanced AT PZEVs

Staff proposes to create a new classification of vehicle called "Enhanced AT PZEVs" and to incentivize their production by allowing them to meet up to 90 percent of the ZEV target in 2012 – 2014, and 50 percent of the ZEV target in 2015 – 2017.

An Enhanced AT PZEV by definition would earn one or more credits per vehicle and use a "ZEV fuel." Those that don't are considered conventional AT PZEVs. Enhanced AT PZEVs, though not gold in terms of zero tailpipe emissions, are extremely clean in terms of both criteria pollutant and climate change fuel cycle emissions and, even more than conventional AT PZEVs make use of fuels and vehicle systems directly enabling further advancement of ZEVs. Examples of Enhanced AT PZEVs include plug-in hybrid electric vehicles (PHEVs) and hydrogen internal combustion engine vehicles.

Enhanced AT PZEVs would provide the option to lower the number of pure ZEVs required in Phase III and Phase IV. That is, manufacturers would be allowed to produce Enhanced AT PZEVs in sufficient quantities to replace the credits from the reduced number of pure ZEVs in each Phase, thereby providing a "backfill" as requested by the Board. Because the per vehicle credit for an Enhanced AT PZEV is less than the credit for a pure ZEV, use of the backfill option will result in a greater number of total vehicles produced.

3.1.5 Simplify the Program with the "New Path"

The staff also proposes to combine the existing Alternative and Base Paths into a single "New Path" beginning in 2012. The New Path would return the compliance calculation to an annual percentage requirement for ZEVs with options to comply with percentages of PZEVs, AT PZEVs and Enhanced AT PZEVs. Table 3.2 illustrates the New Path percentages and the expected numbers of vehicles for 2012 – 2014 and 2015 – 2017.

Table 3.2: Proposed "New Path" Requirement by Vehicle Category

	2012 – 2014 (12 % Total Requirement)[1]			2015 – 2017 (14 % Total Requirement)[1]		
	Percent	Vehicles Per Year[2]	Vehicles over period[2]	Percent	Vehicles Per Year*	Vehicles over period*
ZEV[3]	0.3%– 3%	840 – 8,353	2,500 – 25,000	3% – 6%	8,333-16,660	25,000 – 50,000
Enhanced AT PZEV	0 – 2.7%	Up to 25,000	Up to 75,000	Up to 3%	Up to 28,000	Up to 83,000
AT PZEV	3%	65,000	195,000	2%	51,000	153,000
PZEV	6.0%	420,000	1,260,000	6.0%	420,000	1,260,000

[1] Based on annual California vehicle sales of 1.4 million passenger cars, light-duty trucks (LDT 1 and LDT 2) by the six large volume auto manufacturers.
[2] Assumes that Enhanced AT PZEVs earn 1.5 credits, AT PZEVs earn 0.65 credits in 2012 – 2014, and 0.55 credits 2015 – 2017. Credits earned vary by vehicle technology, and thus the number of vehicles produced may vary from the volumes in this table.
[3] Assumes Type IV ZEV.

Approximately 75,000 Enhanced AT PZEVs could be placed to backfill ninety percent of the gold requirement in 2012 – 2014. This increases to roughly 83,000 vehicles in 2015 – 2017. The AT PZEV or "silver" percentage requirement is based on the existing Alternative Path and results in approximately 195,000 vehicles in 2012 – 2014. Concerning AT PZEVs, the existing program allows manufacturers to use AT PZEVs under the Alternative Path to meet a majority of the ZEV requirements. The number of standard AT PZEVs decreases in the 2015 – 2017 timeframe due to the creation of the new Enhanced AT PZEV category and due to the increasing requirement for the ZEV category. The PZEV option would remain unchanged during the six year period and stay consistent with the existing program.

The New Path is intended to increase flexibility and incentivize the introduction of innovative advanced vehicle technologies. Returning to a single path simplifies the regulatory structure and provides for a more easily described and understood regulation. The New Path results in more certainty and transparency about how many vehicles will be produced and what impacts the program will have on commercialization and air quality improvement.

3.2 ZEV Credits: Carry Forward/Carry Back

Staff Proposal: Modify the credit provisions under the proposed "New Path" to be consistent with the existing provisions contained in the Alternative Path which allow compliance over a three-year window. The proposal would also modify the way credits

may be used after a specified time to avoid excessive credit build up and help assure a smooth and continuous ramp up in production volume.

The ZEV regulation allows the banking and trading of credits earned from early introduction and/or over-compliance with the regulation. Because of the lag between early demonstrations and implementation of the regulation, automakers amassed substantial credit accounts with early actions, including production and placement of NEVs. This has caused delays in the introduction of increasing numbers of ZEVs into the market. In addition, the banked ZEV credits create uncertainty as to what actions automakers will take to comply with the ZEV requirement, which, in turn, impacts the Board's ability to accurately forecast the environmental impacts of the program. Staff is therefore proposing to change the long-term applicability of how banked credits can be used.

3.2.1 Carry Forward

Staff proposes that all ZEV credits earned thru 2008 MY retain their full flexibility thru 2011. Beginning in MY 2012, these credits would no longer be allowed to offset the ZEV requirement; instead they would only be allowed to meet portions of the regulation that could be met with PZEVs, AT PZEVs or Enhanced AT PZEVs. Credits earned in the 2009 MY and later would be allowed to be carried forward for two additional years for application to the gold requirement. For example, gold credits earned in 2010 would retain full flexibility until 2013, at which time "stale" credits could not be used to comply with the gold requirements. Existing provisions for banked AT PZEV and PZEV credit would remain unchanged. The proposed amendments will help alleviate the possibility of long black out periods during which pure ZEV production is curtailed, while, at the same time, allow automakers to build up short term reserves so that they may choose production phases that fit their product planning cycles.

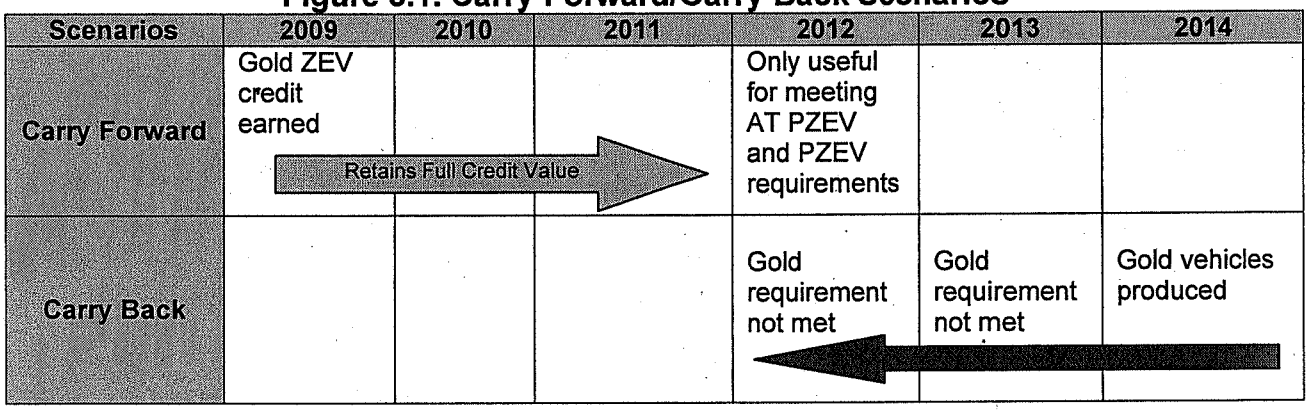
3.2.2 Carry Back

The ZEV regulation currently includes a one-year-carry-back provision for gold-category vehicles, meaning that if an automaker fails to meet its obligation in one year, the obligation may be made up in the next year, after fulfilling the past year's compliance obligation. Staff proposes to change the carry back provision to two years, meaning that an automaker may fulfill an obligation for year one and/or two after meeting the year-three compliance obligation. Like the carry-forward provision described above, this provides flexibility to automakers to match their production development schedules with technology demonstration phases. The stretch from one to two years coincides with the three-year windows originally established in the Alternative Path. The regulation already allows for a two-year carry back for silver and bronze vehicles and would also cover Enhanced AT PZEVs.

Figure 3.1 illustrates the proposed changes. As shown in the figure, a manufacturer producing in 2009 can use those credits to meet requirements in 2009, 2010 and 2011 without restriction. Beginning in 2012 the credits can only be used to meet a

manufacturer's PZEV or AT PZEV requirements. Regarding carry back, a manufacturer producing vehicles in 2014 can use those credits in MYs 2012 and 2013 to fulfill the requirements after fulfilling their full obligation for the 2014 MY.

Figure 3.1: Carry Forward/Carry Back Scenarios



In the worst case, using a combination of both carry forward and carry back an auto manufacturer could have a four-year "black out" in ZEV production. This is also possible under the existing Alternative Path compliance option as a manufacturer can front load Phase II and end load Phase III to achieve compliance. This gap is also consistent with product development cycles, which for demonstration volumes of vehicles is helpful for spacing out generations of technology. As the requirement grows, staff believes carry back will not be heavily relied upon because the risk of carrying such a significant debt is too great.

3.3 Provide for More Equal Treatment of Battery Electric Vehicles

Staff Proposal: Eliminate the cap on the use of full-function and city EVs within the Alternative Compliance Path. Change the ratio for substitution for each vehicle type to be consistent with the credit earned by the vehicle.

Battery EVs were the primary compliance strategy in the early years of the ZEV program. In 2003, findings on cost and durability pointed to an extremely limited commercial market (ARB 2003). In an effort to refocus the regulation towards a technology with mass market commercial potential, the Board shifted the regulation towards acceleration of fuel cell vehicle technology. Many stakeholders expressed a concern that these changes would hinder development of battery EVs. In response, in 2003, the Board provided limited incentives for battery EVs by allowing a portion of the Alternative Path to be met with the technology. However, battery EVs used as substitutes for fuel cell vehicles within the Alternative Path were required to substitute at a ratio between 5:1 and 20:1.

In response to continued public interest in battery EV technology, the ARB has been monitoring the state of battery technology and the prospects for battery EV commercialization. The Board directed that staff reassess the development of battery EV technology and cost in the Panel's technology assessment. The Panel found that

significant effort is going into development of improved batteries for use in vehicles. Lithium and nickel-metal-hydride technologies are receiving the greatest focus and are expected to meet the performance and life cycle demands of customers. However, while technological progress has been made and life cycle cost is starting to look more attractive as gasoline prices increase, cost remains high and at least for lithium, lifetime durability is not yet proven. The Panel concluded that a small market is possible for the technology.

Some automakers are now showing renewed interest in bringing battery EVs to market. Improvements in battery chemistry and announcements by battery companies and start-up automakers have raised new optimism that the technology may be viable in the mid-term. Given the progress made in battery technology and the possibility of automakers coming back into the battery EV market, staff is now proposing that the ZEV regulation be modified to provide for more even treatment of battery EVs (Type I and Type II ZEVs). The amendments would remove the cap for use of battery EVs to meet the gold requirement and would establish compliance ratios for their use based on the credits they earn rather than a secondary "substitution ratio" as was the case in the Alternative Path in the current regulation.

Tables 3.3 and 3.4 demonstrate the existing and proposed treatment of battery EVs under the New Path. Under the existing Alternative Path, manufacturers must meet at least 50 percent of the requirement with Type III vehicles, or fuel cell vehicles. This was included to ensure that fuel cell technology would have the necessary focus and attention. Type I and II vehicles (battery EVs) could be used to meet the remaining 50 percent, but at the credit ratios shown in Table 3.3. The large ratios between fuel cell and battery EVs meant that much larger numbers of battery EVs had to be produced if a manufacturer chose to meet the regulation with the technology. Additionally, a manufacturer had to produce two ZEV technologies to comply with the regulation – fuel cell vehicles and battery EVs.

Table 3.3: Existing Cap and Substitution Ratio for Type I and II ZEVs

ZEV Type	Cap (percent)	Ratio to Type III (2005-2011)	Ratio to Type III (2012-2017)
I (City EVs)	50	20:1	10:1
II (Full Function EVs)	50	10:1	5:1

The staff proposes to remove the cap and modify the ratios for substitution to be consistent with those in Table 3.2. Table 3.4 illustrates the proposed ratios as they relate to Type IV vehicles. For example, 5 full-function-battery EVs would be required in lieu of 3 Type IV fuel cell vehicles during the 2012 – 2014 timeframe.

Table 3.4: Proposed Ratio for Type I and II Vehicles

Type	Cap (percent)	Ratio to Type IV (2009-2017)
I (City EV)	0	2.5 : 1
I.5 (City EV)	0	2 : 1
II (Full Function EV)	0	5 : 3

By returning to technology neutrality and considering battery EVs and fuel cell vehicles similarly, ARB recognizes the equal air quality benefit of both technologies. The market has changed since the amendments to the program in 2003, with several manufacturers showing a renewed interest in battery technology. Current fuel cell development is strong and does not need as much regulatory advantage as is provided by the existing program. It is likely that some manufacturers will pursue more advanced battery EV development as a result of this proposal. Still, staff believes the strong interest and investment in fuel cell vehicle development will continue regardless of these changes.

3.4 Adjust Credit Determination Methods for AT PZEVs

The credit allowances provided to AT PZEVs are intended to accelerate the development and deployment of ZEV technologies in the marketplace. Examples of such technologies include electric drive systems, energy-storage systems, and gaseous fuel storage used in compressed natural gas (CNG) and hydrogen internal combustion engine vehicles. Staff believes that promoting the widespread adoption of ZEV technologies in AT PZEVs leads to component performance improvements and cost reductions that are necessary for ZEV commercialization. The Expert Panel agreed, even though sales of HEVs are steadily increasing, the critical components HEVs share with ZEVs, such as advanced technology batteries, are continuing to rapidly evolve.

Although automotive manufacturers are given a wide variety of AT PZEV options, staff is currently aware of near-term AT PZEV production plans only for CNG vehicles, HEV, and PHEVs.

Staff is proposing several modifications to the treatment of credits for HEV AT PZEVs, primarily to address PHEVs. They include addressing (1) treatment of "blended" PHEVs through an establishment of an equivalent all electric range (EAER), (2) adjusting the allowance for advanced componentry and Type C HEV credit, and (3), PHEV low fuel cycle emissions (LFCE).

3.4.1 Zero-Emission VMT PZEV Allowance

Staff Proposal: Replace the former "all electric range" (AER) calculation used in the zero-emission-vehicle-miles-traveled (VMT) allowance[4] determination with a newly defined EAER to enable blended PHEVs to be appropriately treated relative to non-blended PHEVs.

[4] Allowances are part of a vehicle's credit calculation and credits are the sum of the allowances given.

PHEVs[5] are HEVs which are capable of recharging from off-vehicle power sources in the same way battery EVs do. Since staff last examined the prospects for deployment of PHEVs, manufacturers have indicated an interest in deployment of "blended" PHEVs that have a more limited electric-only driving range. When PHEVs were last considered during 2003 ZEV regulation amendments, it was envisioned that all PHEVs would run off of the battery until it was depleted and then transition to combined engine and electric hybrid operation. Since 2003, the concept of a blended PHEV has emerged as an intermediate step between conventional hybrids and PHEVs. In some cases, it is anticipated that existing HEV models will evolve into blended PHEVs with the addition of extra battery capacity and an on-vehicle charger while their conventional HEV powertrain may remain much the same. A blended PHEV still plugs in and accumulates energy from an off-vehicle electrical power source. Blended PHEVs differ from an AER PHEV in electric range because the engine may start anytime during range testing, usually much before the off vehicle charge energy has been fully depleted. Proponents of blended PHEVs claim they provide the reductions in GHG emissions and petroleum dependency as AER PHEVs do, but through near-term, less-challenging transitional step between existing HEVs and higher-powered, more expensive AER PHEVs. Under the existing regulation, blended PHEVs would not earn the zero-emission-VMT allowance because they could not achieve 10 miles of Urban Dynamometer Driving Schedule (UDDS) range without their internal combustion engines starting.

Staff proposes to retain the existing 10 mile minimum AER requirement for this allowance, but would allow blended PHEVs to qualify with 10 or more miles of VMT EAER described below. Staff also proposes that the AER value used for credit determination be replaced with the EAER value. EAER will be defined as the UDDS miles driven by the PHEV until it has depleted its off-vehicle accumulated energy (charge depleting range or R_{cd}), but this range value is then multiplied by the fraction of those miles derived from off-vehicle electricity (electric range fraction or ERF) relative to electricity and gasoline.

$$\mathbf{EAER = (R_{cd} * ERF)}$$

For PHEVs with significant AER that can satisfy UDDS cycle(s) in electric mode, the ERF is 1.0 and the EAER is equal to the former AER. The allowance for the zero-emission, AER of PHEVs was formerly calculated using the following equation:

$$\mathbf{Allowance = (33.8 + [0.5 * AER])/25),}$$

where the AER is measured on city driving cycle test until the engine turned on.

Staff proposes to replace this allowance formula with the following:

[5] PHEVs are also described as Off-Vehicle Charge Capable HEVs.

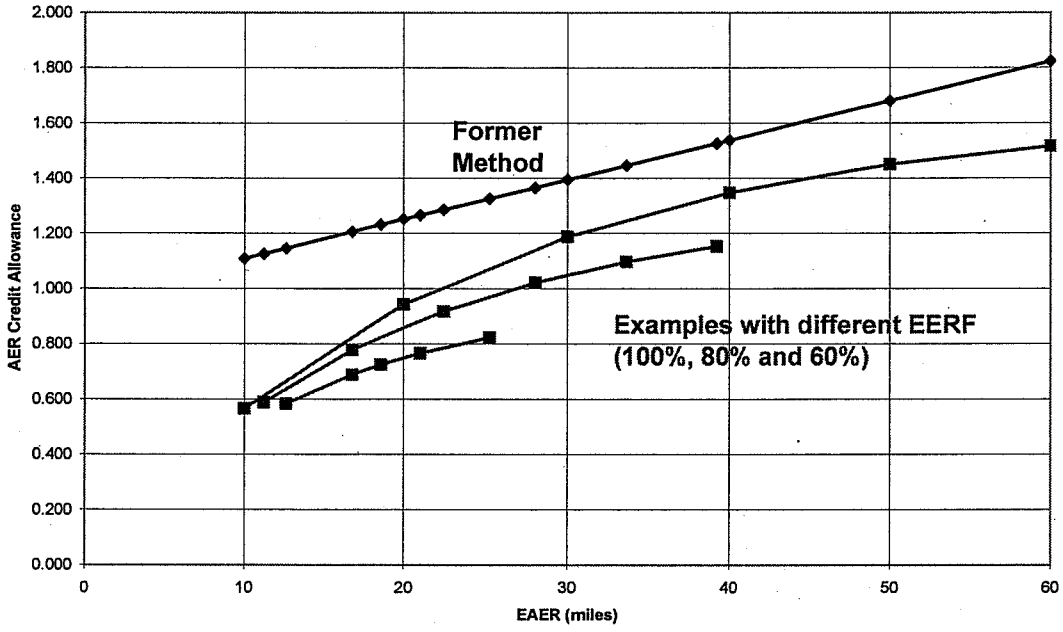
$$\text{Allowance} = \text{EAER} \times (1 - UF_{Rcd}) / 14.6$$

Where:

- R_{cd} is the UDDS range of the PHEV until the off-vehicle accumulated charge energy is depleted.
- ERF is the electric range fraction (electric energy/ total energy)
- UF_{Rcd} is the Utility Factor based on the charge depletion range according to *the 0-100 mile 4th order polynomial curve fit from SAE's J1711*[6]*, March 1999, page 52.*, which expresses the likelihood a vehicle will accumulate a daily range in miles.

The reason that the former linear equation is replaced by the utility-factor based function is to better reflect the likelihood that the range capability of a PHEV will be used by the general population. Under the proposed treatment, allowance per mile is very high near the 10-mile range because it is likely that these zero emission miles will be routinely driven, while the allowance per mile decrease to a lower value as range increases because of the decreased likelihood that these miles will be routinely driven. This new method results in the AER allowance (shown in blue as the "former method) compared to the EAER allowance (shown in pink for three different examples of electric-range-fraction values) as shown in Figure 3.2 below:

Figure 3.2: AER Credit Allowance VS EAER



[6] SAE. SAE International, *Recommended Practice for Measuring the Exhaust Emissions and Fuel Economy of Hybrid-Electric Vehicles*, March 1999

These proposed amendments will also result in low range AER PHEVs receiving less AER allowance under this proposal than they did formerly, but they will also receive additional advanced componentry allowance (see below) to offset this decrease. This combination of changes in allowances is necessary in order to appropriately reward the AER PHEVs relative to blended PHEVs.

3.4.2 PHEV Advanced Componentry Allowance

Staff Proposal: Extend the allowance sunset for Type C HEVs, and add a new higher-power Type F HEV category.

Advanced Componentry Allowance – Staff proposes to implement a phase-down schedule and eliminate the allowance sunset for Type C HEVs. The Type C modification is recommended in response to comments that post-2011 hybrids with significant (>10 kW) power capability can still make an important contribution to technology development even if sub-systems operate at lower-voltage levels that might not be suitable for full-function ZEVs. This is true because Type C HEVs must still make use of advanced energy storage systems that are expected to be used on ZEVs. Staff believes that Type C HEVs may be well suited for very high volume markets where tighter cost constraints may restrict other HEV technologies from being deployed. Staff recommends that the allowance for Type C hybrids be extended indefinitely, but at a reduced allowance level relative to other HEV designs.

Staff also proposes to add a new, higher battery capacity Type F HEV category for HEVs that demonstrate sufficient power capability to propel an HEV through the UDDS driving test cycle on electric power alone. Type F HEVs must also qualify for the zero-emission-VMT allowance, and must demonstrate at least 10 UDDS miles of AER, instead of EAER (i.e., blended PHEVs would not be Type F HEVs).

The Type F HEV category is intended to encourage the deployment of higher battery capacity HEV drive systems interchangeable with those deployed in Type III ZEVs. In this way, design, development, tooling, and other costs can be shared with the systems destined for ZEVs in order to further drive down costs and deploy ZEVs sooner. The allowance schedule proposed is shown in Table 3.5 below:

Table 3.5: Proposed HEV Componentry Allowance Schedule

Year	Type C 10 kW	Type D 10 kW	Type E 50 kW	Type F (NEW) >= 10 mile UDDS Capable
2005-2011	0.2	0.4	0.5	0.85
2012-2014	0.15	0.35	0.45	0.8
2015+	0.1	0.25	0.35	0.7

3.4.3 PZEV Low-Fuel-Cycle-Emissions-Allowance

Staff Proposal: Eliminate the LFCE allowance for vehicles that do not make exclusive use of LFCE fuels. PHEVs receive additional allowance under AER and Advanced Componentry to make up for this loss of LFCE allowance. As a result, only dedicated LFCE fueled vehicles will now be eligible for AT PZEV LFCE allowance. Examples of AT PZEVs still eligible include CNG and hydrogen internal combustion vehicles.

3.4.4 Overall Effect of Changes to PHEV Allowances

The proposed changes would result in PHEVs receiving overall pre-multiplier allowances as shown in examples listed in the Table 3.6 below, where B20, B30 and B40 are blended PHEV examples and P20, P40 and P60 are AER examples.

Table 3.6: PHEV Allowances

PHEV	Type	Rcd	ERF (%)	2011 Allowance	
				Existing	Proposed
B12.5	Blended PHEV	12.5	80	0.7	1.24
B20	Blended PHEV	20	80	0.7	1.45
B30	Blended PHEV	30	80	0.7	1.65
B40	Blended PHEV	40	80	0.7	1.78
P10	AER PHEV	10	100	1.9	1.62
P20	AER PHEV	20	100	2.1	1.99
P40	AER PHEV	40	100	2.4	2.4
P60	AER PHEV	60	100	2.7	2.57

Table 3.5 shows that for AER PHEVs, the allowances awarded are not significantly changed from the existing regulation. Blended PHEVs which under the existing regulation could earn no more than 0.7 credits as a conventional hybrid, can now earn more than double. However, the table also shows that blended PHEVs also do not earn as much as AER PHEVs even if their "range" is similar.

3.4.5 AT PZEV Credit Cap

Staff proposes to implement a pre-multiplier credit cap of 3.0 for all AT PZEVs. While AT PZEV attributes may be attractive features that advance deployment of ZEVs, earning pre-multiplier credit that is greater than that earned by a full function Type II ZEV is not justified.

Table 3.7: AT PZEV Post-Multiplier Credit

AT-PZEV Type	Description	2009-2011		2012 and beyond
		Pre-Multiplier	Final Credit	Final Credit
Type E	HEV	0.70	0.70	0.65
CNG	Compressed Natural Gas Engine	0.70	0.70	0.70
HICE	Hydrogen Internal Combustion Engine	2.30	6.90	2.30
B12.5/ 80% ERF	Blended PHEV	1.24	3.72	3.57
B40/ 80% ERF	Blended PHEV	1.78	5.34	5.18
P10	AER PHEV	1.62	4.86	4.85
P40	AER PHEV	2.40	7.20	7.19

3.5 Increase Credit for Neighborhood Electric Vehicles

Staff Proposal: Double the credit earned by NEVs to 0.3 credits per vehicle to reflect the vehicle's positive environmental benefits but limited functionality compared with full function ZEVs.

During the 2003 ZEV amendments, ARB committed to reviewing the credit value for NEVs. NEVs are low speed vehicles that have a maximum speed of 25 miles per hour and are only allowed to be driven on roads with a maximum speed limit of 35 miles per hour. The positive benefits of NEVs include reducing emissions from cold starts, providing zero tailpipe emissions, providing high consumer usage for short trips and providing a future market and demand for more robust ZEVs. However, NEVs are limited to a niche market due to the small number of areas in California where speed limits are low and due to a limited driving range, currently 30 miles per charge.

According to research to done by DiamlerChrysler and GEM[7], approximately 2 cold starts on average per day are reduced due to the use of NEVs. Cold starts represent a large portion of a conventional gasoline vehicle's environmental impacts. Consequently NEVs can eliminate up to one third of an owner's yearly ozone precursor emissions due to the reduction in cold starts.

[7]GEM. *Surveys of NEV Owner Behavior in California*. December, 2005 Prepared for GEM by Mightycomm and Access Research Group.

In analyzing the credit value of NEVs, staff is mindful that higher credit values in the past encouraged mass production of low quality NEVs many of which remained in California for only a short period of time. Staff proposes an increase in the NEV credit value from 0.15 to 0.3 reflecting the positive benefits listed above balanced with the limited use of the vehicle.

3.6 Extend Travel Provision

Staff Proposal: Extend the provision that allows Type III ZEVs placed in any state that has adopted California's ZEV program to count towards California's ZEV requirement through 2017. Also, allow Type IVs placed in any state to count towards the California requirements. Include Type I and Type II ZEVs but sunset the application of the provision for these vehicles in 2014.

Section 177 of the federal Clean Air Act allows other states to adopt California motor vehicle emission standards, including the ZEV regulation. The current ZEV regulation allows Type III vehicles placed in service in section 177 states to be counted towards compliance with the California percentage ZEV requirements as if they are placed in service in California. Similarly, a vehicle placed in California counts towards compliance in a section 177 state. This "travel" provision was added in 2003 to encourage the initial development of higher cost Type III vehicles by starting with a lower volume production nationwide until the technology is ready to become commercially viable. The travel provision is set to sunset in 2011 under the current regulation. (ARB 2003)

Ten section 177 states have adopted the ZEV regulations: Connecticut, Maine, Maryland, Massachusetts, New Jersey, New Mexico, New York, Oregon, Rhode Island, and Vermont. If manufacturers were to meet the ZEV requirements in each state, the number of ZEVs required nationally more than double and hinder the ability of auto manufacturers to bring these vehicles to market. Therefore, staff proposes that the travel provision for Type III and Type IV vehicles be extended through MY 2017.

Stakeholders also proposed that Type I and Type II vehicles be eligible for the travel provision. Similar to Type III vehicles, the cost to produce and introduce Type I and Type II vehicles into the market is high. In examining this proposal staff believes that technology neutrality is necessary to encourage all advanced technologies to come to market as soon as possible. Staff notes that the successful introduction of AT PZEV hybrids began with low volumes in select states and still represents a small percentage of the overall market and that ZEV technologies must start with low production volumes until the vehicles are commercially viable. Staff proposes that Type I, Type I.5 and Type II vehicles be eligible for the section 177 travel provision through MY 2014 when they are estimated to be commercially viable. Table 3.8 shows the existing and proposed schedule for sun-setting the travel provision.

Table 3.8: Travel Provision Sunset Schedule

Vehicle Type	Type I	Type I.5	Type II	Type III	Type IV
Current:	N/A	N/A	N/A	2011	N/A
Extended to:	2014	2014	2014	2017	2017

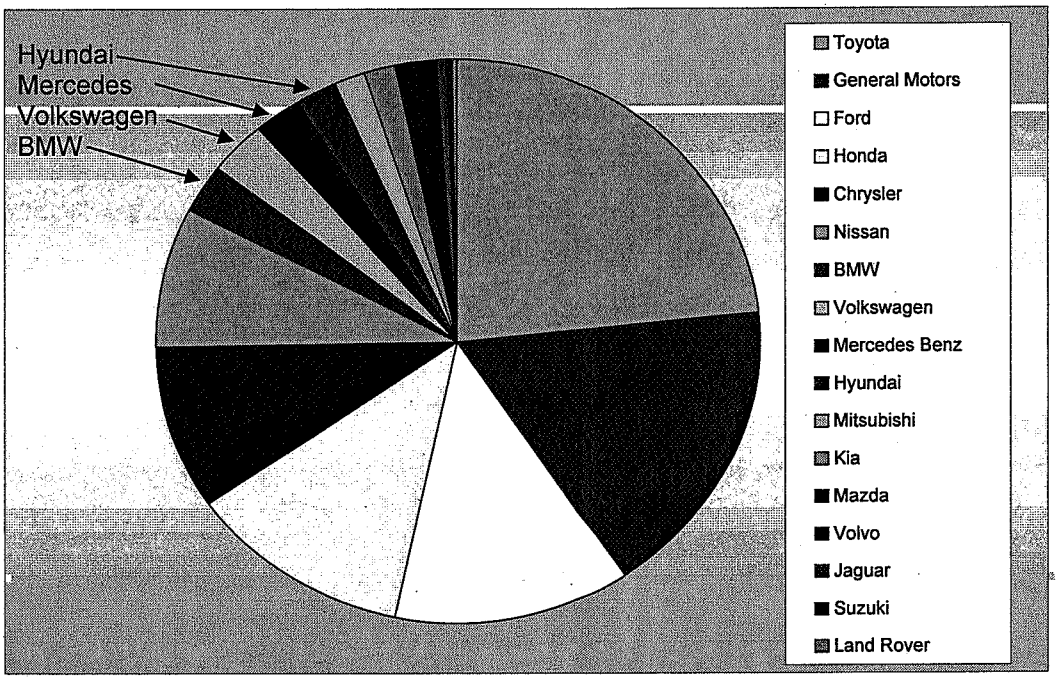
3.7 Modify Transition for Intermediate Volume Manufacturers

Staff Proposal: Extend the transition period by six years for IVMs. During this time, an automaker would be allowed to meet their ZEV obligations with PZEVs and AT PZEVs, where a minimum percentage would have to be AT PZEVs.

ARB's regulations define LVMs as automakers with annual California sales in excess of 60,000 passenger cars and light-duty trucks (LDT 1, LDT 2, and MDVs). They define IVMs as automakers with annual California sales between 3,001 and 60,000 passenger cars, LDT 1s, LDT 2s, and MDVs.

The 60,000 vehicle sales volume threshold was established to acknowledge the significant gap between intermediate volume and large volume automakers. While BMW, Mercedes, Hyundai, and VW, all IVMs, are nearing the 60,000 vehicle threshold, their relative size has not changed in relation to the six largest automakers – Toyota, General Motors, Ford, Honda, Chrysler, and Nissan because the volume of vehicles sold in California has been increasing across the board. This gap is illustrated in figure 3.3 below.

Figure 3.3: Market Share by Manufacturer



Once an automaker exceeds the threshold for three consecutive years, they are defined as a LVM. That automaker then has six years before having to meet the requirements for LVMs. Under the existing regulation, that means they must begin to produce pure ZEVs vehicles or acquire the appropriate credits.

During the May 2007 technology report to the Board, the ARB suggested the threshold for LVMs transitioning to LVMs be changed upward to reflect changes in the overall automobile market. After taking comment, the Board directed that the threshold remain unchanged. However, the Board also directed staff to identify ways to ease the transition for intermediate volume automakers.

Staff is now proposing to provide an additional transition period of six years. During this time, transitioning automakers would be required to produce a growing percentage of AT PZEVs if they do not comply with gold vehicles as described in Table 3.9. In the first three years of the extend transition, newly defined LVMs would have the option to meet the ZEV requirements with a combination of PZEVs and AT PZEVs, of which at least a quarter would have to be AT PZEVs. In the second three years of the ramp-up phase, these manufacturers would continue to meet the ZEV regulation requirements with a combination of PZEVs and AT PZEVs, of which at least a third would have to be AT PZEVs.

Table 3.9: Intermediate to Large Volume Transition

	Current Regulation		Proposed Amendment		
Years	**3 years of volume in excess of 60,000**	**1-6 Lead Time**	**7-9 AT PZEV Transition 1**	**10-12 AT PZEV Transition 2**	**13 and beyond Full ZEV Requirement**
Status	**IVM**	**LVM**	**LVM**	**LVM**	**LVM**
PZEVs	100 % of ZEV Obligation	100% of ZEV Obligation	75% of ZEV Obligation	67% of ZEV Obligation	Full LVM Obligations as dictated by regulation

These changes act as a way to bridge IVMs into ZEV production and provide additional time to develop full ZEV technologies while bringing them into the AT PZEV market with ZEV enabling technologies.

3.8 Additional Modifications

3.8.1 ZEV Credits for Advanced Technology Demonstration Programs

Staff Proposal: Establish new restrictions on the placement of advanced technology demonstration vehicles.

Under the current program, vehicles that are placed in a California advanced technology demonstration program may earn ZEV credits even if they are not "delivered for sale."

In addition, vehicles in these programs are only required to be in California for six months. Staff believes that the nature of demonstrations for these vehicles has changed and that vehicles receiving credit should be demonstrated in California for a longer period of time.

Staff also wants to encourage manufacturers to lease these advanced vehicles to the public or to fleet operators. Thus, staff is proposing that vehicles in an advanced technology demonstration program remain in California for the first year of a two year placement requirement and that the number of vehicles eligible for this provision per manufacturer is six. Beyond six vehicles, manufacturers would then need to certify vehicles through the regular certification process. Additionally, staff is proposing that the advanced technology demonstration program provision be phased out at the end of 2014 when it is anticipated that small scale demonstration programs will no longer be needed.

3.8.2 ZEV Credits for Transportation Systems

Staff Proposal: Clarify minimum participation requirements for transportation system credit.

Under the current ZEV regulation, vehicles that are placed as part of a transportation system, such as a car-share program, can earn additional ZEV credits. Originally the vision for vehicles in these programs was that they would remain in the program for at least two years; however, this was never explicitly stated in the regulatory language. Staff proposes that vehicles in transportation systems remain in these programs for two years. At the same time, staff proposes the level of credits that these vehicles earn be reduced, and would sunset for PZEV and AT PZEV in 2011. ZEVs would continue to receive transportation system credits beyond this sunset.

3.8.3 Fast Refueling

Staff Proposal: Modify the description of fast refueling capability for Type III ZEVs.

Since the 2003 ZEV regulation amendments were adopted, there have been several inquiries regarding the specific details on how the fast refueling capability requirement for Type III ZEVs will be applied. Unfortunately, ARB staff cannot yet cite industry definitions, standards, or test procedures because these are still under development. The fast refueling criterion is important because this distinction between Type II and Type III & IV is crucial to manufacturers who wish to take advantage of the additional incentives ARB is providing for Type III & IV ZEVs through 2017.

The majority of hydrogen fuel cell vehicle prototypes made to date are equipped with compressed hydrogen storage. Since 2003, compressed hydrogen storage systems have become available at an alternative 10,000 pounds per square inch (psi) pressure rating in order to further improve the range of hydrogen vehicles. This increase in pressure results in a hydrogen vehicle range increase of approximately 67 percent for

the same external tank volume. At the time of the 2003 amendments, the feasibility of refilling 5,000 psi tanks in less than 10 minutes seemed certain, and ARB received very little comment regarding challenges involved in meeting the proposed Type III fast refueling criterion of 10 minutes. (ARB 2003)

However, most demonstration vehicles outside of the manufacturer's test facilities currently refuel under conservative default or "non-communication" procedures that were developed at the California Fuel Cell Partnership. Fast refueling is not yet achievable using 10,000 psi storage systems with some of these preliminary fill procedures. The longer refueling times for these systems will eventually decrease as refueling standards and dispensing equipment technology mature and the industry settles on solutions to accelerate the refueling process. Furthermore, ARB staff believes that existing fuel cell vehicles with 10,000 psi hydrogen storage tanks will ultimately be capable of sub-10-minute refueling when used with refueling apparatus that will be deployed for public use. Staff does not intend to require that this fast refueling requirement be met at any currently-existing refueling or charging station. Even at today's refueling stations, 10,000 psi capable vehicles are refueling in nearly 10-minute times; the impact of this technology change is not burdensomely long refuelings.

Staff proposes to clarify the regulation to require a Type III ZEV to have the capability to accumulate at least 95 miles of UDDS range in 10 minutes or less. This change is to align standards with those suggested in ARB's Manufacturers' Advisory Correspondence 2006-02: Policy Regarding the "Fast Refueling Capability" Criterion For 2003 and Subsequent Model-Year Type III Zero-Emission Vehicles (ZEV)[8]. It is expected that the "maximum rated energy capacity" value that a manufacturer declares will be the same value used to determine vehicle range and that this "maximum-rated-energy-capacity" value has already compensated for unusable fuel and fast-fill limitations. Since the requirement is that 95 percent of this capacity be delivered to the vehicle fuel system in 10 minutes or less and since Type III ZEVs must achieve a minimum 100 mile UDDS range, it is, therefore, equivalent to the current ZEV regulation requirement, but would be clarified by staff's proposed amendments.

3.8.4 Release of Production Data and Credit Bank Balances

Staff Proposal: Require that all production data be publicly available beginning in 2009 and release specified ZEV credit bank balance information in MY 2010.

To provide greater transparency to interested stakeholders, staff is proposing that all production credits earned and submitted by automakers in the 2009 MY and beyond be public information. The ZEV bank credit balances of automakers in specified categories would be considered public information beginning in the 2010 MY. This change is

[8] ARB 2006b. California Air Resources Board, *Manufacturers' Advisory Correspondence 2006-02: Policy Regarding the "Fast Refueling Capability" Criterion For 2003 and Subsequent Model-Year Type III Zero-Emission Vehicles (ZEV).* May 10, 2006.

proposed to allow stakeholders and the public to better understand how manufacturers are complying with this regulation, and to assure they can more fully participate in future regulatory hearings on this subject.

3.8.5 Revise the Definition of Independent Low Volume Manufacturer

Staff Proposal: Revise the existing definition of independent low volume manufacturer.

In response to the industry consolidation that was occurring in the late 1990s, ARB adopted percentage ownership criteria and set the value at 50 percent for aggregation of production volume for determination of manufacturer size. Doing so created a fair method to determine aggregation that was objective and equitable for all manufacturers involved in partial ownership scenarios. Adopting this provision also recognized the challenging technical nature of the program and the fact that the requirements to develop and market ZEV technologies place a greater than normal risk and burden on smaller companies. For independent low volume manufacturers, a different aggregation value of 10 percent was adopted.

The inconsistency in aggregation percentages used to determine ZEV requirements could create a situation in which aggregation between two firms with a qualified ownership scenario is asymmetrical. An independent low volume manufacturer that accumulates a capital investment in another firm with ownership totaling greater than 10 percent would be forced to aggregate its sales with the other firm to determine its ZEV obligation. However should the other firm be either an intermediate or small volume manufacturer, this company would not aggregate with the independent low volume manufacturer until ownership exceeded 50 percent. To address this issue, staff is proposing to amend the definition to include a clause in which the Executive Officer can allow an exemption if it is determined that 10% or greater ownership by one of the firms does not result in responsibility for overall direction of both firms.

3.8.6 Revise Phase II Vehicle Requirement Methodology

The existing regulation calculates the Alternative Compliance Path requirements based on a LVM's market share of the target ZEV volume. Using this method creates uncertainty due to shift in market between LVMs. Staff is therefore proposing to use production data from MYs 2003 – 2006 to provide certainty for the requirements during this timeframe for each manufacturer.

4. EFFECT OF PROPOSED CHANGES

This section provides an assessment of the number of vehicles that may be produced due to the proposed changes. Sections 6 and 7 then use these estimates to project the economic and environmental impacts of the proposed changes.

The ZEV program has by far the largest impact on the LVMs as IVMs are able to meet the requirements with PZEVs. Consequently, the analysis focuses on the impact on the six LVMs. Due to the small number of automakers affected and to the resulting confidentiality concerns, staff's analysis of the proposed changes reflects the overall impact to the industry.

Creating further uncertainty in the assessment is the fact that each automaker is in a unique situation. Some have smaller numbers of banked credits, while others have credits sufficient to cover their compliance obligations for a number of years. In addition, manufacturers differ in the status of fuel cell development, the availability of PZEV or AT PZEV products in the near term, and the technologies to be emphasized in their corporate strategy. All of these factors affect a manufacturer's compliance status, and, therefore, the compliance pathways it pursues. Because of these factors, predicting the impacts for the proposed changes with certainty is not possible. Rather the estimates represent plausible outcomes from the proposed amendments based on current ZEV credit accounts, numerous discussions with industry and other information gathered.

The most significant proposed changes are presented below along with their expected impacts to the number and types of vehicles produced.

4.1 Creation of the "New Path" (2012 onward) and Changes to Treatment of Battery EVs

As a result of this proposal, the minimum number of Type IV ZEVs required in Phase III (2012 – 2014) would be reduced from 25,000 to 2,500 vehicles. This pure ZEV requirement could be met with either fuel cell vehicles or battery EVs. If manufacturers choose to produce city EVs, the total production required would increase due the differences in credit value.

Table 4.1 shows the impact from removing the cap and modifying the credit ratios for ZEV Types. The proposed changes are expected to make this approach less costly than producing fuel cell vehicles. However, the amount of interest in battery EV production will depend largely on improvements in battery technology in the near future and their marketability.

Table 4.1: Production Requirements for Zero Emission Vehicles

Vehicle Type	2009 – 2011	2012 – 2014	2015 – 2017
Type I (City EV)	5,000	6,250	62,500
Type I.5 (City EV)	4,000	5,000	50,000
Type II (Full Function)	3,333	4,167	41,667
Type III (Fuel Cell)	2,500	3,125	31,250
Type IV (Fuel Cell)	2,000	2,500	25,000

By comparison, the existing program requires 2,500 Type III vehicles in 2009 to 2011 and 25,000 in 2012 – 2014. The existing program limits the substitution of battery EVs to 50 percent of the requirement with significantly higher credit ratios resulting in much higher production requirements.

The proposal would allow Enhanced AT PZEVs to make up the "shortfall" or difference with the existing requirements. Table 4.2 shows the incremental production of Enhanced AT PZEVs over the three-year period that would be required. To give a sense of the increase in total vehicles required, two Enhanced AT PZEVs are considered, a PHEV with a 40 mile AER, and a blended Enhanced AT PZEV with 12.5 miles of AER. The number of "offset" vehicles varies due to the differences in credit earned for each vehicle type but will exceed the existing 25,000 requirement for Type III vehicles. For purposes of estimating cost and emissions later in Section 6 and 7, a value of 1.5 was used to represent a weighted average Enhanced AT PZEV credit.

Table 4.2: Incremental Production Using Enhanced AT PZEVs as Gold Backfill 2012 – 2014

Vehicle Type	Proposed Credit	Incremental Production
AT PZEV		
HEV: 40 mile AER	2.4	46,875
Blended HEV: 22 mile electric range	1.5	75,000
Blended HEV: 12.5 mile electric range	1.24	90,725

4.2 Increase Credit for Neighborhood Electric Vehicles

Doubling the level of credit for NEVs increases the incentives for manufacturers to produce them. This increase will not necessarily result in overwhelming the market with new NEVs, but will provide a modest incentive for those already in production. Since the 2001 to 2005 timeframe, the number of NEVs placed in California has dropped dramatically. Thus, the impact from this proposed change is expected to be extremely small. Because of the limitations on the use of NEVs for compliance, they are typically used to offset PZEV or AT PZEV requirements. Therefore, the increase in credits for NEVs will reduce the number of AT PZEVs that are produced. The resulting impact is approximately one less AT PZEV for every four NEVs placed.

4.3 Extend "Travel" Provision

Extending the "travel" provision can reduce the industry obligation in states that have adopted the California program. California sales are nearly equal to the sales from all states that have adopted the ZEV requirements. Consequently, this change is anticipated to reduce the number of ZEVs needed in other states by approximately 2,500 vehicles in the 2012 – 2014 timeframe. The proposal would extend the provision for Type III and IV ZEVs through 2017. To the extent that fuel cell vehicles are produced to meet the requirements in that timeframe, this proposal will reduce the number of vehicles by the amount placed in states that have adopted the ZEV program. Similarly, since battery EVs are also included in the travel provision, battery EVs could be reduced by half nationwide.

4.4 Modify Transition for Automakers

Several automakers with a collective market share of roughly 10 percent are projected to be affected by this aspect of staff's proposal. When compared to the existing transition where gold ZEVs are required, the net effect would be a reduction of several hundred pure ZEVs and a corresponding "backfill" or increase of approximately 3,000 to 4,000 PZEVs and AT PZEVs in the 2012 timeframe. Due to the large numbers of PZEVs and AT PZEVs, the overall impact would be a net reduction in cost and emissions.

4.5 Overall Anticipated Impacts

Staff has also looked at the existing ZEV bank on an industry wide basis, as shown in Table 2.4. Using the industry wide aggregate totals for the ZEV bank, staff examined the possible numbers of vehicles to be placed between 2009 and 2017. Presented below are two scenarios of the number of vehicles manufacturers will place, dependent on their use of banked ZEV credits. Staff took into account limited applicability of NEV credits for use in gold and silver categories. Scenario 1, presented in Table 4.3, shows the approximate number of vehicles that would be placed if the manufacturers used no banked ZEV credits.

Table 4.3: Scenario 1 – No Credit Use

Vehicle Type	2009-2011	2012-2014	2015-2017
ZEVs			
Fuel Cell Vehicle Type IV, or	2,000	2,500	25,000
Fuel Cell Vehicle Type III, or	2,500	3,125	31,250
Battery Vehicle Type II, or	3,333	4,167	41,667
City EV Type I.5, or	4,000	5,000	50,000
City EV Type I	5,000	6,250	62,500
Enhanced AT PZEVs	0	75,000	83,333
AT PZEV	207,000	195,000	153,000
PZEV	1,260,000	1,260,000	1,260,000

Assumes Enhanced AT PZEVs earn 1.5 credits, silver vehicles earn 0.65 credits in 2012 – 2014, and 0.55 credits 2015 – 2017. Based on annual California vehicle sales of 1.4 million passenger cars, light-duty trucks (LDT 1 and LDT 2) by the six large volume auto manufacturers.

For Scenario 2, as presented in Table 4.4, staff projected the total number of vehicles to be placed by manufacturers using a combination of banked credits and new production. As shown, existing banked credits are largely spent in the 2009 – 2011 timeframe with minimal impact in 2012. The number of fuel cell vehicles estimated for 2009 – 2011 reflect staff's understanding of industry wide plans for the technology. For both scenarios the number of pure ZEVs is not added together, but rather reflects the number of vehicles that would be needed to meet the requirements for each technology type. Given the current state of battery technology, staff does not anticipate that manufacturers will produce any battery EVs prior to 2012.

Table 4.4: Scenario 2 – Probable Credit Use

Vehicle Type	2009-2011	2012-2014	2015-2017
ZEVs			
Fuel Cell Vehicle Type IV or	250	2,500	25,000
Fuel Cell Vehicle Type III or	200	3,125	31,250
Battery Vehicle Type II or	0	4,167	41,667
City EV Type I.5 or	0	5,000	50,000
City EV Type I	0	6,250	62,500
Enhanced AT PZEVs	30,000	75,000	83,333
AT PZEV	107,000	95,000	153,000
PZEV	700,000	1,260,000	1,260,000

Assumes Enhanced AT PZEVs earn 1.5 credits, silver vehicles earn 0.65 credits in 2012 – 2014, and 0.55 credits 2015 – 2017. Based on annual California vehicle sales of 1.4 million passenger cars, light-duty trucks (LDT 1 and LDT 2) by the six large volume auto manufacturers.

5. REGULATORY ALTERNATIVES

5.1 Do Not Amend Program

ARB staff considered not recommending any amendments to the ZEV regulations. In this case, large volume manufacturers would need to produce and place 25,000 advanced technology vehicles between 2012 and 2014. Based on the data obtained, the technology needed will not be ready for such large volumes and will result in the imposition of a large cost burden on the manufacturers.

The vehicles would need to be priced aggressively to meet the sales targets, and this would reduce the revenue available to the manufacturers to offset their costs. To the extent that the state provides subsidies in order to assist with vehicle marketing, such a large number of vehicles needing subsidies would result in large state expenditures. Under the current program, manufacturers would most likely use their entire amount of banked credits before needing to produce costly additional ZEVs to meet their program requirements.

5.2 Adopt Substantial Revisions to the ZEV Regulation

As part of the regulatory development process, ARB staff considered three options regarding the number of vehicles required under the Alternative Compliance Path, as shown in Table 5.1. The options were evaluated in the context of strengthening the program by deploying advanced technology vehicles to further advance ZEV commercialization and manufacturing capacity while considering balancing the overall costs and compliance feasibility.

Table 5.1: Possible Options

Phase		II	III	IV
Years		2009-2011	2012-2014	2015-2017
***Option 1**	Staff Proposal	2,500	2,500/ Enhanced AT PZEV offset	25,000/ Enhanced AT PZEV offset
***Option 2**	Combined Phase	5,000		10,000 to 15,000
***Option 3**	No Change	2,500	25,000	50,000

* Each LVM would be required to produce their sales-weighted share.

Option 1 would maintain the pressure to continue the development of emerging ZEV technologies. At the same time, the proposal would take greater advantage of the recent interest in new technology options and provide manufacturers with greater flexibility in meeting the ZEV program requirements.

Option 2, suggested by some automakers, provides flexibility around product plans and allows greater time for technology advancement before introducing larger numbers of vehicles. However, staff rejected this option because of the significant risk that it would create a gap in vehicle production as automakers back-load their obligation.

Option 3, suggested by several environmental organizations, delays any action in proposing amendments to Phase III. However, staff rejected this approach as automakers have indicated that product planning and development schedules for the 2012-2014 MYs are now in place and a feasible regulation is needed for this timeframe.

Staff's proposed amendments to ZEV program maintain the on going goals of pure ZEV commercialization while taking into consideration the current cost and associated technological barriers. The changes proposed by staff significantly reduce an automaker's cost of compliance, but still provide increased air quality benefits primarily because they rely upon the proven emission benefits of commercially viable and increasingly available AT PZEVs. Staff believes that relinquishing a portion of the research and development production volume in exchange for reduced costs to automobile manufacturers and increased near term emission benefits is a compromise that benefits almost all stakeholders. The proposed amendments are the most feasible and cost effective option.

6. ECONOMIC IMPACTS

The proposed amendments to the ZEV program are projected by ARB staff to reduce the costs of compliance for automobile manufacturers. Staff believes, therefore, that the proposed amendments would cause no noticeable adverse impact on California employment, business status, and competitiveness when compared to the existing program. Because the ZEV regulations provide considerable flexibility to manufacturers, the magnitude of these savings is difficult to estimate with certainty.

6.1 Legal Requirement

Sections 11346.3 and 11346.5 of the Government Code require 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 consideration of the impact of the proposed regulation on California jobs, business expansion, elimination, or creation, and the ability of California businesses to compete.

State agencies are also required to estimate the cost or savings to any state or local agency and school districts in accordance with instruction adopted by the Department of Finance. This estimate is to include any nondiscretionary costs or savings to local agencies and the costs or savings in federal funding to the state.

6.2 Directly Affected Businesses

LVMs that produce passenger cars and light-duty trucks in California would be directly affected by the proposed amendments. Also affected are businesses that supply parts for these vehicles. California accounts for only a small share of total nationwide motor vehicle and parts manufacturing. There are about 40 companies worldwide that manufacture California-certified light- and medium-duty vehicles and heavy-duty gasoline engines. All but the largest six would not be affected by the amendments with the exception of those IVMs that transition to LVMs due to increasing production volume. Current projections show that one to four IVMs will transition to LVMs. Only one motor vehicle manufacturing plant is located in California, the NUMMI facility, which is a joint venture between GM and Toyota. Since NUMMI does not produce vehicles affected by the amendments to the ZEV regulation, staff expects there to be no California based impacts.

6.3 Potential Impact on Manufacturers

The proposed amendments are expected to reduce costs to motor vehicle manufacturers. The key factors that determine the cost of compliance with the ZEV program are the number and types of vehicles that are required, and the incremental cost per vehicle. The changes that would result from the proposed amendments are

estimated below and are subject to considerable uncertainty because of the flexibility allowed by the regulation.

6.4 Incremental Per-Vehicle Cost Estimates

ARB staff used the incremental costs per vehicle from the 2003 regulatory amendment process as the starting point for the staff estimates. Where appropriate, staff modified the projected costs based on gathered estimates of technology costs and to reflect changes in volume and timing.

Fuel cell Vehicles

The 2003 rulemaking estimated the incremental cost of fuel cell vehicles for development Phase III at $120,000 per vehicle (ARB 2003). However, this assumed a vehicle production of tens of thousands of vehicles. Because the proposal would repeat the volumes required in Phase II with 2,500 vehicles, this analysis uses the cost estimates from 2003 for development required for Phase II. Consequently, the incremental cost is estimated to be $250,000 per vehicle in the 2012 – 2014 timeframe. Fuel cell vehicles with greater range are typically more expensive due to efficiency improvements, and/or greater on-board fuel storage. Staff therefore assumes an average additional incremental cost of $50,000 for these vehicles in the near term, and $25,000 in the mid-term.

Battery Electric Vehicles

Recent announcements have increased optimism in new battery chemistries, namely lithium-based batteries. However, price fluctuations and lithium-ion battery availability make recent cost numbers uncertain, so staff will continue to use the estimates from 2003 until these batteries become available in large pack quantities. The 2003 rulemaking estimated the incremental costs for Type II battery EVs at $17,000 and Type I city EVs at $8,000 (ARB 2003). These estimates, however, were based on larger volume production than would be needed to meet the requirements in 2012 – 2014 and would underestimate the cost to industry. Since the cost of the vehicles will depend on several factors including the battery chemistry used, a sizable cost range is used for Type I and Type II vehicles. Increased range for Type I.5 is largely dependent on greater battery size. In small volumes this increased range is expected to raise the cost of the vehicle by $15,000 over the 2012-2014 timeframe. In much high production quantities over all costs for both are expected to be reduced significantly.

Plug-in Hybrid Electric Vehicle

Staff has relied on a report by EPRI entitled "Comparing the Benefits and Impacts of Hybrid Electric Vehicle Options for Compact Sedan and Sport Utility Vehicles"[9] to

[9] "Comparing the Benefits and Impacts of Hybrid Electric Vehicle Options for Compact Sedan and Sport Utility Vehicles", EPRI, Palo Alto, CA: 2002. 1006892.

estimate the average incremental cost for Enhanced AT PZEVs vehicles produced in low volumes.

Table 6.1 presents the incremental cost estimates for each vehicle technology.

Table 6.1: Incremental Vehicle Cost Estimates

Vehicle Type	2012 to 2014	2015 to 2017
ZEVs		
Fuel Cell Vehicle: Type IV	$300,000	$150,000
Fuel Cell Vehicle: Type III	$250,000	$125,000
Battery Vehicle: Type II	$80,000 to $120,000	$40,000 to $60,000
Battery Vehicle: Type I.5	$40,000 to $80,000	$20,000 to $40,000
Battery Vehicle: Type I	$35,000 to $65,000	$15,000 to $35,000
AT PZEVs		
Plug-in Hybrid Electric Vehicle	$25,000	$12,500

The estimates for the various vehicle types are subject to great uncertainty associated with projecting future costs for evolving technology. As such, though the direction of the cost impact of the proposed amendments is clear, the magnitude of the savings is much more difficult to assess.[10]

6.5 Cost Savings

The incremental vehicle costs from Table 6.1 were used to estimate the costs from the proposed changes to the Phase III and Phase IV requirements. The incremental costs were combined with the projected changes in Table 4.1 to estimate the costs for complying with the proposed amendments through each of the ZEV technologies allowed. Scenarios 1 through 5 present compliance costs assuming the minimum required numbers of ZEVs ("floor" requirement) combined with the maximum use of Enhanced AT PZEVs for backfill. The proposed amendments allow varying amounts of different ZEV technologies to be used to meet the floor requirement. The five scenarios reflect these proposed changes.

Though the number of required vehicles decreases for higher scoring vehicles (e.g., Type III and Type IV), overall costs are higher due to greater incremental cost per vehicle. As compared to the existing regulation, the overall cost of compliance strategies using the combination of vehicle types is lower. These estimates are summarized below in Table 6.2, where the annual cost of each scenario is subtracted from the projected annual cost of the existing regulation ($2,083 million)

[10] ARB 2008. California Air Resources Board, Excel Spreadsheet: Vehicle Estimates and Costs, February 2008

Table 6.2: Estimated Annual Costs and Savings from Proposal (In millions)

Scenarios	Vehicle Types	2012-2017 Annual Cost	2012-2017 Annual Savings
Existing Regulation	**Type III**	**$2,083**	**N/A**
1	Type IV + Enhanced AT PZEV	$1,236	$847
2	Type III[1] + Enhanced AT PZEV	$1,267	$816
3	Type II + Enhanced AT PZEV	$903	$1,180
4	Type I.5 + Enhanced AT PZEV	$786	$1,297
5	Type I + Enhanced AT PZEV	$799	$1,284

[1] Assumes fuel cell vehicle, not battery EV.

Table 6.2 also presents the savings from the proposed amendments when compared to the existing program. As shown, the proposed amendments greatly decrease overall cost due to the reduction in vehicle numbers of the most expensive technologies.

6.6 Potential Impact on Dealerships

The extent to which motor vehicle dealerships are affected by the current ZEV regulation, or the amended regulation, depends on the specifics of the interaction between the dealership and the manufacturer. The proposed changes are expected to have limited impact on dealers as many of the vehicle technologies affected are not expected to be sold commercially and those that will be are placed in relatively small numbers.

6.7 Potential Impacts on Vehicle Operators

The proposed changes would reduce the number of fuel cell and battery EVs demonstrated. These vehicles are not expected to be sold or leased in the timeframe under consideration as a commercial product. As is the case with dealerships, the impact of the current regulation or the amended regulation on vehicle purchasers will depend on the extent to which manufacturers choose, and are able, to pass along any increased costs. Once again, staff cannot estimate the extent to which this would occur, but it is clear that the proposed amendments would serve to reduce any possible cost increases for vehicle purchasers as compared to the current regulation.

6.8 Potential Impact on Business Competitiveness

Because the proposed amendments are anticipated to reduce costs faced by California businesses, they would have no adverse impact on the ability of California businesses to compete with businesses in other states.

6.9 Potential Impact on Employment

The proposed amendments are not expected to cause a noticeable change in California employment because California accounts for only a small share of motor vehicle and parts manufacturing employment, which is not expected to be affected by the regulation.

6.10 Potential Impact on Business Creation, Elimination or Expansion

Staff sees a potential benefit to start up companies specializing in advanced battery technology and ZEVs. The proposed amendments are not expected to affect business creation, elimination or expansion.

6.11 Potential Costs to Local and State Agencies

The proposed amendments are not expected to result in an increase in costs for state and local agencies.

7. ENVIRONMENTAL IMPACTS

This section includes a discussion of the emission impacts of the ZEV program, and, separately the proposed regulatory amendments. The first analysis calculates the projected benefits of the total ZEV program. The analysis includes both criteria pollutant and climate change emissions.

7.1 Program Benefits

The Mobile Source Emission Inventory, EMFAC2007[11], was used to assess the overall emission benefits of the ZEV program. Using EMFAC, staff modeled the ZEV program and compared these results to a vehicle program with no ZEV component. This comparison is applicable to the South Coast Air Basin and represents the emissions from vehicles subject to this regulation. It includes passenger cars and light-duty trucks weighing less than 3,751 pounds gross vehicle weight, plus light duty trucks weighing less than 8,500 pounds gross vehicle weight phased in beginning in 2008.

Table 7.1 presents the difference in emissions for the South Coast Air Basin in 2020 and 2030 for the current ZEV program compared to not having a ZEV program. As shown in Table 7.1 staff estimates that the proposed changes will result in a net decrease of about 13.83 tons per day of direct emissions of reactive organic gases (ROG) and oxides of nitrogen (NOx) in 2020. For 2030, Table 7.1 shows a net decrease of about 15.52 tons per day of direct emissions of ROG and NOx from the proposed amendments when compared to the current program.

Table 7.1: Summertime Emissions, South Coast Air Basin in 2020 and 2030 (Tons per day)

2020	ROGexh.	ROGevap.	NOx	Total
No ZEV Program	36	63	66	164
Current Program	26	60	64	151
Benefit of Current Program v. No Program	**10**	**3**	**2**	**13**
2030	ROGexh.	ROGevap.	NOx	Total
No ZEV Program	22	55	38	115
Current Program	14	49	36	100
Benefit of Current Program v. No Program	**8**	**6**	**2**	**16**

As illustrated, the ZEV requirements provide benefits beyond that achieved by using a fleet emissions average. As important, the program continues to push new technology that will reduce emissions in the future.

7.2 Benefits of Proposed Amendments

The Greenhouse gases, Regulated Emissions, and Energy use in Transportation (GREET)[12] model was used to directly compare the emission impacts from the changes

[11] ARB 2007c, EMFAC2007. Version 2.3, Updated November 2006

being proposed by staff. The most significant element of the proposal affects the requirements for pure ZEVs beginning in 2012.

Using the GREET model, staff analyzed the five scenarios presented in Section 6.5 to show the lifetime emissions benefit of the proposed changes. The analysis considers the impacts from reducing the floor number of gold vehicles and backfilling with Enhanced AT PZEVs. All scenarios were run on a well-to-wheel basis with an assumed 150,000 mile vehicle life. Presented below in Table 7.2 and Table 7.3 are the average lifetime emissions for criteria pollutants and climate change emissions for Phase III and Phase IV respectively.

Table 7.2: Total Lifetime Emissions of Proposed Changes for 2012 – 2014[1] (Tons in thousands)

Scenarios	Lifetime Emissions	
	ROG + NOx	Climate Change (CO2)
Existing Regulation	11	13,200
Average of Five Scenarios	6	9,750
Average Emission Benefit	5	3,450

[1] In all scenarios, the emissions from conventional vehicles were included as necessary to make the total number of vehicles, 145,833, consistent for each scenario.

Table 7.3: Total Lifetime Emissions of Proposed Changes for 2015 – 2017[1] (Tons in thousands)

Scenarios	Lifetime Emissions	
	ROG + NOx	Climate Change (CO2)
Existing Regulation	6	7,800
Average of Five Scenarios	4	5,700
Average Emission Benefit	2	2,100

[1] In all scenarios, the emissions from conventional vehicles were included as necessary to make the total number of vehicles, 145,833, consistent for each scenario.

As shown in Table 7.2 and 7.3, the flexibility provided by the proposed amendments will reduce emissions during the 2012 – 2017 timeframe. In terms of climate change emissions, all alternatives analyzed reduce overall emissions.

7.3 Energy Diversity and Energy Demand

The vehicle technologies expected to be used to comply with the ZEV program typically use fuel more efficiently, and thus when fully commercialized will reduce demand for petroleum fuels. These technologies also use non-petroleum fuels, such as electricity and hydrogen, which helps diversify the transportation fuel market. The ZEV program

[12] ARB et al 2007d, Modified California GREET model "greet1.7ROW_US_CA_v92" ftp://ftp.arb.ca.gov/carbis/fuels/ab1007/CA_Greet_june07_ June, 2007

and the proposed amendments are consistent with recent reports that recommend increased vehicle efficiency and increased use of alternative fuels.

7.4 Environmental Justice

The proposed regulation is consistent with the ARB's Environmental Justice Policy to reduce health risks from criteria pollutants in all communities, including low-income and minority communities. Many communities are located near heavily traveled freeways. By reducing emissions of air pollutants from light duty vehicles, the proposed regulation will provide air quality benefits by reducing exposure to and associated health risk from these pollutants.

7.5 California Environmental Quality Act

The California Environmental Quality Act (CEQA) and ARB policy require an analysis to determine the potential environmental impacts of proposed regulations. Because the ARB's program involving the adoption of regulations has been certified by the Secretary of Resources pursuant to Public Resources Code section 21080.5, the CEQA environmental analysis requirements may be included in the Initial Statement of Reasons (ISOR) for this rulemaking. In the ISOR, ARB must include a "functionally equivalent" document, rather than adhering to the format described in CEQA of an Initial Study, a Negative Declaration, and an Environmental Impact Report. In addition, staff will respond, in the Final Statement of Reasons for the regulation, to all significant environmental issues raised by the public during the public review period or at the Board public hearing.

Public Resources Code section 21159 requires that the environmental impact analysis conducted by ARB include the following: an analysis of reasonably foreseeable environmental impacts of the methods of compliance; an analysis of reasonably foreseeable feasible mitigation measures; and an analysis of reasonably foreseeable alternative means of compliance with the regulation.

Compliance with the proposed regulation is expected to directly affect air quality and potentially affect other environmental media as well. Our analysis of the reasonable foreseeable environmental impacts of the methods of compliance is presented below. Regarding mitigation measures, CEQA requires an agency to identify and adopt feasible mitigation measures that would minimize any significant adverse environmental impacts described in the environmental analysis.

Because this regulatory proposal identifies no new potentially significant environmental effects, it would not have any significant or potentially significant effects on the environment. Therefore no alternatives or mitigation measures are proposed to avoid or reduce any significant effects on the environment.

8. COST-EFFECTIVENESS

This section discusses the cost-effectiveness of the proposed amendments. Determining the cost-effectiveness of the ZEV program has always been more difficult and uncertain than for other regulatory measures due to the far-reaching nature and longer lead times of the program. Predicting the future cost of technologies that are still in the demonstration stage is difficult at best. In addition, the ZEV program has always combined two distinct objectives – first, achieving emission reductions today through expanded introduction of commercially available near-zero emission technology, and second, accelerating the development of pure ZEV technologies that have the potential to provide significant air quality benefits over the long term, but have minimal immediate air quality impact given their pre-commercial status and limited production.

Cost-effectiveness is a measure of the cost incurred to achieve a specific outcome, as compared to other ways to reach that same end. Under the proposed amendments, the primary impact would be to reduce the number of fuel cell and battery EVs required in the 2012 – 2017 timeframe. As noted in Section 6.5, the estimated annual savings to industry from these changes would be $1.3 billion in 2012 – 2014 and $0.9 billion in 2015 – 2017 depending upon the compliance strategy chosen, though some compliance options would increase a manufacturer's costs if chosen. Consequently, when compared to the existing program, the proposed amendments produce positive cost-effectiveness. That is, the overall impact to the environment is improved at less cost due to the expected commercialization of larger numbers of AT PZEVs.

9. SUMMARY AND STAFF RECOMMENDATION

9.1 Summary of Staff Proposal

Staff's proposed modifications would recognize the state of development for the leading ZEV technologies, provide greater flexibility in manufacturer compliance and increase the near-term air quality benefits through the commercialization of larger numbers of AT PZEVs. In addition, the proposed amendments maintain pressure toward the commercialization of ZEV technologies while at the same time reflecting the current state and cost of ZEV technology. The staff proposal contains the following specific amendments:

Table 9.1: Summary of Proposed Modifications

Goal	Solution
Address technology challenges of fuel cell vehicles	Lower required numbers of fuel cells during Phase III and IV (2012 – 2014 & 2015 – 2017) and create Type IV ZEV.
Incentivize PHEVs with zero emission mile capability	Allow Enhanced AT PZEVs in Phase III to count for 90% of gold requirement. Establish new calculations for AT PZEV credits to account for new plug in hybrid configurations.
Simplify regulation	Create "New Path" to replace two path system.
Remove barriers to using Battery EVs for compliance	Remove caps on Type I and II battery EVs; change ratio for use and create Type I.5 ZEV, however maintain higher credits for fuel cell vehicles compared to battery EVs to reflect relative state of development.
Fulfill commitment to revisit role of NEVs	Up credit to 0.3 to recognize environmental benefits.
Smooth transition for IVMs going to LVM	Create transition period emphasizing AT PZEVs.
Program compliance transparency	Release of ZEV production data beginning in 2009 and ZEV credit balances in 2010.
Conforming changes	Extend travel provision.

9.2 Staff Recommendation

ARB staff recommends that the Board amend section 1962, Title 13, California Code of Regulations, and the incorporated test procedures and related regulations, and adopt section 1962.1. The proposed amendments and adoptions are set forth in the Proposed Regulation Order in Appendix A.

10. REFERENCES

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APPENDIX A: PROPOSED AMENDMENTS

1. Proposed Regulation Order: Amendments and Adoption to the Zero-Emission Vehicle Program

   Attached

2. Proposed Amendments to the test procedures incorporated by reference in sections 1962 and 1962.1, title 13, California Code of Regulations.

   Copies of the Test Procedures are available on the ARB's Internet site at http://www.arb.ca.gov/msprog/zevprog/2007rule/2007rule.htm, or may also be obtained by contacting the agency contact person for this rulemaking, Mark Williams, at (916) 327-5610 or via email at mwilliam@arb.ca.gov.

Appendix A: Standards and Test Procedures
Part 1

Proposed Regulation Order Part 1: Amend California Code of Regulations, title 13, section 1962 for Zero Emission and Hybrid Electric Vehicles

PROPOSED 2008 AMENDMENTS TO THE CALIFORNIA ZERO EMISSION VEHICLE REGULATION

Note: Set forth below are the 2008 amendments to the California zero emission vehicle (ZEV) regulation. The text of the amendments is shown in underline to indicate additions and strikeout to indicate deletions, compared to the preexisting regulatory language.

§ 1962. Zero-Emission Vehicle Standards for 2005 through 2008 ~~and Subsequent~~ Model Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles.

(a) ***ZEV Emission Standard.*** The Executive Officer shall certify new 2005 through 2008 ~~and Subsequent~~ model passenger cars, light-duty trucks and medium-duty vehicles as ZEVs if the vehicles produce zero exhaust emissions of any criteria pollutant (or precursor pollutant) under any and all possible operational modes and conditions. Incorporation of a fuel-fired heater shall not preclude a vehicle from being certified as a ZEV provided: (1) the fuel-fired heater cannot be operated at ambient temperatures above 40°F, (2) the heater is demonstrated to have zero fuel evaporative emissions under any and all possible operational modes and conditions, and (3) the emissions of any pollutant from the fuel-fired heater when operated at an ambient temperature between 68°F and 86°F do not exceed the emission standard for that pollutant for a ULEV under section 1961(a)(1).

A vehicle that would meet the emissions standards for a ZEV except that it uses a fuel-fired heater that can be operated at ambient temperatures above 40°F, that cannot be demonstrated to have zero fuel evaporative emissions under any and all possible operation modes and conditions, or that has emissions of any pollutant exceeding the emission standard for that pollutant for a ULEV under section 1961(a)(1), shall be certified based on the emission level of the fuel-fired heater.

(b) ***Percentage ZEV Requirements.***

(1) ***General Percentage ZEV Requirement.***

(A) ***Basic Requirement.*** The minimum percentage ZEV requirement for each manufacturer is listed in the table below as the percentage of the PCs and LDT1s, and LDT2s to the extent required by section (b)(1)(C), produced by the manufacturer and delivered for sale in California that must be ZEVs, subject to the conditions in this section 1962(b).

Model Years	*Minimum ZEV Requirement*
2005 through 2008	10 percent
~~2009 through 2011~~	~~11 percent~~
~~2012 through 2014~~	~~12 percent~~
~~2015 through 2017~~	~~14 percent~~
~~2018 and subsequent~~	~~16 percent~~

(B) ***Calculating the Number of Vehicles to Which the Percentage ZEV Requirement is Applied.*** A manufacturer's volume of PCs and LDT1s produced and delivered for sale in California will be averaged for the 1997, 1998, and 1999 model years to determine the California PC and LDT1 production volume for the model year 2005 ZEV requirements. For ~~subsequent~~the three-year periods following model year 2005, a manufacturer's California production volume of PCs and LDT1s, and LDT2s as applicable, will be based on a three-year average of the manufacturer's volume of PCs and LDT1s, and LDT2s as applicable, produced and delivered for sale in California in the prior fourth, fifth and sixth years (e.g. 2006 to 2008 model-year ZEV requirements will be based on California production volumes of PCs and LDT1s, and LDT2s as applicable, for 2000 to 2002 model years). This production averaging is used to determine ZEV requirements only, and has no effect on a manufacturer's size determination. As an alternative to the three year averaging of prior year production described above, a manufacturer may during model year 2005 or the first model year of a subsequent three year period elect to base its ZEV obligation on the number of PCs and LDT1s, and LDT2s to the extent required by section (b)(1)(C), produced by the manufacturer and delivered for sale in California that same year. If a manufacturer elects to use this method after model year 2005 it must be used for each year of the three-year period. In applying the ZEV requirement, a PC, LDT1, or LDT2 as applicable,~~(beginning in the 2007 model year)~~ that is produced by a small volume manufacturer, but is marketed in California by another manufacturer under the other manufacturer's nameplate, shall be treated as having been produced by the marketing manufacturer.

(C) ***Phase-in of ZEV Requirements for LDT2s.*** Beginning with the ZEV requirements for the 2007 model year, a manufacturer's LDT2 production shall be included in determining the manufacturer's overall ZEV requirement under section (b)(1)(A) in the increasing percentages shown the table below.

2007	*2008*	~~*2009*~~	~~*2010*~~	~~*2011*~~	~~*2012+*~~
17%	34%	~~51%~~	~~68%~~	~~85%~~	~~100%~~

(D) *Exclusion of ZEVs in Determining a Manufacturer's Sales Volume.* In calculating for purposes of sections 1962(b)(1)(B) and 1962(b)(1)(C) the volume of PCs, LDT1s and LDT2s a manufacturer has produced and delivered for sale in California, the manufacturer shall exclude the number of ZEVs produced by the manufacturer, or by a subsidiary in which the manufacturer has a greater than 50% ownership interest, and delivered for sale in California.

(2) *Requirements for Large Volume Manufacturers.*

(A) *Primary Requirements for Large Volume Manufacturers.*

In the 2005 through 2008 model years, a large-volume manufacturer must meet at least 20% of its ZEV requirement with ZEVs or ZEV credits generated by such vehicles, and at least another 20% with ZEVs, advanced technology PZEVs, or credits generated by such vehicles. The remainder of the large-volume manufacturer's ZEV requirement may be met using PZEVs or credits generated by such vehicles.

~~As the ZEV requirement increases over time from 10% in model year 2005 to 16% in model years 2018 and subsequent, the maximum portion of a large volume manufacturer's percentage ZEV requirement that may be satisfied by PZEVs that are not advanced technology PZEVs, or credits generated by such vehicles, is limited to 6% of the manufacturer's applicable California PC, LDT1, and LDT2 production volume; advanced technology PZEVs or credits generated by such vehicles may be used to meet up to one-half of the manufacturer's remaining ZEV requirement.~~

(B) *Alternative Requirements for Large Volume Manufacturers.*

1. *Minimum Floor for Production of Type III ZEVs.*

a. *Requirement For the 2005-2008 Model Years.* A large volume manufacturer electing to be subject to the alternative compliance requirements during model years 2005 through 2008 must produce, deliver for sale, and place in service in California enough 2001-2008 model-year Type III ZEVs to generate ZEV credits sufficient to meet a cumulative percentage ZEV requirement of 1.09 percent of the manufacturer's average annual California sales of PCs and LDT1s over the five year period from model years 1997 through 2001, or submit an equivalent number of credits generated by such vehicles. The manufacturer may meet up to one half of this requirement with [i] 2004-2008 model-year Type I or Type II ZEVs, provided that 20 Type I ZEVs or 10 Type II ZEVs will equal one Type III ZEV, and [ii] 1997-2003 model-year Type I or Type II ZEVs that qualify for an extended service multiplier under section 1962(f) for a year primarily during calendar years 2004-2008, provided that 33 years of such a multiplier will equal one Type III ZEV.

b. *[RESERVED]~~Requirement For the 2009-2011 Model Years.~~* ~~A large volume manufacturer electing to be subject to the alternative compliance requirements during model years 2009 through 2011 must produce, deliver for sale, and place in service in California enough 2009-2011 model-year Type III ZEVs to generate ZEV credits sufficient to meet the 2009-2011 alternative path percentage, as calculated pursuant to section 1962(b)(2)(B)1.e., of the manufacturer's section 1962(b)(1) percentage ZEV requirement for the 2010 model year, based on the prior year method described in section 1962(b)(1)(B), or submit an equivalent number of credits generated by such vehicles. The manufacturer may meet up to one half of this requirement with [i] 2009-2011 model-year Type I or Type II ZEVs, provided that 20 Type I ZEVs or 10 Type II ZEVs will equal one Type III ZEV, and [ii] 1997-2003 model-~~

~~year ZEVs that qualify for an extended service multiplier under section 1962(f) for a year primarily during calendar years 2009-2011, provided that 33 years of such a multiplier will equal one Type III ZEV.~~

~~c. *[RESERVED]Requirement For the 2012-2014 Model Years.* A large volume manufacturer electing to be subject to the alternative compliance requirements during model years 2012 through 2014 must produce, deliver for sale, and place in service in California enough 2012-2014 model year Type III ZEVs to generate ZEV credits sufficient to meet the 2012-2014 alternative path percentage, as calculated pursuant to section 1962(b)(2)(B)1.e., of the manufacturer's section 1962(b)(1) percentage ZEV requirement for the 2013 model year, based on the prior year method described in section 1962(b)(1)(B), or submit an equivalent number of credits generated by such vehicles. The manufacturer may meet up to one half of this requirement with 2012-2014 model year Type I or Type II ZEVs, provided that 10 Type I ZEVs or 5 Type II ZEVs will equal one Type III ZEV.~~

~~d. *[RESERVED]Requirement For the 2015-2017 Model Years.* A large volume manufacturer electing to be subject to the alternative compliance requirements during model years 2015 through 2017 must produce, deliver for sale, and place in service in California enough 2015-2017 model year Type III ZEVs to generate ZEV credits sufficient to meet the 2015-2017 alternative path percentage, as calculated in section 1962(b)(2)(B)1.e., of the manufacturer's section 1962(b)(1) percentage ZEV requirement for the 2016 model year, based on the prior year method described in section 1962(b)(1)(B), or submit an equivalent number of credits generated by such vehicles. The manufacturer may meet up to one half of this requirement with 2015-2017 model year Type I or Type II ZEVs, provided that 10 Type I ZEVs or 5 Type II ZEVs will equal one Type III ZEV.~~

~~e. *[RESERVED]Calculation of a Manufacturer's Alternative Path Percentage.* A manufacturer's alternative path percentage for a given time period is calculated as the target number of credits for each time period divided by the applicable combined model year ZEV obligation of all large volume manufacturers for that same time period, where:~~

~~Time Period~~	~~Target Number of Alternative Path Type III ZEVs~~	~~Credits per Vehicle~~	~~Target Number of Credits~~	~~Combined Model Year ZEV Obligation~~	~~Alternative Path Percentage~~
~~2009—2011~~	~~2,500~~	~~4~~	~~10,000~~	~~A~~	~~(10,000/A)x100~~
~~2012—2014~~	~~25,000~~	~~3~~	~~75,000~~	~~B~~	~~(75,000/B)x100~~
~~2015—2017~~	~~50,000~~	~~3~~	~~150,000~~	~~C~~	~~(150,000/C)x100~~

~~And where:~~

~~A = The combined total section 1962(b)(1) percentage ZEV requirement, based on the prior year method described in section 1962(b)(1)(B), that would apply for all large manufacturers for the 2010 model year,~~
~~B = The combined total section 1962(b)(1) percentage ZEV requirement, based on the prior year method described in section 1962(b)(1)(B), that would apply for all large manufacturers for the 2013 model year, and~~
~~C = The combined total section 1962(b)(1) percentage ZEV requirement, based on the prior year method described in section 1962(b)(1)(B), that would apply for all large manufacturers for the 2016 model year.~~

f. ***Exclusion of Additional Credits for Transportation Systems.*** Any additional credits for transportation systems generated in accordance with section 1962(g)(5) shall not be counted towards compliance with this section 1962(b)(2)(B)1.a.~~-d~~.

g. ***Carry-over of Excess Credits.*** ~~Where a manufacturer generates more qualifying ZEV credits than are needed to meet the minimum floor requirement for the production of Type III ZEVs in one of the periods identified in section 1962(b)(2)(B)1.a.-c., the qualifying ZEV credits may be used towards meeting the minimum floor requirement for the production of Type III ZEVs in a subsequent period, provided that the value of these carryover credits shall be based on the model year in which the credits are used.~~ ZEV credits generated from excess production in model years 2005 through 2008 may be carried forward and applied to the 2009 through 2011 minimum floor requirement specified in 1962.1(b)(2)(B)1.b. provided that the value of these carryover credits shall be based on the model year in which the credits are used.

h. ***Failure to Meet Requirement for Production of Type III ZEVs.*** A manufacturer that, after electing to be subject to the alternative requirements in section 1962(b)(2)(B) for any model year from 2005 through ~~2017~~ 2008, fails to meet the requirement in section 1962(b)(2)(B)1.a.~~-d~~. by the end of the specified ~~three or~~ four year period in which the model year falls, shall be treated as subject to the primary requirements in section 1962(b)(2)(A) for all model years in the specified ~~three or~~ four year period.

i. The number of Type III ZEVs needed for a manufacturer under section 1962(b)(2)(B)1.a.~~-d~~ shall be rounded to the nearest whole number.

2. ***Compliance With Percentage ZEV Requirements.*** In the 2005 through 2008 model years, a large volume manufacturer electing to be subject to the alternative compliance requirements in a given model year must meet at least 40 percent of its ZEV requirement for that model year with ZEVs, advanced technology PZEVs, or credits generated from such vehicles. The remainder of the large volume manufacturer's ZEV requirement may be met using PZEVs or credits generated from such vehicles. ~~As the ZEV requirement increases over time from 11% in model year~~

~~2009 to 16% in model years 2018 and subsequent, the maximum portion of the large volume manufacturer's percentage ZEV requirement that may be satisfied by PZEVs that are not advanced technology PZEVs, or credits generated by such vehicles, is limited to 6% of the manufacturer's applicable California PC, LDT1, and LDT2 production volume; ZEVs, advanced technology PZEVs, or credits generated by such vehicles may be used to meet the manufacturer's remaining ZEV requirement.~~

3. ***Sunset of Alternative Requirements After the 201~~7~~08 Model Year.*** The alternative requirements in section 1962(b)(2)(B) are not available after the 201~~7~~08 model year.

(C) ***Election of the Primary or Alternative Requirements for Large Volume Manufacturers for the 2005 through 2008 Model Years.*** A large volume manufacturer shall be subject to the primary ZEV requirements for the 2005 model year unless it notifies the Executive Officer in writing prior to the start of the 2005 model year that it is electing to be subject to the alternative compliance requirements for that model year. Thereafter, through the 2008 model year, a manufacturer shall be subject to the same compliance option as applied in the previous model year unless it notifies the Executive Officer in writing prior to the start of a new model year that it is electing to switch to the other compliance option for that new model year. However, a large volume manufacturer that has previously elected to be subject to the primary ZEV requirements for one or more of the model years in the ~~three or~~ four year periods identified in section 196~~1~~2(b)(~~1~~2)(B)1.a.~~-d~~. may prior to the end of the ~~three or~~ four year period elect to become subject to the alternative compliance requirements for the full ~~three or~~ four year period upon a demonstration that it has complied with all of the applicable requirements for that period in section 1962(b)(2)(B)1.a.~~-d~~.

(D) ***Use of Credits from Model Year 2003-2004 PZEVs.*** A large volume manufacturer may produce, and deliver for sale in California, model year 2003 or 2004 PZEVs that generate credits exceeding the number of credits equal to 6 percent of the average annual volume of 1997, 1998 and 1999 PCs and LDT1s produced and delivered for sale in California by the manufacturer. In that event, the manufacturer may use those excess credits as AT PZEV credits in the 2005 and 2006 model years.

(3) ***Requirements for Intermediate Volume Manufacturers.*** In the 2005 through 2008 ~~and subsequent~~ model years, an intermediate volume manufacturer may meet its ZEV requirement with up to 100 percent PZEVs or credits generated by such vehicles.

(4) ***Requirements for Small Volume Manufacturers and Independent Low Volume Manufacturers.*** A small volume manufacturer or an independent low volume manufacturer is not required to meet the percentage ZEV requirements. However, a small volume manufacturer or an independent low volume manufacturer may earn and market credits for the ZEVs or PZEVs it produces and delivers for sale in California.

(5) ***Counting ZEVs and PZEVs in Fleet Average NMOG Calculations.*** For the purposes of calculating a manufacturer's fleet average NMOG value and NMOG credits under sections 1960.1(g)(2) and 1961(b) and (c), a vehicle certified as a ZEV is counted as one ZEV, and a PZEV is counted as one SULEV certified to the 150,000 mile standards regardless of any ZEV or PZEV multipliers.

(6) ***Implementation Prior to 2005 Model Year.*** Prior to the 2005 model year, a manufacturer that voluntarily produces vehicles meeting the ZEV emission standards applicable to 2005 and subsequent model year vehicles may certify the vehicles to those standards and requirements for purposes of calculating fleet average NMOG exhaust emission values and NMOG credits under sections 1960.1(g)(2) and 1961(b) and (c), and for calculating ZEV credits as set forth in section 1962(d).

(7) ***Changes in Small Volume, Independent Low Volume, and Intermediate Volume Manufacturer Status.***

(A) ***Increases in California Production Volume.*** In the 2003 ~~and subsequent~~ through 2008 model years, if a small volume manufacturer's average California production volume exceeds 4,500 units of new PCs, LDTs, and MDVs based on the average number of vehicles produced and delivered for sale for the three previous consecutive model years, or if an independent low volume manufacturer's average California production volume exceeds 10,000 units of new PCs, LDTs, and MDVs based on the average number of vehicles produced and delivered for sale for the three previous consecutive model years, or if an intermediate volume manufacturer's average California production volume exceeds 60,000 units of new PCs, LDTs, and MDVs based on the average number of vehicles produced and delivered for sale for the three previous consecutive model years, the manufacturer shall no longer be treated as a small volume, independent low volume, or intermediate volume manufacturer, as applicable, and shall comply with the ZEV requirements for independent low volume, intermediate volume or large volume manufacturers, as applicable, beginning with the sixth model year after the last of the three consecutive model years. The lead time shall be four rather than six years where a manufacturer ceases to be a small or intermediate volume manufacturer in the 2003 ~~or subsequent~~ through 2008 model years due to the aggregation requirements in majority ownership situations, except that if the majority ownership in the manufacturer was acquired prior to the 2001 model year, the manufacturer must comply with the stepped-up ZEV requirements starting in the 2010 model year.

(B) ***Decreases in California Production Volume.*** If a manufacturer's average California production volume falls below 4,500, 10,000 or 60,000 units of new PCs, LDTs, and MDVs, as applicable, based on the average number of vehicles produced and delivered for sale for the three previous consecutive model years, the manufacturer shall be treated as a small volume, independent low volume, or intermediate volume manufacturer, as applicable, and shall be subject to the requirements for a small volume, independent low volume, or intermediate volume manufacturer beginning with the next model year.

(C) ***Calculating California Production Volume in Change of Ownership Situations.*** Where a manufacturer experiences a change in ownership in a particular model year, the change will affect application of the aggregation requirements on the manufacturer starting with the next model year. The manufacturer's small or intermediate volume manufacturer status for the next model year shall be based on the average California production volume in the three previous consecutive model years of those manufacturers whose production volumes must be aggregated for that next model year. For example, where a change of ownership during the 2004 model year results in a requirement that the production volume of Manufacturer A be aggregated with the production volume of Manufacturer B, Manufacturer A's status for the 2005 model year will be based on the production volumes of Manufacturers A and B in the 2002-2004 model years. Where the production volume of Manufacturer A must be aggregated with the production volumes of Manufacturers B and C for the 2004 model year, and during that model year a change in ownership eliminates the requirement that Manufacturer B's production volume be aggregated with Manufacturer A's, Manufacturer A's status for the 2005 model year will be based on the production volumes of Manufacturers A and C in the 2002-2004 model years. In either case, the lead time provisions in section 1962(b)(~~5~~7)(A) and (B) will apply.

(c) ***Partial ZEV Allowance Vehicles (PZEVs).***

(1) ***Introduction.*** This section 1962(c) sets forth the criteria for identifying vehicles delivered for sale in California as PZEVs. A PZEV is a vehicle that cannot be certified as a ZEV but qualifies for a PZEV allowance of at least 0.2.

(2) ***Baseline PZEV Allowance.*** In order for a vehicle to be eligible to receive a PZEV allowance, the manufacturer must demonstrate compliance with all of the following requirements. A qualifying vehicle will receive a baseline PZEV allowance of 0.2.

(A) ***SULEV Standards.*** Certify the vehicle to the 150,000-mile SULEV exhaust emission standards for PCs and LDTs in section 1961(a)(1) (for model years 2003 through 2006, existing SULEV intermediate in-use compliance standards shall apply to all PZEVs). Bi-fuel, fuel-flexible and dual-fuel vehicles must certify to the applicable 150,000-mile SULEV exhaust emission standards when operating on both fuels;

(B) ***Evaporative Emissions.*** Certify the vehicle to the evaporative emission standards in section 1976(b)(1)(E) ("zero"-fuel evaporative emissions standards);

(C) ***OBD.*** Certify that the vehicle will meet the applicable on-board diagnostic requirements in sections 1968.1 or 1968.2, as applicable, for 150,000 miles; and

(D) ***Extended Warranty.*** Extend the performance and defects warranty period set forth in sections 2037(b)(2) and 2038(b)(~~2~~1) to 15 years or 150,000 miles, whichever occurs first, except that the time period is to be 10 years for a zero emission energy storage device used for traction power (such as a battery, ultracapacitor, or other electric storage device).

(3) ***Zero-Emission VMT PZEV Allowance.***

(A) ***Calculation of Zero Emission VMT Allowance.*** A vehicle that meets the requirements of section 1962(c)(2) and has zero-emission vehicle miles traveled ("VMT") capability will generate an additional zero emission VMT PZEV allowance calculated as follows:

Urban All-Electric Range	*Zero-emission VMT Allowance*
< 10 miles	0.0
10 miles to 90 miles	(33.8 + [0.5 x Urban AER])/35
>90 miles	2.25

The urban all-electric range shall be determined in accordance with section E.3.(2)(a) of the "California Exhaust Emission Standards and Test Procedures for 2005 ~~and Subsequent~~ through 2008 Model Zero-Emission Vehicles, and 2001 and Subsequent Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," incorporated by reference in section 1962(h).

(B) ***Alternative Procedures.*** As an alternative to determining the zero-emission VMT allowance in accordance with the preceding section 1962(c)(3)(A), a manufacturer may submit for Executive Officer approval an alternative procedure for determining the zero-emission VMT potential of the vehicle as a percent of total VMT, along with an engineering evaluation that adequately substantiates the zero-emission VMT determination. For example, an alternative procedure may provide that a vehicle with zero-emissions of one regulated pollutant (e.g. NOx) and not another (e.g. NMOG) will qualify for a zero-emission VMT allowance of 1.5.

(C) ***Additional Allowances for Qualifying HEVs.*** The Executive Officer shall approve an additional 0.1 zero-emission VMT partial ZEV allowance for an HEV with an all-electric range if the manufacturer demonstrates to the reasonable satisfaction of the Executive Officer that the HEV is equipped with software and/or other strategies that would promote maximum use of off-vehicle charging, and that the strategies employed are reasonably reliable and tamper-proof.

(4) ***PZEV Allowance for Advanced ZEV Componentry.*** A vehicle that meets the requirements of section 1962(c)(2) may qualify for an advanced componentry PZEV allowance as provided in this section 1962(c)(4).

(A) ***Use of High Pressure Gaseous Fuel or Hydrogen Storage System.*** A vehicle equipped with a high pressure gaseous fuel storage system capable of refueling at 3600 pounds per square inch or more and operating exclusively on this gaseous fuel shall qualify for an advanced componentry PZEV allowance of 0.2. A vehicle capable of operating exclusively on hydrogen stored in a high pressure system capable of refueling at 3600 pounds per square inch or more, or stored in nongaseous form, shall instead qualify for an advanced componentry PZEV allowance of 0.3.

(B) ***Use of a Qualifying HEV Electric Drive System.***

1. ***Classification of HEVs.*** HEVs qualifying for additional allowances or allowances that may be used in the AT PZEV category are classified in one of five types of HEVs based on the criteria in the following table.

Characteristics	*Type A*	*Type B*	*Type C*	*Type D*	*Type E*
Electric Drive System Peak Power Output	>= 4 kW	>= 4 kW <10 kW	>= 10 kW	>= 10 kW	>= 50 kW
Traction Drive System Voltage	<60 Volts	>= 60 Volts	< 60 Volts	>= 60 Volts	>= 60 volts
Traction Drive Boost	Yes	Yes	Yes	Yes	Yes
Regenerative Braking	Yes	Yes	Yes	Yes	Yes
Idle Start/Stop	Yes	Yes	Yes	Yes	Yes

2. ***Type A HEVs.*** A 2008 or earlier model-year PZEV that the manufacturer demonstrates to the reasonable satisfaction of the Executive Officer meets all of the criteria for a Type A HEV does not receive an additional allowance for meeting those criteria but generates credits that may be used in the AT PZEV category through the 2008 model year.

3. ***Type B HEVs.*** A 2008 or earlier model-year PZEV that the manufacturer demonstrates to the reasonable satisfaction of the Executive Officer meets all of the criteria for a Type B HEV qualifies for an additional advanced componentry allowance of 0.2.

4. ***Type C HEVs.*** A ~~2011~~2008 or earlier model-year PZEV that the manufacturer demonstrates to the reasonable satisfaction of the Executive Officer meets all of the criteria for a Type C HEV, and that is equipped with an advanced traction energy storage system – such as nickel metal-hydride batteries, ultracapacitors, or other similar systems – with a design lifetime of at least 10 years, qualifies for an additional advanced componentry allowance of 0.2.

5. ***Type D HEVs.*** A PZEV that the manufacturer demonstrates to the reasonable satisfaction of the Executive Officer meets all of the criteria for a Type D HEV qualifies for an additional advanced componentry allowance of 0.4 in the 2003 through ~~2011~~2008 model years~~, 0.35 in the 2012 through 2014 model years, and 0.25 in the 2015 and subsequent model years~~.

6. ***Type E HEVs.*** A PZEV that the manufacturer demonstrates to the reasonable satisfaction of the Executive Officer meets all of the criteria for a Type E HEV qualifies for an additional advanced componentry allowance of 0.5 in the 2003 through ~~2011~~2008 model years~~, 0.45 in the 2012 through 2014 model years, and 0.35 in the 2015 and subsequent model years~~.

7. ***Severability.*** In the event that all or part of section 1962(c)(4)(B)1.-6. is found invalid, the remainder of section 1962, including the remainder of section 1962(c)(4)(B)1.-6. if any, remains in full force and effect.

(5) ***PZEV Allowance for Low Fuel-Cycle Emissions.*** A vehicle that uses fuel(s) with very low fuel-cycle emissions shall receive a PZEV allowance not to exceed 0.3 (0.15 in the case of an HEV that uses for propulsion any fuel that does not have very low fuel-cycle emissions). In order to receive the fuel-cycle PZEV allowance, a manufacturer must demonstrate to the Executive Officer, using peer-reviewed studies or other relevant information, that NMOG emissions associated with the fuel(s) used by the vehicle (on a grams/mile basis) are lower than or equal to 0.01 grams/mile. Fuel-cycle emissions must be calculated based on near-term production methods and infrastructure assumptions, and the uncertainty in the results must be quantified. The fuel-cycle PZEV allowance is calculated according to the following formula:

PZEV Fuel Cycle Allowance = 0.3 x [(percent of VMT using fuel(s) meeting the requirements of the preceding paragraph) / 100]

A manufacturer's demonstration to the Executive Officer that a vehicle qualifies for a fuel-cycle PZEV allowance shall include test results and/or empirical data supporting the estimate of the relative proportion of VMT while operating on fuel(s) with very low fuel-cycle emissions.

(6) ***Calculation of PZEV Allowance.***

(A) ***Calculation of Combined PZEV Allowance for a Vehicle.*** The combined PZEV allowance for a qualifying vehicle in a particular model year is the sum

of the PZEV allowances listed in this section 1962(c)(6), multiplied by any PZEV introduction phase-in multiplier listed in section 1962(c)(7), subject to the caps in section 1962(c)(6)(B).

1. ***Baseline PZEV Allowance.*** The baseline PZEV allowance of 0.2 for vehicles meeting the criteria in section 1962(c)(2);

2. ***Zero-Emission VMT PZEV Allowance.*** The zero-emission VMT PZEV allowance, if any, determined in accordance with section 1962(c)(3);

3. ***Advanced Componentry PZEV Allowance.*** The advanced ZEV componentry ZEV allowance, if any, determined in accordance with section 1962(c)(4); and

4. ***Fuel-Cycle Emissions PZEV Allowance.*** The fuel-cycle emissions PZEV allowance, if any, determined in accordance with section 1962(c)(5).

(B) ***Caps on the Value of an AT PZEV Allowance.***

1. ***[RESERVED]~~Cap for 2012 and Subsequent Model-Year Vehicles.~~*** ~~The maximum value of AT PZEV allowances a 2012 and subsequent model-year vehicle may earn, including the baseline PZEV allowance, is 3.0.~~

2. ***Cap Based on the Credit Value of a Type III ZEV.*** In no case may the combined AT PZEV allowance for a qualifying vehicle in a particular model year, including the baseline PZEV allowance, exceed the ZEV credits for a Type III ZEV placed in service in the same model year.

(7) ***PZEV Multipliers.***

(A) ***PZEV Introduction Phase-In Multiplier.*** Each 2000 through 2005 model-year PZEV that is produced and delivered for sale in California, other than a PZEV qualifying for a phase-in multiplier under section 1962(c)(7)(B), qualifies for a PZEV introduction phase-in multiplier as follows:

	MY 2000-2003	*MY 2004*	*MY 2005*
Multiplier	4.0	2.0	1.33

(B) ***Introduction Phase-In Multiplier for PZEVs That Earn a Zero Emission VMT Allowance.*** Each 2000 through ~~2011~~ 2008 model year PZEV that earns a zero emission VMT allowance under section 1962(c)(3) and is produced and delivered for sale in California qualifies for a phase-in multiplier as follows:

	MY 2000-2008	*~~MY 2009-2011~~*
Multiplier	6.0	~~3.0~~

(d) ***Qualification for ZEV Multipliers and Credits.***

(1) ***1996-1998 Model-Year ZEV Multipliers.***

(A) ***1996-1998 Model-Year ZEV Multiplier Based on Vehicle Range.*** 1996-1998 model-year ZEVs shall qualify for a ZEV multiplier based on vehicle range as follows:

ZEV Multiplier	*Vehicle Range (miles)*	
	Model Years 1996 and 1997	*Model Year 1998*
2	any	≥ 100
3	≥ 70	≥ 130

Range shall be determined in accordance with section 9.f.(2)(a) of the "California Exhaust Emission Standards and Test Procedures for 1988 Through 2000 Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles," incorporated by reference in section 1960.1(k).

(B) ***1996-1998 Model-Year ZEV Multiplier Based on Specific Energy of Battery.*** 1996-1998 model-year ZEVs shall qualify for a ZEV multiplier based on specific energy of the battery as follows:

ZEV Multiplier	*Specific Energy of Battery (w-hr/kg)*
2	any
3	≥ 40

(C) ***Election of Multiplier.*** A 1996-1998 model-year ZEV may qualify for a ZEV multiplier according to section 1962(d)(1)(A) or section 1962(d)(1)(B), but not both.

(2) ***1999-2000 Model-Year ZEV Multiplier Calculation for Extended Electric Range Vehicles.*** Each ZEV that is produced and delivered for sale in California in the 1999-2000 model years and that has an extended electric range shall qualify for a ZEV multiplier as follows:

All-electric range	*MY 1999-2000*
100-175	6-10

ZEV multipliers under the above schedule will be determined by linear interpolation between the values shown in the above schedule. Range shall be determined in

accordance with Section E.3.(2)(a) of the "California Exhaust Emission Standards and Test Procedures for 2003 and Subsequent Model Zero-Emission Vehicles, and 2001 and Subsequent Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," incorporated by reference in section 1962(h). ZEVs that have a refueling time of less than 10 minutes and a range of 100 miles or more shall be counted as having unlimited all-electric range, and shall consequently earn the maximum allowable ZEV multiplier for a specific model year. ZEVs that have a range of 80 to 99 miles shall qualify for ZEV multipliers in the 1999-2000 model years in accordance with the following equation:

ZEV multiplier = (6) x (AER equivalent to a 10 minute recharge/100) x 0.5.

As an option to the above mechanism, the manufacturer of a 1999 model-year ZEV may elect to have its multiplier based on the regulatory requirements pertaining to multipliers based on range or specific energy in section 1960.1(g)(2) and (h)(2). title 13, California Code of Regulations that were applicable to 1999 model-year ZEVs immediately before this section 1962 became operative on November 27, 1999 as a result of the "LEV II" rulemaking.

(3) ***ZEV Multipliers for 2001-2002 Model Years.***

(A) ***ZEV Phase-In Multiplier.*** Each 2001 and 2002 model-year ZEV that is placed in service in California by September 30, 2003 qualifies for a ZEV phase-in multiplier of 4.0. A 2001 or 2002 model-year ZEV that is placed in service in California after September 30, 2003 earns credits in accordance with section 1962(d)(5) instead of section 1962(d)(3).

(B) ***ZEV Extended Electric Range Multiplier.***

1. ***Basic Multiplier Schedule.*** Each 2001 and 2002 model-year ZEV that is placed in service in California and that has an extended urban electric range qualifies for a ZEV extended electric range multiplier as follows:

Urban All-Electric Range	*Multiplier*
< 50 miles	1
≥ 50 miles to < 275 miles	(Urban AER-25)/25
≥ 275 miles	10

A NEV is not eligible to earn a ZEV extended electric range multiplier. In determining ZEV range multipliers, specialty ZEVs may, upon Executive Officer approval, be tested at the parameters used to determine the ZEV multipliers for the existing ZEV.

2. ***Fast refueling.***

a. ***Full Fueling in 10 Minutes or Less.*** A 2001-2002 model-year ZEV with the demonstrated capability to accept fuel or electric charge until achieving at least 95% SOC or rated fuel capacity in 10 minutes or less when starting from all operationally allowable SOC or fuel states is counted as having unlimited zero emission range and qualifies for the maximum allowable ZEV extended electric range multiplier.

b. ***At Least 60-Mile Range in Less Than 10 Minutes.*** A 2001-2002 model year ZEV with the demonstrated capacity to accept fuel or electric charge equivalent to at least 60 miles of UDDS range when starting from 20% SOC in less than 10 minutes is counted as having 60 additional miles (up to a 275 mile maximum) of UDDS range in the range multiplier determination in section 1962(d)(3)(C)1.

(C) ***Combined ZEV Multiplier.*** During the 2001-2002 model years, the combined ZEV multiplier for each ZEV in a specific model year is the product of:

1. The ZEV phase-in multiplier if any as set forth in section 1962(d)(3)(A), times

2. The extended electric range multiplier if any as set forth in section 1962(d)(3)(B).

(4) ***Effect of ZEV Multipliers in the 1996-2002 Model Years.*** In calculating the number of ZEVs produced and delivered for sale in California by a manufacturer in the 1996-2002 model years and the ZEV credits from such vehicles, the number of ZEVs qualifying for a particular ZEV multiplier shall be multiplied by the combined ZEV multiplier.

(5) ***ZEV Credits for the 2003 ~~and Subsequent~~ through 2008 Model Years.***

(A) ***ZEV Tiers for Credit Calculations.*** Starting in the 2003 model year, ZEV credits from a particular ZEV are based on the assignment of a given ZEV into one of the following five ZEV tiers:

ZEV Tier	*Common Description*	*UDDS ZEV Range*	*Fast Refueling Capability*
NEV	NEV	No minimum	N/A
Type 0	Utility EV	<50 miles	N/A
Type I	City EV	>= 50, <100 miles	N/A
Type II	Full Function EV	>= 100 miles	N/A
Type III	Fuel Cell EV	>= 100 miles	Must be capable of replacing 95% maximum rated energy capacity in <= 10 minutes

A specialty ZEV that has the same zero emission energy storage device and chassis as an existing ZEV from which it was modified may, upon Executive Officer approval, be categorized on the basis of that existing ZEV. A specialty vehicle that is optimized for a particular duty cycle that conflicts with optimization for maximum vehicle range may be promoted to the next higher ZEV tier upon a determination by the Executive Officer that the specialty vehicle has ZEV componentry equivalent to that utilized by ZEVs in the next tier and would meet the requirements for the next tier if optimized for maximum range.

(B) ***ZEV Credits for 2003 ~~and Subsequent~~ through 2008 Model-Year ZEVs.*** A 2003 ~~and subsequent~~ through 2008 model-year ZEV, other than a NEV, earns 1 ZEV credit when it is produced and delivered for sale in California. A 2003 ~~and subsequent~~ through 2008 model-year ZEV earns additional credits based on the earliest ~~model~~ year in which the ZEV is placed in service (not earlier than the ZEV's model year). The following table identifies the total credits that a ZEV in each of the five ZEV tiers will earn, including the credit not contingent on placement in service, if it is placed in service in the specified model year or by June 30 after the end of the specified ~~model~~ year.

Total Credit Earned by ZEV Type and Model Year for Production and Delivery for Sale and for Placement										
Tier	*~~Model~~ Year in Which ZEV is Placed in Service*									
	2003	*2004*	*2005*	*2006*	*2007*	*2008*	*~~2009~~*	*~~2010~~*	*~~2011~~*	*~~2012+~~*
NEV	1.25	0.625	0.625	0.15	0.15	0.15	~~0.15~~	~~0.15~~	~~0.15~~	~~0.15~~
Type 0 ~~(Utility)~~	1.5	1.5	1.5	1.5	1.5	1.5	~~1~~	~~1~~	~~1~~	~~1~~
Type ~~1~~I ~~(City)~~	8	8	8	7	7	7	~~2~~	~~2~~	~~2~~	~~2~~
Type II	12	12	12	10	10	10	~~3~~	~~3~~	~~3~~	~~3~~
Type III	40	40	40	40	40	40	4	4	4	~~3~~

(C) ***Multiplier for Certain Type I and Type II ZEVs.*** A 2004 through ~~2011~~2008 model-year Type I and Type II ZEV shall qualify for a multiplier of 1.25 if it is either sold to a motorist or is leased for three or more years to a motorist who is given the option to purchase or re-lease the vehicle for two years or more at the end of the first lease term.

(D) ***Counting a Type III ZEVs Placed in a Section 177 State.*** Through the ~~2011~~2008 model year, a Type III ZEV that is certified to the California ZEV standards and is placed in service in a state that is administering the California ZEV requirements pursuant to section 177 of the federal Clean Air Act (42 U.S.C. § 7507) applicable for the ZEV's model year may be counted towards compliance with the California percentage ZEV requirements in section 1962(b), including the requirements in section 1962(b)(2)(B), as if it were delivered for sale and placed in service in California. Similarly, a ~~2011~~2008 and earlier model-year Type III ZEV that is certified to the California ZEV standards and is placed in service in California may be counted towards the percentage ZEV requirements of any state that is administering the California ZEV requirements pursuant to section 177 of the federal Clean Air Act, including requirements based on section 1962(b)(2)(B).

(e) [Reserved]

(f) ***Extended Service Multiplier for 1997-2003 Model-Year ZEVs and PZEVs With ≥ 10 Mile Zero Emission Range.*** Except in the case of a NEV, an additional ZEV or PZEV multiplier will be earned by the manufacturer of a 1997 through 2003 model-year ZEV, or PZEV with ≥ 10 mile zero emission range for each full year it is registered for operation on public roads in California beyond its first three years of service, through the ~~2011~~2008 calendar year. For additional years of service starting earlier than April 24, 2003, the manufacturer will receive 0.1 times the ZEV credit that

would be earned by the vehicle if it were leased or sold new in that year, including multipliers, on a year-by-year basis beginning in the fourth year after the vehicle is initially placed in service. For additional years of service starting April 24, 2003 or later, the manufacturer will receive 0.2 times the ZEV credit that would be earned by the vehicle if it were leased or sold new in that year, including multipliers, on a year-by-year basis beginning in the s year after the vehicle is initially placed in service. The extended service multiplier is reported and earned in the year following each continuous year of service.

(g) ***Generation and Use of ZEV Credits; Calculation of Penalties***

(1) ***Introduction.*** A manufacturer that produces and delivers for sale in California ZEVs or PZEVs in a given model year exceeding the manufacturer's ZEV requirement set forth in section 1962(b) shall earn ZEV credits in accordance with this section 1962(g).

(2) ***ZEV Credit Calculations.***

(A) ***Credits from ZEVs.*** The amount of g/mi ZEV credits earned by a manufacturer in a given model year from ZEVs shall be expressed in units of g/mi NMOG, and shall be equal to the number of credits from ZEVs produced and delivered for sale in California that the manufacturer applies towards meeting the ZEV requirements for the model year subtracted from the number of ZEVs produced and delivered for sale in California by the manufacturer in the model year and then multiplied by the NMOG fleet average requirement for PCs and LDT1s for that model year.

(B) ***Credits from PZEVs.*** The amount of g/mi ZEV credits from PZEVs earned by a manufacturer in a given model year shall be expressed in units of g/mi NMOG, and shall be equal to the total number of PZEVs produced and delivered for sale in California that the manufacturer applies towards meeting its ZEV requirement for the model year subtracted from the total number of PZEV allowances from PZEVs produced and delivered for sale in California by the manufacturer in the model year and then multiplied by the NMOG fleet average requirement for PCs and LDT1s for that model year.

(C) ***Separate Credit Accounts.*** The number of credits from a manufacturer's [i] ZEVs, [ii] advanced technology PZEVs, and [iii] all other PZEVs shall each be maintained separately.

(3) ***ZEV Credits for MDVs and LDTs Other Than LDT1s.*** ZEVs and PZEVs classified as MDVs or as LDTs other than LDT1s may be counted toward the ZEV requirement for PCs, ~~and~~ LDT1s, and LDT2s as applicable, and included in the calculation of ZEV credits as specified in this section 1962(g) if the manufacturer so designates.

(4) ***ZEV Credits for Advanced Technology Demonstration Programs.*** A vehicle, other than a NEV, that is placed in a California advanced technology demonstration program may earn ZEV credits even if it is not "delivered for sale." or registered with the California Department of Motor Vehicles (DMV). To earn such credits, the manufacturer must demonstrate to the reasonable satisfaction of the Executive Officer that the vehicles will be regularly used in applications appropriate to evaluate issues related to safety, infrastructure, fuel specifications or public education, and that for more than 50 percent of the first year of placement the vehicle will be situated in California. Such a vehicle is eligible to receive the same allowances and credits that it would have earned if placed in service. To determine vehicle credit, the model-year designation for a demonstration vehicle shall be consistent with the model-year designation for conventional vehicles placed in the same timeframe.

(5) ***ZEV Credits for Transportation Systems.***

(A) ***General.*** In model years 2001 through ~~2011~~2008, a ZEV, advanced technology PZEV or PZEV placed as part of a transportation system may earn additional ZEV credits, which may used in the same manner as other credits earned by vehicles of that category, except as provided in section (g)(5)(C) below. A NEV is not eligible to earn credit for transportation systems. To earn such credits, the manufacturer must demonstrate to the reasonable satisfaction of the Executive Officer that the vehicle will be used as a part of a project that uses an innovative transportation system as described in section (g)(5)(B) below.

(B) ***Credits Earned.*** In order to earn additional credit under this section (g)(5), a project must at a minimum demonstrate [i] shared use of ZEVs, AT PZEVs or PZEVs, and [ii] the application of "intelligent" new technologies such as reservation management, card systems, depot management, location management, charge billing and real-time wireless information systems. If, in addition to factors [i] and [ii] above, a project also features linkage to transit, the project may receive further additional credit. For ZEVs only, not including NEVs, a project that features linkage to transit, such as dedicated parking and charging facilities at transit stations, but does not demonstrate shared use or the application of intelligent new technologies, may also receive additional credit for linkage to transit. The maximum credit awarded per vehicle shall be determined by the Executive Officer, based upon an application submitted by the manufacturer and, if appropriate, the project manager. The maximum credit awarded shall not exceed the following:

Type of Vehicle	*Shared Use, Intelligence*	*Linkage to Transit*
PZEV	2	1
Advanced Technology PZEV	4	2
ZEV	6	3

(C) ***Cap on Use of Credits.***

1. ***ZEVs.*** Credits earned or allocated by ZEVs pursuant to this section (g)(5), not including all credits earned by the vehicle itself, may be used to satisfy up to one-tenth of a manufacturer's ZEV obligation in any given model year.

2. ***AT PZEVs.*** Credits earned or allocated by AT PZEVs pursuant to this section (g)(5), not including all credits earned by the vehicle itself, may be used to satisfy up to one-twentieth of a manufacturer's ZEV obligation in any given model year, but may only be used in the same manner as other credits earned by vehicles of that category.

3. ***PZEVs.*** Credits earned or allocated by PZEVs pursuant to this section (g)(5), not including all credits earned by the vehicle itself, may be used to satisfy up to one-fiftieth of the manufacturer's ZEV obligation in any given model year, but may only be used in the same manner as other credits earned by vehicles of that category.

(D) ***Allocation of Credits.*** Credits shall be assigned by the Executive Officer to the project manager or, in the absence of a separate project manager, to the vehicle manufacturers upon demonstration that a vehicle has been placed in a project. Credits shall be allocated to vehicle manufacturers by the Executive Officer in accordance with a recommendation submitted in writing by the project manager and signed by all manufacturers participating in the project, and need not be allocated in direct proportion to the number of vehicles placed.

(6) ***~~Submittal~~Use of ZEV Credits.*** A manufacturer may meet the ZEV requirements in any given model year by submitting to the Executive Officer a commensurate amount of g/mi ZEV credits, consistent with section 1962(b). These credits may be earned previously by the manufacturer or acquired from another party, except that beginning with the 2006 model year credits earned from NEVs offered for sale or placed in service in model years 2001 through 2005 cannot be used to satisfy more than the following portion of a manufacturer's percentage ZEV obligation that may only be satisfied with credits from ZEVs ~~and, starting with the 2009 model year, the manufacturer's percentage ZEV obligation that may be satisfied by credits from AT PZEVs but not PZEVs~~:

ZEV Category		*~~AT PZEV Category~~*	
2006	*2007 and beyond*	*~~2009~~*	*~~2010 and beyond~~*
75%	50%	~~75%~~	~~50%~~

This limitation applies to credits earned in model years 2001 through 2005 by the same manufacturer or earned in model years 2001 through 2005 by another manufacturer

and acquired. The amount of g/mi ZEV credits required to be submitted shall be calculated according to the criteria set forth in this section 1962(g).

ZEV credits generated from excess production in model years 2005 through 2008, including those acquired from another party, may be carried forward and applied to the manufacturer's percentage ZEV obligation that may only be satisfied by credits from ZEVs in section 1962.1(b)(2)(B)1.b. Beginning with the 2012 model year, those earned ZEV credits may no longer be used to satisfy the manufacturer's percentage ZEV obligation that may only be satisfied by credits from ZEVs, but may be used to satisfy the manufacturer's percentage ZEV obligation that may be satisfied by credits from Enhanced AT PZEVs, AT PZEVs, or PZEVs. For example, ZEV credit earned in 2008 would retain full flexibility through 2011, at which time that credit could only be used as Enhanced AT PZEV, AT PZEV, or PZEV credits.

(7) *Requirement to Make Up a ZEV Deficit.*

(A) *General.* A manufacturer that produces and delivers for sale in California fewer ZEVs than required in a given model year shall make up the deficit by the end of the ~~next~~third model year by submitting to the Executive Officer a commensurate amount of g/mi ZEV credits~~, except that credits generated from PZEVs may be used to offset deficits for two model years~~. The amount of g/mi ZEV credits required to be submitted shall be calculated by [i] adding the number of ZEVs produced and delivered for sale in California by the manufacturer for the model year to the number of ZEV allowances from partial ZEV allowance vehicles produced and delivered for sale in California by the manufacturer for the model year (for a large volume manufacturer, not to exceed that permitted under section 1962(b)(2)), [ii] subtracting that total from the number of ZEVs required to be produced and delivered for sale in California by the manufacturer for the model year, and [iii] multiplying the resulting value by the fleet average requirements for PCs and LDT1s for the model year in which the deficit is incurred.

(8) *Penalty for Failure to Meet ZEV Requirements.* Any manufacturer that fails to produce and deliver for sale in California the required number of ZEVs ~~or~~and submit an appropriate amount of g/mi ZEV credits and does not make up ZEV deficits within the specified time period shall be subject to the Health and Safety Code section 43211 civil penalty applicable to a manufacturer that sells a new motor vehicle that does not meet the applicable emission standards adopted by the state board. The cause of action shall be deemed to accrue when the ZEV deficits are not balanced by the end of the specified time period. For the purposes of Health and Safety Code section 43211, the number of vehicles not meeting the state board's standards shall be calculated according to the following equation, provided that the percentage of a large volume manufacturer's ZEV requirement for a given model year that may be satisfied with partial ZEV allowance vehicles or ZEV credits from such vehicles may not exceed the percentages permitted under section 1962(b)(2)(A):

(No. of ZEVs required to be produced and delivered for sale in California for the model year) - (No. of ZEVs produced and delivered for sale in California for the model year) - (No. of ZEV allowances from partial ZEV allowance vehicles produced and delivered for sale in California for the model year) - [(Amount of ZEV credits submitted for the model year) / (the fleet average requirement for PCs and LDT1s for the model-year)].

(h) ***Test Procedures.*** The certification requirements and test procedures for determining compliance with this section 1962 are set forth in "California Exhaust Emission Standards and Test Procedures for 2005 ~~and Subsequent~~through 2008 Model Zero-Emission Vehicles, and 2001 and Subsequent Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," adopted by the state board on August 5, 1999, and last amended ~~December 19, 2003~~ [Insert date of amendments], which is incorporated herein by reference.

(i) ***ZEV-Specific Definitions.*** The following definitions apply to this section 1962.

(1) "Advanced technology PZEV" or "AT PZEV" means any PZEV with an allowance greater than 0.2 before application of the PZEV early introduction phase-in multiplier

(2) "Battery electric vehicle" means any vehicle that operates solely by use of a battery or battery pack, or that is powered primarily through the use of an electric battery or battery pack but uses a flywheel or capacitor that stores energy produced by the electric motor or through regenerative braking to assist in vehicle operation.

(~~2.~~53) "Electric drive system" means an electric motor and associated power electronics which provide acceleration torque to the drive wheels sometime during normal vehicle operation. This does not include components that could act as a motor, but are configured to act only as a generator or engine starter in a particular vehicle application.

(~~3~~4) "Neighborhood electric vehicle" means a motor vehicle that meets the definition of Low-Speed Vehicle either in section 385.5 of the Vehicle Code or in 49 CFR 571.500 (as it existed on July 1, 2000), and is certified to zero-emission vehicle standards.

(45) "Placed in service" means having been sold or leased to an end-user and not to a dealer or other distribution chain entity, and having been individually registered for on-road use by the California Department of Motor Vehicles.

(~~4.~~56) "Regenerative braking" means the partial recovery of the energy normally dissipated into friction braking that is returned as electrical current to an energy storage device.

(~~5~~7) "Specialty ZEV" means a ZEV that is designed for a commercial or governmental fleet application, and either [i] has the same zero emissions energy storage device and chassis as an existing ZEV from which it is modified, or [ii] in the case of a vehicle that is not based on an existing ZEV platform, is optimized for a particular duty cycle, such as urban delivery service, that conflicts with optimization for maximum vehicle range.

(~~6~~8) "Type 0, I, II, and III ZEV" all have the meanings set forth in section 1962(d)(5)(A).

(j) ***Abbreviations.*** The following abbreviations are used in this section 1962:

"AER" means all-electric range.
"BEV" means battery electric vehicle.
"HEV" means hybrid-electric vehicle.
"HFEDS" means highway fuel economy driving cycle.
"LDT" means light-duty truck.
"LDT1" means a light-truck with a loaded vehicle weight of 0-3750 pounds.
"LDT2" means a "LEV II" light-duty truck with a loaded vehicle weight of 3751 pounds to a gross vehicle weight of 8500 pounds, or a "LEV I" light-duty truck with a loaded vehicle weight of 3751-5750 pounds.
"MDV" means medium-duty vehicle.
"Non-Methane Organic Gases" or "NMOG" means the total mass of oxygenated and non-oxygenated hydrocarbon emissions.
"MY" means model year.
"NEV" means neighborhood electric vehicle.
"NOx" means oxides of nitrogen.
"PC" means passenger car.
"PZEV" means any vehicle that is delivered for sale in California and that qualifies for a partial ZEV allowance of at least 0.2.
"SOC" means state of charge.
"SULEV" means super-ultra-low-emission-vehicle.
"UDDS" means urban dynamometer driving cycle.
"ULEV" means ultra-low emission vehicle.
"VMT" means vehicle miles traveled.
"ZEV" means zero-emission vehicle.

(k) ***Severability.*** Each provision of this section is severable, and in the event that any provision of this section is held to be invalid, the remainder of this article remains in full force and effect.

Note: Authority cited: Sections 39600, 39601, 43013, 43018, 43101, 43104 and 43105, Health and Safety Code. Reference: Sections 39002, 39003, 39667, 43000, 43009.5, 43013, 43018, 43100, 43101, 43101.5, 43102, 43104, 43105, 43106, 43107, 43204, and 43205.5, Health and Safety Code.

Appendix A: Standards and Test Procedures
Part 2

Proposed Regulation Order Part 2: Amendments to the Incorporated "California Exhaust Emission Standards and Test Procedures for 2005 through 2008 Model Zero-Emission Vehicles, and 2001 and Subsequent Model Hybrid Electric Vehicles, in the Passenger Car, Light-duty Truck and Medium-duty Vehicle Classes (title 13, California Code of Regulations, section 1962)

California Environmental Protection Agency
AIR RESOURCES BOARD

CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 2005 ~~AND SUBSEQUENT~~THROUGH 2008 MODEL ZERO-EMISSION VEHICLES, AND 2001 AND SUBSEQUENT MODEL HYBRID ELECTRIC VEHICLES, IN THE PASSENGER CAR, LIGHT-DUTY TRUCK AND MEDIUM-DUTY VEHICLE CLASSES

Adopted: August 5, 1999
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CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 2005 ~~AND SUBSEQUENT~~THROUGH 2008 MODEL ZERO-EMISSION VEHICLES, AND 2001 AND SUBSEQUENT MODEL HYBRID ELECTRIC VEHICLES, IN THE PASSENGER CAR,LIGHT-DUTY TRUCK AND MEDIUM-DUTY VEHICLE CLASSES

A. Applicability

The emission standards and test procedures in this document are applicable to 2005 ~~and subsequent~~through 2008 model-year zero-emission passenger cars, light-duty trucks and medium-duty vehicles, and 2001 and subsequent model-year hybrid electric passenger cars, light-duty trucks and medium-duty vehicles. The general procedures and requirements necessary to certify a vehicle for sale in California are contained in the "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles" (hereinafter "LDV/MDV TPs"), and apply except as amended herein. A manufacturer may elect to certify a 2000 model-year hybrid electric vehicle under these standards and test procedures and the LDV/MDV TPs.

B. Definitions

In addition to the following, these test procedures incorporate by reference the definitions and abbreviations set forth in the Title 40 Code of Federal Regulations § 86.1803-01, the definitions and abbreviations set forth in the LDV/MDV TPs, and the definitions set forth in section 1900, title 13, CCR.

"Advanced technology PZEV" or "AT PZEV" means any PZEV with an allowance greater than 0.2 before application of the PZEV early introduction phase-in multiplier.

"All-Electric Range Test" means a test sequence used to determine the range of an electric vehicle or of a hybrid electric vehicle without the use of its auxiliary power unit. The All-Electric Range Test cycle consists of the Highway Fuel Economy Schedule and the Urban Dynamometer Driving Schedule (see section E of these test procedures).

"Auxiliary power unit" means a device that converts consumable fuel energy into mechanical or electrical energy. Some examples of auxiliary power units are internal combustion engines, gas turbines, or fuel cells.

"Battery electric vehicle" or "BEV" means any vehicle that operates solely by use of a battery or battery pack, or that is powered primarily through the use of an electric battery or battery pack but uses a flywheel or capacitor that stores energy produced by the electric motor or through regenerative braking to assist in vehicle operation.

"Battery or Battery pack" means any electrical energy storage device consisting of any number of individual battery modules or cells that is used to propel a battery electric or hybrid electric vehicle. These terms may also generically refer to capacitor and flywheel energy storage devices in the context of hybrid electric vehicles.

"Battery state-of-charge" means the quantity of electrical energy remaining in the battery relative to the maximum rated capacity of the battery expressed in percent.

"Charge-depleting" means that the battery of a hybrid electric vehicle ultimately fully discharges and impairs vehicle operation as the vehicle continuously operates over a given driving cycle when no off-vehicle charging is performed and the consumable fuel is regularly replenished. Hybrid electric vehicles are required to be classified as either charge-sustaining or charge-depleting over each driving cycle (i.e. UDDS, HFEDS, US06, or SC03).

"Charge-sustaining" means that the battery of a hybrid electric vehicle ultimately does not fully discharge and impair vehicle operation as the vehicle continuously operates over a given driving cycle when no off-vehicle charging is performed and the consumable fuel is regularly replenished. Hybrid electric vehicles are required to be classified as either charge-sustaining or charge-depleting over each driving cycle (i.e. UDDS, HFEDS, US06, or SC03).

"Consumable fuel" means any solid, liquid, or gaseous matter that releases energy when consumed by an auxiliary power unit.

"Electric drive system" means an electric motor and associated power electronics which provide acceleration torque to the drive wheels sometime during normal vehicle operation. This does not include components that could act as a motor, but are configured to act only as a generator or engine starter in a particular vehicle application.

"Fuel-fired heater" means a fuel burning device that creates heat for the purpose of warming the passenger compartment of a vehicle but does not contribute to the propulsion of the vehicle.

"Hybrid electric vehicle" or "HEV" means any vehicle that can draw propulsion energy from both of the following on-vehicle sources of stored energy: 1) a consumable fuel and 2) an energy storage device such as a battery, capacitor, or flywheel.

"HFEDS" means highway fuel economy driving schedule. See 40 CFR 600.109(b).

"Neighborhood Electric Vehicle" or "NEV" means a motor vehicle that meets the definition of "low-speed vehicle" either in section 385.5 of the Vehicle Code or in 49 CFR 571.500 (as it existed on July 1, 2000), and is certified to zero-emission vehicle standards.

~~**"HFEDS"** means highway fuel economy driving schedule. See 40 CFR 600.109(b).~~

"Off-vehicle charge capable" means having the capability to charge a battery from an off-vehicle electric energy source that cannot be connected or coupled to the vehicle in any manner while the vehicle is being driven.

"Placed in service" means having been sold or leased to an end-user and not just to a dealer or other distribution chain entity, and having been individually registered for on-road use by the California Department of Motor Vehicles.

"PZEV" means any vehicle that is delivered for sale in California and that qualifies for a partial ZEV allowance of at least 0.2.

"Regenerative braking" means the partial recovery of the energy normally dissipated into friction braking that is returned as electrical current to an energy storage device.

"SC03" means the U.S. EPA SC03 driving schedule representing vehicle operation with air conditioning, as set forth in Appendix I of 40 CFR Part 86.

"SOC Net Change Tolerance" means the state-of-charge net change tolerance that is applied to the SOC Criterion for charge-sustaining hybrid electric vehicles when validating an emission test. See section D.8 of these procedures for tolerance specifications.

"SOC Criterion" means the state-of-charge criterion that is applied to charge-sustaining hybrid electric vehicle to validate an emission test. The SOC Criterion requires that no net change in battery energy occurs over a given test cycle, i.e. the final battery state-of-charge that is recorded at the end of the emission test must be equivalent to the initial battery state-of-charge that is set at the beginning of the emission test. The SOC Net Change Tolerance shall be applied to the SOC Criterion.

"Specialty ZEV" means a ZEV that is designed for a commercial or governmental fleet application, and either [i] has the same zero emissions energy storage device and chassis as an existing ZEV from which it is modified, or [ii] in the case of a vehicle that is not based on an existing ZEV platform, is optimized for a particular duty cycle, such as urban delivery service, that conflicts with optimization for maximum vehicle range.

"Type 0, I, II, and III ZEV" all have the meanings set forth in section C.4.4(a).

"US06" means the US06 driving schedule for aggressive driving as set forth in Appendix I of 40 CFR Part 86.

"UDDS" means urban dynamometer driving schedule as set forth Appendix I of 40 CFR Part 86.

"Zero-emission vehicle" or **"ZEV"** means any vehicle certified to zero-emission standards.

"Zero-emission VMT" means the vehicle miles traveled with zero exhaust emissions of any criteria pollutant (or precursor pollutant).

C. Zero-Emission Vehicle Standards.

1. ZEV Emission Standard. The Executive Officer shall certify new 2005 ~~and subsequent~~through 2008 model passenger cars, light-duty trucks and medium-duty vehicles as ZEVs if the vehicles produce zero exhaust emissions of any criteria pollutant (or precursor pollutant) under any and all possible operational modes and conditions. Incorporation of a fuel-fired heater shall not preclude a vehicle from being certified as a ZEV provided: (1) the fuel-fired heater cannot be operated at ambient temperatures above 40°F, (2) the heater is demonstrated to have zero fuel evaporative emissions under any and all possible operational modes and conditions, and (3) the emissions of any pollutant from the fuel-fired heater when operated at an ambient temperature between 68°F and 86°F do not exceed the emission standard for that pollutant for a ULEV under section 1961(a)(1), title 13, CCR.

A vehicle that would meet the emissions standards for a ZEV except that it uses a fuel-fired heater that can be operated at ambient temperatures above 40°F, that cannot be demonstrated to have zero fuel evaporative emissions under any and all possible operation modes and conditions, or that has emissions of any pollutant exceeding the emission standard for that pollutant for a ULEV under section 1961(a)(1), title 13, CCR, shall be certified based on the emission level of the fuel-fired heater.

2. Percentage ZEV Requirements

2.1 General Percentage ZEV Requirement.

(a) *Basic Requirement.* The minimum percentage ZEV requirement for each manufacturer is listed in the table below as the percentage of the PCs and LDT1s, and LDT2s to the extent required by section C.2.2(c), produced by the manufacturer and delivered for sale in California that must be ZEVs, subject to the conditions in section C.2.2.

Model Years	*Minimum ZEV Requirement*
2005 through 2008	10 percent
~~2009 through 2011~~	~~11 percent~~
~~2012 through 2014~~	~~12 percent~~
~~2015 through 2017~~	~~14 percent~~
~~2018 and subsequent~~	~~16 percent~~

(b) *Calculating the Number of Vehicles to Which the Percentage ZEV Requirement is Applied.* A manufacturer's volume of PCs and LDT1s produced and delivered for sale in California will be averaged for the 1997, 1998, and 1999 model years to determine the California PC and LDT1 production volume for the model year 2005 ZEV requirements. For ~~subsequent~~the three-year periods following model years 2005, a manufacturer's California production volume of PCs and LDT1s, and LDT2s as applicable, will be based on a three-year average of the manufacturer's volume of PCs and LDT1s, and LDT2s as applicable, produced and delivered for sale in California in

the prior fourth, fifth and sixth years (e.g. 2006 to 2008 model-year ZEV requirements will be based on California production volumes of PCs and LDT1s, and LDT2s as applicable, for 2000 to 2002 model years). This production averaging is used to determine ZEV requirements only, and has no effect on a manufacturer's size determination. As an alternative to the three year averaging of prior year production described above, a manufacturer may during model year 2005 or the first model year of a subsequent three year period elect to base its ZEV obligation on the number of PCs and LDT1s, and LDT2s to the extent required by section C.2.1(c), produced by the manufacturer and delivered for sale in California that same year. If a manufacturer elects to use this method after model year 2005 it must be used for each year of the three-year period. In applying the ZEV requirement, a PC, LDT1, or LDT2 as applicable, ~~(beginning in the 2007 model year)~~ that is produced by a small volume manufacturer, but is marketed in California by another manufacturer under the other manufacturer's nameplate, shall be treated as having been produced by the marketing manufacturer.

(c) *Phase-in of ZEV Requirements for LDT2s.* Beginning with the ZEV requirements for the 2007 model year, a manufacturer's LDT2 production shall be included in determining the manufacturer's overall ZEV requirement under section C.2.1(a) in the increasing percentages shown in the table below.

2007	*2008*	~~*2009*~~	~~*2010*~~	~~*2011*~~	~~*2012+*~~
17%	34%	~~51%~~	~~68%~~	~~85%~~	~~100%~~

(d) *Exclusion of ZEVs in Determining a Manufacturer's Sales Volume.* In calculating for purposes of section C2.1(b) and (c) the volume of PCs, LDT1s and LDT2s a manufacturer has produced and delivered for sale in California, the manufacturer shall exclude the number of ZEVs produced by the manufacturer, or by a subsidiary in which the manufacturer has a greater than 50% ownership interest, and delivered for sale in California.

2.2 Requirements for Large Volume Manufacturers.

(a) *Primary Requirements for Large Volume Manufacturers.* In the 2005 through 2008 model years, a large-volume manufacturer must meet at least 20% of its ZEV requirement with ZEVs or ZEV credits generated by such vehicles, and at least another 20% with ZEVs, advanced technology PZEVs, or credits generated by such vehicles. The remainder of the large-volume manufacturer's ZEV requirement may be met using PZEVs or credits generated by such vehicles. ~~As the ZEV requirement increases over time from 10% in model year 2005 to 16% in model years 2018 and subsequent, the maximum portion of a large volume manufacturer's percentage ZEV requirement that may be satisfied by PZEVs that are not advanced technology PZEVs, or credits generated by such vehicles, is limited to 6% of the manufacturer's applicable California PC, LDT1, and LDT2 production volume; advanced technology PZEVs or credits generated by such vehicles may be used to meet up to one-half of the manufacturer's remaining ZEV requirement.~~

(b) *Alternative Requirements for Large Volume Manufacturers.*

(1) *Minimum Floor for Production of Type III ZEVs.*

(A) *Requirement For the 2005-2008 Model Years.* A large volume manufacturer electing to be subject to the alternative compliance requirements during model years 2005 through 2008 must produce, deliver for sale, and place in service in California enough 2001-2008 model-year Type III ZEVs to generate ZEV credits sufficient to meet a cumulative percentage ZEV requirement of 1.09 percent of the manufacturer's average annual California sales of PCs and LDT1s over the five year period from model years 1997 through 2001, or submit an equivalent number of credits generated by such vehicles. The manufacturer may meet up to one half of this requirement with [i] 2004-2008 model-year Type I or Type II ZEVs, provided that 20 Type I ZEVs or 10 Type II ZEVs will equal one Type III ZEV, and [ii] 1997-2003 model-year Type I or Type II ZEVs that qualify for an extended service multiplier under section C.6. for a year primarily during calendar years 2004-2008, provided that 33 years of such a multiplier will equal one Type III ZEV.

(B) *[RESERVED]~~Requirement For the 2009-2011 Model Years.~~* ~~A large volume manufacturer electing to be subject to the alternative compliance requirements during model years 2009 through 2011 must produce, deliver for sale, and place in service in California enough 2009-2011 model year Type III ZEVs to generate ZEV credits sufficient to meet the 2009-2011 alternative path percentage, as calculated pursuant to section C.2.2(b)(1)(E), of the manufacturer's section C.2.1(a) percentage ZEV requirement for the 2010 model year, based on the prior year method described in section C.2.1(b), or submit an equivalent number of credits generated by such vehicles. The manufacturer may meet up to one half of this requirement with [i] 2009-2011 model-year Type I or Type II ZEVs, provided that 20 Type I ZEVs or 10 Type II ZEVs will equal one Type III ZEV, and [ii] 1997-2003 model-year ZEVs that qualify for an extended service multiplier under section C.6. for a year primarily during calendar years 2009-2011, provided that 33 years of such a multiplier will equal one Type III ZEV.~~

(C) *[RESERVED]~~Requirement For the 2012-2014 Model Years.~~* ~~A large volume manufacturer electing to be subject to the alternative compliance requirements during model years 2012 through 2014 must produce, deliver for sale, and place in service in California enough 2012-2014 model year Type III ZEVs to generate ZEV credits sufficient to meet the 2012-2014 alternative path percentage, as calculated pursuant to section C.2.2(b)(1)(E), of the manufacturer's section C.2.1(a) percentage ZEV requirement for the 2013 model year, based on the prior year method described in section C.2.1(b), or submit an equivalent number of credits generated by such vehicles. The manufacturer may meet up to one half of this requirement with 2012-2014 model year Type I or Type II ZEVs, provided that 10 Type I ZEVs or 5 Type II ZEVs will equal one Type III ZEV.~~

(D) *[RESERVED]~~Requirement For the 2015-2017 Model Years.~~* ~~A large volume manufacturer electing to be subject to the alternative compliance requirements during model years 2015 through 2017 must produce, deliver for sale, and place in service in California enough 2015-2017 model year Type III ZEVs to generate ZEV credits sufficient to meet the 2015-2017 alternative path percentage, as calculated in section C.2.2(b)(1)(E), of the manufacturer's section C.2.1(a) percentage ZEV requirement for the 2016 model year, based on the prior year method described in section C.2.1(b), or submit an equivalent number of credits generated by such vehicles. The manufacturer may meet up to one half of this requirement with 2015-2017 model year Type I or Type II ZEVs, provided that 10 Type I ZEVs or 5 Type II ZEVs will equal one Type III ZEV.*

(E) *[RESERVED]~~Calculation of a Manufacturer's Alternative Path Percentage.~~* ~~A manufacturer's alternative path percentage for a given time period is calculated as the target number of credits for each time period divided by the applicable combined model year ZEV obligation of all large volume manufacturers for that same time period, where:~~

~~*Time Period (MYs)*~~	~~*Target Number of Alternative Path Type III ZEVs*~~	~~*Credits per Vehicle*~~	~~*Target Number of Credits*~~	~~*Combined Model Year ZEV Obligation*~~	~~*Alternative Path Percentage*~~
~~2009 – 2011~~	~~2,500~~	~~4~~	~~10,000~~	~~A~~	~~10,000/Ax100~~
~~2012 – 2014~~	~~25,000~~	~~3~~	~~75,000~~	~~B~~	~~75,000/B x100~~
~~2015 – 2017~~	~~50,000~~	~~3~~	~~150,000~~	~~C~~	~~150,000/C x100~~

~~And where:~~

~~A = The combined total section C.2.1(a) percentage ZEV requirement, based on the prior year method described in section C.2.1(b), that would apply for all large manufacturers for the 2010 model year,~~
~~B = The combined total section C.2.1(a) percentage ZEV requirement, based on the prior year method described in section C.2.1(b), that would apply for all large manufacturers for the 2013 model year, and~~
~~C = The combined total section C.2.1(a) percentage ZEV requirement, based on the prior year method described in section C.2.1(b), that would apply for all large manufacturers for the 2016 model year.~~

(F) *Exclusion of Additional Credits for Transportation Systems.* Any additional credits for transportation systems generated in accordance with section C.7.5 shall not be counted towards compliance with this section C.2.2(b)(1)(A)~~-(E)~~.

(G) *Carry-over of Excess Credits.* ~~Where a manufacturer generates more qualifying ZEV credits than are needed to meet the minimum floor requirement for the production of Type III ZEVs in one of the periods identified in section C.2.2(b)(1)(A)-(C), the qualifying ZEV credits may be used towards meeting the minimum floor requirement for the production of Type III ZEVs in a subsequent period, provided that the value of these carryover credits shall be based on the model year in which the credits are used.~~ ZEV credits generated from excess production in model years 2005 through 2008 may be carried forward and applied to the 2009 through 2011 minimum floor requirement specified in 1962.1(b)(2)(B)1.b. provided that the value of these carryover credits shall be based on the model year in which the credits are used.

(H) *Failure to Meet Requirement for Production of Type III ZEVs.* A manufacturer that, after electing to be subject to the alternative requirements in section C.2.2(b) for any model year from 2005 through ~~2017~~2008, fails to meet the requirement in section C.2.2(b)(1)(A)~~-(D)~~ by the end of the specified ~~three or~~ four year period in which the model year falls, shall be treated as subject to the primary requirements in section C.2.1(a) for all model years in the specified ~~three or~~ four year period.

~~(I)~~ The number of Type III ZEVs needed for a manufacturer under section C.2.2(b)(1)(A)~~-(D)~~ shall be rounded to the nearest whole number.

(2) *Compliance With Percentage ZEV Requirements.* In the 2005 through 2008 model years, a large volume manufacturer electing to be subject to the alternative compliance requirements in a given model year must meet at least 40 percent of its ZEV requirement for that model year with ZEVs, advanced technology PZEVs, or credits generated from such vehicles. The remainder of the large volume manufacturer's ZEV requirement may be met using PZEVs or credits generated from such vehicles. ~~As the ZEV requirement increases over time from 11% in model year 2009 to 16% in model years 2018 and subsequent, the maximum portion of the large volume manufacturer's percentage ZEV requirement that may be satisfied by PZEVs that are not advanced technology PZEVs, or credits generated by such vehicles, is limited to 6% of the manufacturer's applicable California PC, LDT1, and LDT2 production volume; ZEVs, AT PZEVs, or credits generated by such vehicles may be used to meet the manufacturer's remaining ZEV requirement.~~

(3) *Sunset of Alternative Requirements After the ~~2017~~2008 Model Year.* The alternative requirements in section C.2.2(b) are not available after the ~~2017~~2008 model year.

(c) *Election of the Primary or Alternative Requirements for Large Volume Manufacturers for the 2005 through 2008 Model Years.* A large volume manufacturer shall be subject to the primary ZEV requirements for the 2005 model year unless it notifies the Executive Officer in writing prior to the start of the 2005 model year that it is electing to be subject to the alternative compliance requirements for that model year. Thereafter, through the 2008 model year, a manufacturer shall be subject to the same compliance option as applied in the previous model year unless it notifies the Executive

Officer in writing prior to the start of a new model year that it is electing to switch to the other compliance option for that new model year. However, a large volume manufacturer that has previously elected to be subject to the primary ZEV requirements for one or more of the model years in the ~~three or~~ four year periods identified in section C.2.2(b)(1)(A~~) (D~~) may prior to the end of the ~~three or~~ four year period elect to become subject to the alternative compliance requirements for the full ~~three or~~ four year period upon a demonstration that it has complied with all of the applicable requirements for that period in section C.2.2(b)(1)(A~~) (D~~).

(d) *Use of Credits from Model Year 2003-2004 PZEVs.* A large volume manufacturer may produce, and deliver for sale in California, model year 2003 or 2004 PZEVs that generate credits exceeding the number of credits equal to 6 percent of the average annual volume of 1997, 1998 and 1999 PCs and LDT1s produced and delivered for sale in California by the manufacturer. In that event, the manufacturer may use those excess credits as AT PZEV credits in the 2005 and 2006 model years.

2.3 Requirements for Intermediate Volume Manufacturers. In the 2005 ~~and subsequent~~through 2008 model years, an intermediate volume manufacturer may meet its ZEV requirement with up to 100 percent PZEVs or credits generated by such vehicles.

2.4 Requirements for Small Volume Manufacturers and Independent Low Volume Manufacturers. A small volume manufacturer or an independent low volume manufacturer is not required to meet the percentage ZEV requirements. However, a small volume manufacturer or an independent low volume manufacturer may earn and market credits for the ZEVs or PZEVs it produces and delivers for sale in California.

2.5 Counting ZEVs and PZEVs in Fleet Average NMOG Calculations. For purposes of calculating a manufacturer's fleet average NMOG value and NMOG credits under sections 1960.1(g)(2) and 1961(b) and (c), title 13, CCR, a vehicle certified as a ZEV is counted as one ZEV, and a PZEV is counted as one SULEV certified to the 150,000 mile standards, regardless of any ZEV or PZEV multipliers.

2.6 Implementation Prior to 2005 Model Year. Prior to the 2005 model year, a manufacturer that voluntarily produces vehicles meeting the ZEV emission standards applicable to 2005 and subsequent model year vehicles may certify the vehicles to those standards and requirements for purposes of calculating fleet average NMOG exhaust emission values and NMOG credits under sections 1960.1(g)(2) and 1961(b) and (c), title 13, CCR, and for calculating ZEV credits as set forth in section C.7.

2.7 ~~–~~Changes in Small Volume, Independent Low Volume, and Intermediate Volume Manufacturer Status.

(a) *Increases in California Production Volume.* In the 2003 ~~and subsequent~~through 2008 model years, if a small volume manufacturer's average

California production volume exceeds 4,500 units of new PCs, LDTs, and MDVs based on the average number of vehicles produced and delivered for sale for the three previous consecutive model years, or if an independent low volume manufacturer's average California production volume exceeds 10,000 units of new PCs, LDTs, and MDVs based on the average number of vehicles produced and delivered for sale for the three previous consecutive model years, or if an intermediate volume manufacturer's average California production volume exceeds 60,000 units of new PCs, LDTs, and MDVs based on the average number of vehicles produced and delivered for sale for the three previous consecutive model years, the manufacturer shall no longer be treated as a small volume, independent low volume, or intermediate volume manufacturer, as applicable, and shall comply with the ZEV requirements for independent low volume, intermediate volume or large volume manufacturers, as applicable, beginning with the sixth model year after the last of the three consecutive model years. The lead time shall be four rather than six years where a manufacturer ceases to be a small or intermediate volume manufacturer in the 2003 ~~or subsequent~~through 2008 model years due to the aggregation requirements in majority ownership situations, except that if the majority ownership in the manufacturer was acquired prior to the 2001 model year, the manufacturer must comply with the stepped-up ZEV requirements starting in the 2010 model year.

(b) *Decreases in California Production Volume.* If a manufacturer's average California production volume falls below 4,500, 10,000 or 60,000 units of new PCs, LDTs, and MDVs, as applicable, based on the average number of vehicles produced and delivered for sale for the three previous consecutive model years, the manufacturer shall be treated as a small volume, independent low volume, or intermediate volume manufacturer, as applicable, and shall be subject to the requirements for a small volume, independent low volume, or intermediate volume manufacturer beginning with the next model year. In determining small volume manufacturer status, vehicles produced by one manufacturer and marketed in California by another manufacturer under the other manufacturer's nameplate shall be treated as part of the California production volume of the sales of the marketing manufacturer.

(c) *Calculating California Production Volume in Change of Ownership Situations.* Where a manufacturer experiences a change in ownership in a particular model year, the change will affect application of the aggregation requirements on the manufacturer starting with the next model year. The manufacturer's small or intermediate volume manufacturer status for the next model year shall be based on the average California production volume in the three previous consecutive model years of those manufacturers whose production volumes must be aggregated for that next model year. For example, where a change of ownership during the 2004 model year results in a requirement that the production volume of Manufacturer A be aggregated with the production volume of Manufacturer B, Manufacturer A's status for the 2005 model year will be based on the production volumes of Manufacturers A and B in the 2002-2004 model years. Where the production volume of Manufacturer A must be aggregated with the production volumes of Manufacturers B and C for the 2004 model year, and during that model year a change in ownership eliminates the requirement that Manufacturer

B's production volume be aggregated with Manufacturer A's, Manufacturer A's status for the 2005 model year will be based on the production volumes of Manufacturers A and C in the 2002-2004 model years. In either case, the lead time provisions in section 2.~~5~~7(a) and (b) will apply.

3. Partial ZEV Allowance Vehicles (PZEVs).

3.1 Introduction. This section C.3 sets forth the criteria for identifying vehicles delivered for sale in California as PZEVs. A PZEV is a vehicle that cannot be certified as a ZEV but qualifies for a PZEV allowance of at least 0.2.

3.2 Baseline PZEV Allowance. In order for a vehicle to be eligible to receive a PZEV allowance, the manufacturer must demonstrate compliance with all of the following requirements. A qualifying vehicle will receive a baseline PZEV allowance of 0.2.

(a) *SULEV Standards.* Certify the vehicle to the 150,000-mile SULEV exhaust emission standards for PCs and LDTs in section 1961(a)(1), title 13, CCR (for model years 2003 through 2006, existing SULEV intermediate compliance standards shall apply to all PZEVs). Bi-fuel, fuel-flexible and dual-fuel vehicles must certify to the applicable 150,000-mile SULEV exhaust emission standards when operating on both fuels;

(b) *Evaporative Emissions.* Certify the vehicle to the evaporative emission standards in section 1976(b)(1)(E), title 13, CCR (~~"~~zero~~"~~ fuel evaporative emissions standards);

(c) *OBD.* Certify that the vehicle will meet the applicable on-board diagnostic requirements in section~~s~~ 1968.1 or 1968.2, as applicable, title 13, CCR for 150,000 miles; and

(d) *Extended Warranty.* Extend the performance and defects warranty period set forth in sections 2037(b)(2) and 2038(b)(~~2~~1) to 15 years or 150,000 miles, whichever occurs first, except that the time period is to be 10 years for a zero emission energy storage device used for traction power (such as a battery, ultracapacitor, or other electric storage device).

3.3 Zero-Emission VMT PZEV Allowance.

(a) *Calculation of Zero Emission VMT Allowance.* A vehicle that meets the requirements of section C.3.2 and has zero-emission vehicle miles traveled ("VMT") capability will generate an additional zero emission VMT PZEV allowance, calculated as follows:

Urban All-Electric Range	*Zero-emission VMT Allowance*
< 10 miles	0.0
10 miles to 90 miles	(33.8 + [0.5 x Urban AER])/35
> 90 miles	2.25

The urban all-electric range shall be determined in accordance with section E.3.(2)(a) of these test procedures.

(b) *Alternative Procedures.* As an alternative to determining the zero-emission VMT allowance in accordance with the preceding section C.3.3(a), a manufacturer may submit for Executive Officer approval an alternative procedure for determining the zero-emission VMT potential of the vehicle as a percent of total VMT, along with an engineering evaluation that adequately substantiates the zero-emission VMT determination. For example, an alternative procedure may provide that a vehicle with zero-emissions of one regulated pollutant (e.g. NOx) and not another (e.g. NMOG) will qualify for a zero-emission VMT allowance of 1.5.

(c) *Additional Allowances for Qualifying HEVs.* The Executive Officer shall approve an additional 0.1 zero-emission VMT partial ZEV allowance for an HEV with an all-electric range if the manufacturer demonstrates to the reasonable satisfaction of the Executive Officer that the HEV is equipped with software and/or other strategies that would promote maximum use of off-vehicle charging, and that the strategies employed are reasonably reliable and tamper-proof.

3.4 PZEV Allowance for Advanced ZEV Componentry. A vehicle that meets the requirements of section C.3.2 may qualify for an advanced componentry PZEV allowance as provided in this section 3.4.

(a) *Use of High Pressure Gaseous Fuel or Hydrogen Storage System.* A vehicle equipped with a high pressure gaseous fuel storage system capable of refueling at 3600 pounds per square inch or more and operating exclusively on this gaseous fuel shall qualify for an advanced componentry PZEV allowance of 0.2. A vehicle capable of operating exclusively on hydrogen stored in a high pressure system capable of refueling at 3600 pounds per square inch or more, or stored in nongaseous form, shall instead qualify for an advanced componentry PZEV allowance of 0.3.

(b) *Use of a Qualifying HEV Electric Drive System.*

(1) *Classification of HEVs.* HEVs qualifying for additional allowances or allowances that may be used in the AT PZEV category are classified in one of five types of HEVs based on the criteria in the following table.

Characteristics	*Type A*	*Type B*	*Type C*	*Type D*	*Type E*
Electric Drive System Peak Power Output	>= 4 kW	>= 4 kW <10 kW	>= 10 kW	>= 10 kW	>= 50 kW
Traction Drive System Voltage	<60 Volts	>= 60 Volts	< 60 Volts	>= 60 Volts	>= 60 volts
Traction Drive Boost	Yes	Yes	Yes	Yes	Yes
Regenerative Braking	Yes	Yes	Yes	Yes	Yes
Idle Start/Stop	Yes	Yes	Yes	Yes	Yes

(2) *Type A HEVs.* A 2008 or earlier model-year PZEV that the manufacturer demonstrates to the reasonable satisfaction of the Executive Officer meets all of the criteria for a Type A HEV does not receive an additional allowance for meeting those criteria but generates credits that may be used in the AT PZEV category through the 2008 model year.

(3) *Type B HEVs.* A 2008 or earlier model-year PZEV that the manufacturer demonstrates to the reasonable satisfaction of the Executive Officer meets all of the criteria for a Type B HEV qualifies for an additional advanced componentry allowance of 0.2.

(4) *Type C HEVs.* A ~~2011~~2008 or earlier model-year PZEV that the manufacturer demonstrates to the reasonable satisfaction of the Executive Officer meets all of the criteria for a Type C HEV, and that is equipped with an advanced traction energy storage system – such as nickel metal-hydride batteries, ultracapacitors, or other similar systems – with a design lifetime of at least 10 years, qualifies for an additional advanced componentry allowance of 0.2.

(5) *Type D HEVs.* A PZEV that the manufacturer demonstrates to the reasonable satisfaction of the Executive Officer meets all of the criteria for a Type D HEV qualifies for an additional advanced componentry allowance of 0.4 in the 2003 through ~~2011~~2008 model years~~, 0.35 in the 2012 through 2014 model years, and 0.25 in the 2015 and subsequent model years~~.

(6) *Type E HEVs.* A PZEV that the manufacturer demonstrates to the reasonable satisfaction of the Executive Officer meets all of the criteria for a Type E HEV qualifies for an additional advanced componentry allowance of 0.5 in the 2003 through ~~2011~~2008model years~~, 0.45 in the 2012 through 2014 model years, and 0.35 in the 2015 and subsequent model years~~.

(7) *Severability.* In the event that all or part of section C.3.4(b)(1)-(6) is found invalid, the remainder of these standards and test procedures, including the remainder of section C.3.4(b)(1)-(6) if any, remains in full force and effect.

3.5 PZEV Allowance for Low Fuel-Cycle Emissions. A vehicle that uses fuel(s) with very low fuel-cycle emissions shall receive a PZEV allowance not to exceed 0.3 (0.15 in the case of an HEV that uses for propulsion any fuel that does not have very low fuel-cycle emissions). In order to receive the fuel-cycle PZEV allowance, a manufacturer must demonstrate to the Executive Officer, using peer-reviewed studies or other relevant information, that NMOG emissions associated with the fuel(s) used by the vehicle (on a grams/mile basis) are lower than or equal to 0.01 grams/mile. Fuel-cycle emissions must be calculated based on near-term production methods and infrastructure assumptions, and the uncertainty in the results must be quantified. The fuel-cycle PZEV allowance is calculated according to the following formula:

PZEV Fuel Cycle Allowance = 0.3 x [(percent of VMT using fuel(s) meeting the requirements of the preceding paragraph)/ 100]

A manufacturer's demonstration to the Executive Officer that a vehicle qualifies for a fuel-cycle PZEV allowance shall include test results and/or empirical data supporting the estimate of the relative proportion of VMT while operating on fuel(s) with very low fuel-cycle emissions.

3.6 Calculation of PZEV Allowance.

(a) *Calculation of Combined PZEV Allowance for a Vehicle.* The combined PZEV allowance for a qualifying vehicle in a particular model year is the sum of the PZEV allowances listed in this section C.3.6, multiplied by any PZEV introduction phase-in multiplier listed in section C.3.7, subject to the cap in section C.3.6(b).

(1) *Baseline PZEV Allowance.* The baseline PZEV allowance of 0.2 for vehicles meeting the criteria in section C.3.2;

(2) *Zero Emission VMT PZEV Allowance.* The zero-emission VMT PZEV allowance, if any, determined in accordance with section C.3.3.;

(3) *Advanced ZEV Componentry PZEV Allowance.* The advanced ZEV componentry PZEV allowance, if any, determined in accordance with section C.3.4; and

(4) *Fuel-cycle Emissions PZEV Allowance.* The fuel-cycle emissions PZEV allowance, if any, determined in accordance with section C.3.5.

(b) *Caps on the Value of an AT PZEV Allowance.*

(1) *[RESERVED]~~Cap for 2012 and Subsequent Model Year Vehicles. The maximum value of AT PZEV allowances a 2012 and subsequent model year vehicle may earn, including the baseline PZEV allowance, is 3.0.~~*

(2) *Cap Based on the Credit Value of a Type III ZEV.* In no case may the combined AT PZEV allowance for a qualifying vehicle in a particular model year, including the baseline PZEV allowance, exceed the ZEV credits for a Type III ZEV placed in service in the same model year.

3.7 PZEV Multipliers

(a) *PZEV Introduction Phase-In Multiplier.* Each 2000 through 2005 model-year PZEV that is produced and delivered for sale in California, other than a PZEV qualifying for a phase-in multiplier under section C.3.7(b), qualifies for a PZEV introduction phase-in multiplier as follows:

	MY 2000-2003	*MY 2004*	*MY 2005*
Multiplier	4.0	2.0	1.33

(b) *Introduction Phase-In Multiplier for PZEVs That Earn a Zero Emission VMT Allowance.* Each 2000 through ~~2011~~2008 model year PZEV that earns a zero emission VMT allowance under section C.3.3 and is produced and delivered for sale in California qualifies for a phase-in multiplier as follows:

	MY 2000-2008	*~~MY 2009-2011~~*
Multiplier	6.0	~~3.0~~

4. Qualification for ZEV Multipliers and Credits.

4.1 1999-2000 Model-Year ZEV Multiplier Calculation for Extended Electric Range Vehicles. Each ZEV that is produced and delivered for sale in California in the 1999-2000 model years and that has an extended electric range shall qualify for a ZEV multiplier as follows:

All-electric range	*MY 1999-2000*
100-175	6-10

ZEV multipliers under the above schedule will be determined by linear interpolation between the values shown in the above schedule. Range shall be determined in accordance with section E.3.(2)(a) of these test procedures. ZEVs that have a refueling time of less than 10 minutes and a range of 100 miles or more shall be counted as having unlimited all-electric range, and shall consequently earn the maximum allowable ZEV multiplier for a specific model year. ZEVs that have a range of 80 to 99 miles shall

qualify for ZEV multipliers in the 1999-2000 model years in accordance with the following equation:

ZEV multiplier = (6) x (AER equivalent to a 10 minute recharge/100) x 0.5.

As an option to the above mechanism, the manufacturer of a 1999 model-year ZEV may elect to have its multiplier based on the regulatory requirements pertaining to multipliers based on range or specific energy in section 1960.1(g)(2) and (h)(2). title 13, CCR, that were applicable to 1999 model-year ZEVs immediately before this section 1962 became operative on November 27, 1999 as a result of the "LEV II" rulemaking.

4.2 ZEV Multipliers for 2001-2002 Model Years.

(a) *ZEV Phase-In Multiplier.* Each 2001 and 2002 model-year ZEV that is placed in service in California by September 30, 2003 qualifies for a ZEV phase-in multiplier of 4.0. A 2001 or 2002 model-year ZEV that is placed in service in California after September 30, 2003 earns credits in accordance with section 4.4 instead of section 4.2.

(b) *ZEV Extended Electric Range Multiplier.*

(1) *Basic Multiplier Schedule.* Each 2001 and 2002 model-year ZEV that is placed in service in California and that has an extended urban electric range qualifies for a ZEV extended electric range multiplier as follows:

Urban All-Electric Range	*Multiplier*
< 50 miles	1
>≧ 50 miles to < 275 miles	(Urban AER-25)/25
>≧ 275 miles	10

A NEV is not eligible to earn a ZEV extended electric range multiplier. In determining ZEV range multipliers, specialty ZEVs may, upon Executive Officer approval, be tested at the parameters used to determine the ZEV multipliers for the existing ZEV.

(2) *Fast refueling.*

(A) *Full Fueling in 10 Minutes or Less.* A 2001 -2002 model-year ZEV with the demonstrated capability to accept fuel or electric charge until achieving at least 95% SOC or rated fuel capacity in 10 minutes or less when starting from all operationally allowable SOC or fuel states is counted as having unlimited zero emission range and qualifies for the maximum allowable ZEV extended electric range multiplier.

(B) *At Least 60-Mile Range in Less Than 10 Minutes.* A 2001-2002 model year ZEV with the demonstrated capacity to accept fuel or electric charge equivalent to at least 60 miles of UDDS range when starting from 20% SOC in less than 10 minutes is counted as having 60 additional miles (up to a 275 mile maximum) of UDDS range in the range multiplier determination in section C.4.2(c)(1).

(c) *Combined Multiplier.* During the 2001-2002 model years, the combined ZEV multiplier for each ZEV in a specific model year is the product of:

(1) The ZEV phase-in multiplier if any as set forth in section C.4.2(a), times

(2) The extended electric range multiplier if any as set forth in section C.4.2(b).

4.3 Effect of ZEV Multipliers in the 1996-2002 Model Years. In calculating the number of ZEVs produced and delivered for sale in California by a manufacturer in the 1996-2002 model years and the ZEV credits from such vehicles, the number of ZEVs qualifying for a particular ZEV multiplier shall be multiplied by the combined ZEV multiplier.

4.4 ZEV Credits for the 2003 ~~and Subsequent~~through 2008 Model Years.

(a) *ZEV Tiers for Credit Calculations.* Starting in the 2003 model year, ZEV credits from a particular ZEV are based on the assignment of a given ZEV into one of the following five ZEV tiers:

ZEV Tier	*Common Description*	*UDDS ZEV Range*	*Fast Refueling Capability*
NEV	NEV	No minimum	N/A
Type 0	Utility EV	<50 miles	N/A
Type I	City EV	>= 50, <100 miles	N/A
Type II	Full Function EV	>= 100 miles	N/A
Type III	Fuel Cell EV	>= 100 miles	Must be capable of replacing 95% maximum rated energy capacity in <= 10 minutes

A specialty ZEV that has the same zero emission energy storage device and chassis as an existing ZEV from which it was modified may, upon Executive Officer approval, be categorized on the basis of that existing ZEV. A specialty vehicle that is optimized for a particular duty cycle that conflicts with optimization for maximum vehicle range may be promoted to the next higher ZEV tier upon a determination by the Executive Officer that the specialty vehicle has ZEV componentry equivalent to that utilized by ZEVs in the

next tier and would meet the requirements for the next tier if optimized for maximum range.

(b) *ZEV Credits for 2003 ~~and Subsequent~~through 2008 Model-Year ZEVs.* A 2003 ~~and subsequent~~through 2008 model-year ZEV, other than a NEV, earns 1 ZEV credit when it is produced and delivered for sale in California. A 2003 ~~and subsequent~~through 2008 model-year ZEV earns additional credits based on the earliest model year in which the ZEV is placed in service (not earlier than the ZEV's model year). The following table identifies the total credits that a ZEV in each of the five ZEV tiers will earn, including the credit not contingent on placement in service, if it is placed in service in the specified model year or by June 30 after the end of the specified ~~model~~ year.

Total Credit Earned by ZEV Type and Model Year for Production and Delivery for Sale and for Placement										
Tier	*~~Model~~ Year in Which ZEV is Placed in Service*									
	2003	*2004*	*2005*	*2006*	*2007*	*2008*	*~~2009~~*	*~~2010~~*	*~~2011~~*	*~~2012+~~*
NEV	1.25	0.625	0.625	0.15	0.15	0.15	~~0.15~~	~~0.15~~	~~0.15~~	~~0.15~~
Type 0 (Utility)	1.5	1.5	1.5	1.5	1.5	1.5	~~1~~	~~1~~	~~1~~	~~1~~
Type 1 (City)	8	8	8	7	7	7	~~2~~	~~2~~	~~2~~	~~2~~
Type II	12	12	12	10	10	10	~~3~~	~~3~~	~~3~~	~~3~~
Type III	40	40	40	40	40	40	4	4	4	~~3~~

(c) *Multiplier for Certain Type I and Type II ZEVs.* A 2004 through ~~2011~~2008 model-year Type I and Type II ZEV shall qualify for a multiplier of 1.25 if it is either sold to a motorist or is leased for three or more years to a motorist who is given the option to purchase or re-lease the vehicle for two years or more at the end of the first lease term.

(d) *Counting a Type III ZEV Placed in a Section 177 State.* Through the ~~2011~~2008 model year, a Type III ZEV that is certified to the California ZEV standards and is placed in service in a state that is administering the California ZEV requirements pursuant to section 177 of the federal Clean Air Act (42 U.S.C. § 7507) applicable for the ZEV's model year may be counted towards compliance with the California percentage ZEV requirements in section C.2, including the requirements in section C.2.2(b), as if it were delivered for sale and placed in service in California. Similarly, a ~~2011~~2008 and earlier model-year Type III ZEV that is certified to the California ZEV standards and is placed in service in California may be counted towards the percentage ZEV requirements of any state that is administering the California ZEV requirements

pursuant to section 177 of the federal Clean Air Act, including requirements based on section C.2.2(b).

5. [Reserved]

6. Extended Service Multiplier for 1997-2003 Model-Year ZEVs and PZEVs With ≥ 10 Mile Zero Emission Range. Except in the case of a NEV, an additional ZEV or PZEV multiplier will be earned by the manufacturer of a 1997 through 2003 model-year ZEV, or PZEV with ≥ 10 mile zero emission range, for each full year it is registered for operation on public roads in California beyond its first three years of service, through the ~~2011~~2008 calendar year. For additional years of service starting earlier than April 24, 2003, the manufacturer will receive 0.1 times the ZEV credit that would be earned by the vehicle if it were leased or sold new in that year, including multipliers, on a year-by-year basis beginning in the fourth year after the vehicle is initially placed in service. For additional years of service starting April 24, 2003 or later, the manufacturer will receive 0.2 times the ZEV credit that would be earned by the vehicle if it were leased or sold new in that year, including multipliers, on a year-by-year basis beginning in the fourth year after the vehicle is initially placed in service. The extended service multiplier is reported and earned in the year following each continuous year of service.

7. Generation and Use of ZEV Credits; Calculation of Penalties

7.1 Introduction. A manufacturer that produces and delivers for sale in California ZEVs or PZEVs in a given model year exceeding the manufacturer's ZEV requirement set forth in section C.2 shall earn ZEV credits in accordance with this section C.7.

7.2 ZEV Credit Calculations.

(a) *Credits from ZEVs.* The amount of g/mi ZEV credits earned by a manufacturer in a given model year from ZEVs shall be expressed in units of g/mi NMOG, and shall be equal to the number of credits from ZEVs produced and delivered for sale in California that the manufacturer applies towards meeting the ZEV requirements for the model year subtracted from the number of ZEVs produced and delivered for sale in California by the manufacturer in the model year and then multiplied by the NMOG fleet average requirement for PCs and LDT1s for that model year.

(b) *Credits from PZEVs.* The amount of g/mi ZEV credits from PZEVs earned by a manufacturer in a given model year shall be expressed in units of g/mi NMOG, and shall be equal to the total number of PZEV allowances from PZEVs produced and delivered for sale in California that the manufacturer applies towards meeting its ZEV requirement for the model year subtracted from the total number of PZEV allowances from PZEVs produced and delivered for sale in California by the manufacturer in the

model year and then multiplied by the NMOG fleet average requirement for PCs and LDT1s for that model year.

(c) *Separate Credit Accounts.* The number of credits from a manufacturer's [i] ZEVs and [ii] advanced technology PZEVs, and [iii] all other PZEVs shall each be maintained separately.

7.3 ZEV Credits for MDVs and LDTs Other Than LDT1s. ZEVs and PZEVs classified as MDVs or as LDTs other than LDT1s may be counted toward the ZEV requirement for PCs, ~~and~~ LDT1s, and LDT2s as applicable, and included in the calculation of ZEV credits as specified in this section C.4 if the manufacturer so designates.

7.4 ZEV Credits for Advanced Technology Demonstration Programs. A vehicle, other than a NEV, that is placed in a California advanced technology demonstration program may earn ZEV credits even if it is not "delivered for sale~~.~~" or registered with the California Department of Motor Vehicles (DMV). To earn such credits, the manufacturer must demonstrate to the reasonable satisfaction of the Executive Officer that the vehicles will be regularly used in applications appropriate to evaluate issues related to safety, infrastructure, fuel specifications or public education, and that for more than 50 percent of the first year of placement the vehicle will be situated in California. Such a vehicle is eligible to receive the same allowances and credits that it would have earned if placed in service. To determine vehicle credit, the model-year designation for a demonstration vehicle shall be consistent with the model-year designation for conventional vehicles placed in the same timeframe.

7.5 ZEV Credits for Transportation Systems.

(a) *General.* In model years 2001 through ~~2011~~2008, a ZEV, advanced technology PZEV or PZEV placed as part of a transportation system may earn additional ZEV credits, which may used in the same manner as other credits earned by vehicles of that category, except as provided in section C.7.5(c) below. A NEV is not eligible to earn credit for transportation systems. To earn such credits, the manufacturer must demonstrate to the reasonable satisfaction of the Executive Officer that the vehicle will be used as a part of a project that uses an innovative transportation system as described in section 7.5(b) below.

(b) *Credits Earned.* In order to earn additional credit under this section (g)(5), a project must at a minimum demonstrate [i] shared use of ZEVs, AT PZEVs or PZEVs, and [ii] the application of "intelligent" new technologies such as reservation management, card systems, depot management, location management, charge billing and real-time wireless information systems. If, in addition to factors [i] and [ii] above, a project also features linkage to transit, the project may receive further additional credit. For ZEVs only, not including NEVs, a project that features linkage to transit, such as dedicated parking and charging facilities at transit stations, but does not demonstrate shared use or the application of intelligent new technologies, may also receive

additional credit for linkage to transit. The maximum credit awarded per vehicle shall be determined by the Executive Officer, based upon an application submitted by the manufacturer and, if appropriate, the project manager. The maximum credit awarded shall not exceed the following:

Type of Vehicle	*Shared Use, Intelligence*	*Linkage to Transit*
PZEV	2	1
Advanced Technology PZEV	4	2
ZEV	6	3

(c) *Cap on Use of Credits.*

(1) *ZEVs.* Credits earned or allocated by ZEVs pursuant to this section C.7.5, not including all credits earned by the vehicle itself, may be used to satisfy up to one-tenth of a manufacturer's ZEV obligation in any given model year.

(2) *AT PZEVs.* Credits earned or allocated by AT PZEVs pursuant to this section C.7.5, not including all credits earned by the vehicle itself, may be used to satisfy up to one-twentieth of a manufacturer's ZEV obligation in any given model year, but may only be used in the same manner as other credits earned by vehicles of that category.

(3) *PZEVs.* Credits earned or allocated by PZEVs pursuant to this section C.7.5, not including all credits earned by the vehicle itself, may be used to satisfy up to one-fiftieth of the manufacturer's ZEV obligation in any given model year, but may only be used in the same manner as other credits earned by vehicles of that category.

(d) *Allocation of Credits.* Credits shall be assigned by the Executive Officer to the project manager or, in the absence of a separate project manager, to the vehicle manufacturers upon demonstration that a vehicle has been placed in a project. Credits shall be allocated to vehicle manufacturers by the Executive Officer in accordance with a recommendation submitted in writing by the project manager and signed by all manufacturers participating in the project, and need not be allocated in direct proportion to the number of vehicles placed.

7.6 ~~Submittal~~Use of ZEV Credits. A manufacturer may meet the ZEV requirements in any given model year by submitting to the Executive Officer a commensurate amount of g/mi ZEV credits, consistent with section C.2. These credits may be earned previously by the manufacturer or acquired from another party, except that beginning with the 2006 model year credits earned from NEVs offered for sale or placed in service in model years 2001 through 2005 cannot be used to satisfy more than the following portion of a manufacturer's percentage ZEV obligation that may only be satisfied with credits from ZEVs~~ and, starting with the 2009 model year, the manufacturer's percentage ZEV obligation that may be satisfied by credits from AT PZEVs but not PZEVs:~~

ZEV Category		~~AT PZEV Category~~	
2006	2007 and beyond	~~2009~~	~~2010 and beyond~~
75%	50%	~~75%~~	~~50%~~

This limitation applies to credits earned in model years 2001 through 2005 by the same manufacturer or earned in model years 2001 through 2005 by another manufacturer and acquired. The amount of g/mi ZEV credits required to be submitted shall be calculated according to the criteria set forth in this section C.7.

ZEV credits generated from excess production in model years 2005 through 2008, including those acquired from another party, may be carried forward and applied to the manufacturer's percentage ZEV obligation that may only be satisfied by credits from ZEVs in section 1962.1(b)(2)(B)1.b. Beginning with the 2012 model year, those earned ZEV credits may no longer be used to satisfy the manufacturer's percentage ZEV obligation that may only be satisfied by credits from ZEVs, but may be used to satisfy the manufacturer's percentage ZEV obligation that may be satisfied by credits from Enhanced AT PZEVs, AT PZEVs, or PZEVs. For example, ZEV credit earned in 2008 would retain full flexibility through 2011, at which time that credit could only be used as Enhanced AT PZEV, AT PZEV, or PZEV credits.

7.7 Requirement to Make Up a ZEV Deficit.

(a) *General.* A manufacturer that produces and delivers for sale in California fewer ZEVs than required in a given model year shall make up the deficit by the end of the ~~next~~third model year by submitting to the Executive Officer a commensurate amount of g/mi ZEV credits~~, except that credits generated from PZEVs may be used to offset deficits for two model years~~. The amount of ZEV credits required to be submitted shall be calculated by [i] adding the number of ZEVs produced and delivered for sale in California by the manufacturer for the model year to the number of ZEV allowances from partial ZEV allowance vehicles produced and delivered for sale in California by the manufacturer for the model year (for a large volume manufacturer, not to exceed that permitted under section C.2.1), [ii] subtracting that total from the number of ZEVs required to be produced and delivered for sale in California by the manufacturer for the model year, and [iii] multiplying the resulting value by the fleet average requirements for PCs and LDT1s for the model year in which the deficit is incurred.

7.8 Penalty for Failure to Meet ZEV Requirements. Any manufacturer that fails to produce and deliver for sale in California the required number of ZEVs ~~or~~and submit an appropriate amount of g/mi ZEV credits and does not make up ZEV deficits within the specified time period shall be subject to the Health and Safety Code section 43211 civil penalty applicable to a manufacturer that sells a new motor vehicle that does not meet the applicable emission standards adopted by the state board. The cause of action shall be deemed to accrue when the ZEV deficits are not balanced by the end of the specified time period. For the purposes of Health and Safety Code

section 43211, the number of vehicles not meeting the state board's standards shall be calculated according to the following equation, provided that the percentage of a large volume manufacturer's ZEV requirement for a given model year that may be satisfied with partial ZEV allowance vehicles or ZEV credits from such vehicles may not exceed the percentages permitted under section C.2.1:

(No. of ZEVs required to be produced and delivered for sale in California for the model year) - (No. of ZEVs produced and delivered for sale in California for the model year) - (No. of ZEV allowances from partial ZEV allowance vehicles produced and delivered for sale in California for the model year) - [(Amount of ZEV credits submitted for the model
year) / (the fleet average requirement for PCs and LDT1s for the model-year)].

8. Severability. Each provision of these standards and test procedures is severable, and in the event that any provision of these standards and test procedures is held to be invalid, the remainder of the standards and test procedures remains in full force and effect.

D. Certification Requirements [NO CHANGE]

E. Test Procedures [NO CHANGE]

Appendix A: Standards and Test Procedures
Part 3

Proposed Regulation Order Part 3: Amend California Code of Regulations, title 13, section 1961 for Low Emission Vehicles (fuel fired heater amend if necessary)

Amend § 1961. "Exhaust Emission Standards and Test Procedures - 2004 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles" to read:

[NO CHANGE].

Appendix A: Standards and Test Procedures
Part 4

Proposed Regulation Order Part 4: Amend California Code of Regulations, title 13, section 1900 for Zero Emission Vehicle Definitions

Amend Title 13, Motor Vehicles, Division 3, Air Resources Board, Chapter 1, Motor Vehicle Pollution Control Devices, Article 1, General Provisions, § 1900, Definitions to read:

§ 1900. Definitions.

(a) The definitions of this section supplement and are governed by the definitions set forth in chapter 2 (commencing with section 39010), part 1, division 26 of the Health and Safety Code. The definitions set forth in the applicable model-year new vehicle certification and assembly-line test procedures adopted in this chapter are hereby incorporated by reference.

(b) In addition to the definitions incorporated under subdivision (a), the following definitions shall govern the provisions of this chapter;

(1) – (7) [NO CHANGE.]

(8) "Independent low volume manufacturer" means a manufacturer with California annual sales of less than 10,000 new passenger cars, light-duty trucks and medium-duty vehicles following aggregation of sales pursuant to this section 1900(b)(8). Annual sales shall be determined as the average number or sales sold for the three previous consecutive model years for which a manufacturer seeks certification; however, for a manufacturer certifying for the first time in California, annual sales shall be based on projected California sales for the model year. A manufacturer's California sales shall consist of all vehicles or engines produced by the manufacturer and delivered for sale in California, except that vehicles or engines produced by the manufacturer and marketed in California by another manufacturer under the other manufacturer's nameplate shall be treated as California sales of the marketing manufacturer. The annual sales from different firms shall be aggregated in the following situations: (1) vehicles produced by two or more firms, one of which is 10% or greater part owned by another; except in circumstances for which the Executive Officer determines that 10% or greater ownership by one of the firms does not result in responsibility for overall direction of both firms; or (2) vehicles produced by any two or more firms if a third party has equity ownership of 10% or more in each of the firms; or (3) vehicles produced by two or more firms having a common corporate officer(s) who is (are) responsible for the overall direction of the companies; or (4) vehicles imported or distributed by all firms where the vehicles are manufactured by the same entity and the importer or distributor is an authorized agent of the entity.

(9) – (22) [NO CHANGE.]

Note: Authority cited: Sections 39600, 39601, 43013, 43018, 43101 and 43104, Health and Safety Code. Reference: Sections 39002, 39003, 39010, 39500, 40000, 43000, 43013, 43018.5, 43100, 43101, 43101.5, 43102, 43103, 43104, 43106 and 43204, Health and Safety Code; and Section 27156, Vehicle Code.

Appendix A: Standards and Test Procedures
Part 5

Proposed Regulation Order Part 5: Amend California Code of Regulations, title 13, section 1962.1 for Zero Emission Vehicle Charging Stations (renumber to 1962.2)

Renumber Title 13, Motor Vehicles, Division 3, Air Resources Board, Chapter 1, Motor Vehicle Pollution Control Devices, Article 1, General Provisions, § 1962.1, Electric Vehicle Charging Requirements as follows:

§ 1962.~~1~~2. Electric Vehicle Charging Requirements

(a) Applicability.This section applies to (1) all battery electric vehicles that qualify for 1.0 or greater ZEV credit under section 1962, and (2) all hybrid electric vehicles that are capable of being recharged by a battery charger that transfers energy from the electricity grid to the vehicle for purposes of recharging the vehicle traction battery, other than battery electric vehicles and hybrid electric vehicles that are only capable of Level 1 charging.

(b) Definitions.

(1) The definitions in section 1962 apply to this section.

(2) "Level 1 charging" means a charging method that allows an electric vehicle or hybrid electric vehicle to be charged by having its charger connected to the most common grounded receptacle (NEMA 5-15R). A vehicle that is only capable of Level 1 charging is one that is charged by an on-board or off-board charger capable of accepting energy from the existing AC supply network. The maximum power is 12 amps, with a branch circuit rating of 15 amps, and continuous power of 1.44 kilowatts.

(c) Requirements. Beginning with the 2006 model year, all vehicles identified in subsection (a) must be equipped with a conductive charger inlet port which meets all the specifications contained in Society of Automotive Engineers (SAE) Surface Vehicle Recommended Practice SAE J1772 REV NOV 2001, SAE Electric Vehicle Conductive Charger Coupler, which is incorporated herein by reference. All such vehicles must be equipped with an on-board charger with a minimum output of 3.3 kilovolt amps.

Note: Authority cited: Sections 39600, 39601, 43013, 43018, 43101, 43104 and 43105, Health and Safety Code. Reference: Sections 39002, 39003, 39667, 43000, 43009.5, 43013, 43018, 43100, 43101, 43101.5, 43102, 43104, 43105, 43106, 43107, 43204 and 43205.5, Health and Safety Code.Authority cited: Sections 39600, 39601, 43013, 43018, 43101, 43104 and 43105, Health and Safety Code. Reference: Sections 39002, 39003, 39667, 43000, 43009.5, 43013, 43018, 43100, 43101, 43101.5, 43102, 43104, 43105, 43106, 43107, 43204 and 43205.5, Health and Safety Code.

Appendix A: Standards and Test Procedures
Part 6

Proposed Regulation Order Part 6: Adopt California Code of Regulations, title 13, section 1962.1 for Zero Emission and Hybrid Electric Vehicles

PROPOSED 2008 AMENDMENTS TO THE CALIFORNIA ZERO EMISSION VEHICLE REGULATION

1. Adopt section 1962.1 as follows (**This is a newly adopted regulation, shown without underline as permitted by California Code of Regulations, title 1, section 8.**):

§ 1962.1 Zero-Emission Vehicle Standards for 2009 and Subsequent Model Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles.

(a) ***ZEV Emission Standard.*** The Executive Officer shall certify new 2009 and subsequent model passenger cars, light-duty trucks and medium-duty vehicles as ZEVs if the vehicles produce zero exhaust emissions of any criteria pollutant (or precursor pollutant) under any and all possible operational modes and conditions.

(b) ***Percentage ZEV Requirements.***

(1) ***General Percentage ZEV Requirement.***

(A) ***Basic Requirement.*** The minimum percentage ZEV requirement for each manufacturer is listed in the table below as the percentage of the PCs and LDT1s, and LDT2s to the extent required by section (b)(1)(C), produced by the manufacturer and delivered for sale in California that must be ZEVs, subject to the conditions in this section 1962.1(b).

Model Years	*Minimum ZEV Requirement*
2009 through 2011	11 %
2012 through 2014	12 %
2015 through 2017	14 %
2018 and subsequent	16 %

(B) ***Calculating the Number of Vehicles to Which the Percentage ZEV Requirement is Applied.*** A manufacturer's production volume of PCs and LDT1s, and LDT2s as applicable, produced and delivered for sale in California to comply with a given model year ZEV requirement will be based on a three-year average of the manufacturer's volume of PCs and LDT1s, and LDT2s as applicable, produced and delivered for sale in California in the prior fourth, fifth and sixth years (e.g. 2010 model-year ZEV requirements will be based on California production volumes of PCs and LDT1s, and LDT2s as applicable, for the 2004 to 2006 model years). This production averaging is used to determine ZEV requirements only, and has no effect on a manufacturer's size determination. As an alternative to the three year averaging of prior year production described above, a manufacturer may elect to base its ZEV obligation on the number of PCs and LDT1s, and LDT2s to the extent required by section (b)(1)(C), produced by the manufacturer and delivered for sale in California that same model year. In applying the ZEV requirement, a PC, LDT1, or LDT2 as

applicable, that is produced by a small volume manufacturer, but is marketed in California by another manufacturer under the other manufacturer's nameplate, shall be treated as having been produced by the marketing manufacturer.

(C) ***Phase-in of ZEV Requirements for LDT2s.*** Beginning with the ZEV requirements for the 2009 model year, a manufacturer's LDT2 production shall be included in determining the manufacturer's overall ZEV requirement under section (b)(1)(A) in the increasing percentages shown the table below.

2009	*2010*	*2011*	*2012+*
51%	68%	85%	100%

(D) *Exclusion of ZEVs in Determining a Manufacturer's Sales Volume.* In calculating for purposes of sections 1962.1(b)(1)(B) and 1962.1(b)(1)(C) the volume of PCs, LDT1s and LDT2s a manufacturer has produced and delivered for sale in California, the manufacturer shall exclude the number of ZEVs produced by the manufacturer, or by a subsidiary in which the manufacturer has a greater than 50 percent ownership interest, and delivered for sale in California.

(2) ***Requirements for Large Volume Manufacturers.***

(A) ***Primary Requirements for Large Volume Manufacturers through Model Year 2011.***

In the 2009 through 2011 model years, a large-volume manufacturer must meet at least 22.5 percent of its ZEV requirement with ZEVs or ZEV credits generated by such vehicles, and at least another 22.5 percent with ZEVs, advanced technology PZEVs, or credits generated by such vehicles. The remainder of the large-volume manufacturer's ZEV requirement may be met using PZEVs or credits generated by such vehicles.

(B) ***Alternative Requirements for Large Volume Manufacturers through Model Year 2011.***

1. ***Minimum Floor for Production of Type III ZEVs.***

a. ***[RESERVED].***

b. ***Requirement for the 2009-2011 Model Years.*** A large volume manufacturer electing to be subject to the alternative compliance requirements during model years 2009 through 2011 must produce, deliver for sale, and place in service in California enough 2009-2011 model-year Type III ZEVs to generate ZEV credits sufficient to meet a cumulative percentage ZEV requirement of 0.65 percent of the manufacturer's average annual California sales of PCs and LDT1s over the three year period from model years 2003 through 2005, or submit an equivalent number of credits

generated by such vehicles. The manufacturer may meet this requirement with [i] 2009-2011 model-year Type I or Type II ZEVs, provided that 2 Type I ZEVs or 1.33 Type II ZEVs or 0.8 Type IV ZEVs will equal one Type III ZEV.

c. ***[RESERVED].***

d. ***[RESERVED].***

e. ***[RESERVED]***

f. ***Exclusion of Additional Credits for Transportation Systems.*** Any additional credits for transportation systems generated in accordance with section 1962.1(g)(5) shall not be counted towards compliance with this section 1962.1(b)(2)(B)1.b.

g. ***Carry-over of Excess Credits.*** ZEV credits generated from excess production in model years 2005 through 2008 may be carried forward and applied to the 2009 through 2011 minimum floor requirement specified in 1962.1(b)(2)(B)1.b. provided that the value of these carryover credits shall be based on the model year in which the credits are used. Beginning in 2012, these credits may no longer be used to meet the ZEV requirement; they may be used as Enhanced AT PZEV, AT PZEV, or PZEV credits. ZEV credits earned in model year 2009 and subsequent would be allowed to be carried forward for two years for application to the ZEV requirement. For example, ZEV credit earned in 2010 would retain full flexibility through 2012, at which time that credit could only be used as Enhanced AT PZEV, AT PZEV, or PZEV credits, and could not be used to satisfy the ZEV credit obligation, which may only be satisfied with credit generated from ZEVs.

h. ***Failure to Meet Requirement for Production of Type III ZEVs.*** A manufacturer that, after electing to be subject to the alternative requirements in section 1962.1(b)(2)(B) for any model year from 2009 through 2011, fails to meet the requirement in section 1962.1(b)(2)(B)1.b. by the end of the specified three year period in which the model year falls, shall be treated as subject to the primary requirements in section 1962.1(b)(2)(A) for all model years in the specified three year period.

i. ***Rounding Convention.*** The number of Type III ZEVs needed for a manufacturer under section 1962.1(b)(2)(B)1.b. shall be rounded to the nearest whole number.

2. ***Compliance with Percentage ZEV Requirements.*** In the 2009 through 2011 model years, a large volume manufacturer electing to be subject to the alternative compliance requirements in a given model year must meet at least 45 percent of its ZEV requirement for that model year with ZEVs, advanced technology PZEVs, or credits generated from such vehicles. The remainder of the large volume manufacturer's ZEV requirement may be met using PZEVs or credits generated from such vehicles.

3. ***Sunset of Alternative Requirements after the 2011 Model Year.*** The alternative requirements in section 1962.1(b)(2)(B) are not available after the 2011 model year.

(C) ***Election of the Primary or Alternative Requirements for Large Volume Manufacturers for the 2009 through 2011 Model Years.*** A large volume manufacturer shall be subject to the primary ZEV requirements for the 2009 model year unless it notifies the Executive Officer in writing prior to the start of the 2009 model year that it is electing to be subject to the alternative compliance requirements for that model year. Thereafter, a manufacturer shall be subject to the same compliance option as applied in the previous model year unless it notifies the Executive Officer in writing prior to the start of a new model year that it is electing to switch to the other compliance option for that new model year. However, a large volume manufacturer that has previously elected to be subject to the primary ZEV requirements for one or more of the model years in the three year period identified in section 1962.1(b)(1)(B)1.b. may prior to the end of the three year period elect to become subject to the alternative compliance requirements for the full three year period upon a demonstration that it has complied with all of the applicable requirements for that period in section 1962.1(b)(2)(B)1.b.

(D) ***Requirements for Large Volume Manufacturers in Model Years 2012 through 2017.***

In the 2012 through 2017 model years, a large-volume manufacturer must meet the ZEV total percent requirement as shown in the table below with ZEVs or ZEV credits generated by such vehicles. The entire requirement may be met solely with ZEVs. Optionally, a manufacturer may choose to meet or exceed the minimum ZEV floor and then satisfy the remainder of the manufacturer requirement using Enhanced AT PZEVs, AT PZEVs, and PZEVs. The following table enumerates the total percent ZEV requirement and the maximum component percentages for the optional Enhanced AT PZEV, AT PZEV, and PZEV categories that may be used to meet the total percentage ZEV requirement.

Years	Total ZEV Percent Requirement	Minimum ZEV floor percentage range	Enhanced AT PZEVs percentage range	AT PZEVs	PZEVs up to
2012 – 2014	12	0.3 – 3.0	0.0 – 2.7	3.0	6.0
2015 – 2017	14	3.0 – 6.0	0.0 – 3.0	2.0	6.0

(E) ***Requirements for Large Volume Manufacturers in Model Year 2018 and Subsequent.***

In the 2018 and subsequent model years, a large-volume manufacturer must meet a ZEV total percent requirement of 16 percent. The maximum portion of a

large volume manufacturer's percentage ZEV requirement that may be satisfied by PZEVs that are not advanced technology PZEVs, or credits generated by such vehicles, is limited to 6 percent of the manufacturer's applicable California PC, LDT1, and LDT2 production volume; advanced technology PZEVs or credits generated by such vehicles may be used to meet up to one-half of the manufacturer's remaining ZEV requirement.

(3) ***Requirements for Intermediate Volume Manufacturers.*** In 2009 and subsequent model years, an intermediate volume manufacturer may meet its ZEV requirement with up to 100 percent PZEVs or credits generated by such vehicles.

(4) ***Requirements for Small Volume Manufacturers and Independent Low Volume Manufacturers.*** A small volume manufacturer or an independent low volume manufacturer is not required to meet the percentage ZEV requirements. However, a small volume manufacturer or an independent low volume manufacturer may earn and market credits for the ZEVs or PZEVs it produces and delivers for sale in California.

(5) ***Counting ZEVs and PZEVs in Fleet Average NMOG Calculations.*** For the purposes of calculating a manufacturer's fleet average NMOG value and NMOG credits under sections 1960.1(g)(2) and 1961(b) and (c), a vehicle certified as a ZEV is counted as one ZEV, and a PZEV is counted as one SULEV certified to the 150,000 mile standards regardless of any ZEV or PZEV multipliers.

(6) ***[RESERVED]***

(7) ***Changes in Small Volume, Independent Low Volume, and Intermediate Volume Manufacturer Status.***

(A) ***Increases in California Production Volume.*** In 2009 and subsequent model years, if a small volume manufacturer's average California production volume exceeds 4,500 units of new PCs, LDTs, and MDVs based on the average number of vehicles produced and delivered for sale for the three previous consecutive model years, or if an independent low volume manufacturer's average California production volume exceeds 10,000 units of new PCs, LDTs, and MDVs based on the average number of vehicles produced and delivered for sale for the three previous consecutive model years, the manufacturer shall no longer be treated as a small volume, or independent low volume manufacturer, as applicable, and shall comply with the ZEV requirements for independent low volume or intermediate volume manufacturers, as applicable, beginning with the sixth model year after the last of the three consecutive model years.

If an intermediate volume manufacturer's average California production volume exceeds 60,000 units of new PCs, LDTs, and MDVs based on the average number of vehicles produced and delivered for sale for the three previous consecutive model years, the manufacturer shall no longer be treated as an intermediate volume manufacturer and shall, beginning with the sixth model year after the last of the three

consecutive model years, meet the ZEV requirements with PZEVs, of which at least one-fourth would have to be AT PZEVs and shall, beginning with the ninth model year after the last of the three consecutive model years, meet the ZEV regulation requirements with PZEVs, of which at least one-third would have to be AT PZEVs. The manufacturer would comply with all ZEV requirements for large volume manufacturers beginning with the twelfth model year after the last of the three consecutive model years.

The lead time shall be four rather than six years where a manufacturer ceases to be a small or intermediate volume manufacturer in 2003 or subsequent years due to the aggregation requirements in majority ownership situations, except that if the majority ownership in the manufacturer was acquired prior to the 2001 model year, the manufacturer must comply with the stepped-up ZEV requirements starting in the 2010 model year.

(B) ***Decreases in California Production Volume.*** If a manufacturer's average California production volume falls below 4,500, 10,000 or 60,000 units of new PCs, LDTs, and MDVs, as applicable, based on the average number of vehicles produced and delivered for sale for the three previous consecutive model years, the manufacturer shall be treated as a small volume, independent low volume, or intermediate volume manufacturer, as applicable, and shall be subject to the requirements for a small volume, independent low volume, or intermediate volume manufacturer beginning with the next model year.

(C) ***Calculating California Production Volume in Change of Ownership Situations.*** Where a manufacturer experiences a change in ownership in a particular model year, the change will affect application of the aggregation requirements on the manufacturer starting with the next model year. The manufacturer's small or intermediate volume manufacturer status for the next model year shall be based on the average California production volume in the three previous consecutive model years of those manufacturers whose production volumes must be aggregated for that next model year. For example, where a change of ownership during the 2010 model year results in a requirement that the production volume of Manufacturer A be aggregated with the production volume of Manufacturer B, Manufacturer A's status for the 2011 model year will be based on the production volumes of Manufacturers A and B in the 2008-2010 model years. Where the production volume of Manufacturer A must be aggregated with the production volumes of Manufacturers B and C for the 2010 model year, and during that model year a change in ownership eliminates the requirement that Manufacturer B's production volume be aggregated with Manufacturer A's, Manufacturer A's status for the 2011 model year will be based on the production volumes of Manufacturers A and C in the 2008-2010 model years. In either case, the lead time provisions in section 1962.1(b)(5)(A) and (B) will apply.

(c) ***Partial ZEV Allowance Vehicles (PZEVs).***

(1) ***Introduction.*** This section 1962.1(c) sets forth the criteria for identifying vehicles delivered for sale in California as PZEVs. The PZEV is a vehicle that cannot be certified as a ZEV but qualifies for a PZEV allowance of at least 0.2.

(2) ***Baseline PZEV Allowance.*** In order for a vehicle to be eligible to receive a PZEV allowance, the manufacturer must demonstrate compliance with all of the following requirements. A qualifying vehicle will receive a baseline PZEV allowance of 0.2.

(A) ***SULEV Standards.*** Certify the vehicle to the 150,000-mile SULEV exhaust emission standards for PCs and LDTs in section 1961(a)(1). Bi-fuel, fuel-flexible and dual-fuel vehicles must certify to the applicable 150,000-mile SULEV exhaust emission standards when operating on both fuels;

(B) ***Evaporative Emissions.*** Certify the vehicle to the evaporative emission standards in section 1976(b)(1)(E) (zero-fuel evaporative emissions standards);

(C) ***OBD.*** Certify that the vehicle will meet the applicable on-board diagnostic requirements in sections 1968.1 or 1968.2, as applicable, for 150,000 miles; and

(D) ***Extended Warranty.*** Extend the performance and defects warranty period set forth in sections 2037(b)(2) and 2038(b)(1) to 15 years or 150,000 miles, whichever occurs first, except that the time period is to be 10 years for a zero emission energy storage device used for traction power (such as a battery, ultracapacitor, or other electric storage device).

(3) ***Zero-Emission VMT PZEV Allowance.***

(A) ***Calculation of Zero Emission VMT Allowance.*** A vehicle that meets the requirements of section 1962.1(c)(2) and has zero-emission vehicle miles traveled ("VMT") capability will generate an additional zero emission VMT PZEV allowance calculated as follows:

Urban Equivalent All-Electric Range (EAER)	*Zero-emission VMT Allowance*
≤ 10 miles	0.0
10 miles to 100 miles	EAER x $(1 - UF_{Rcd})/14.6$
> 100 miles	1.58

The urban equivalent all-electric range (EAER) and urban charge depletion range (R_{cd}) shall be determined in accordance with section E.3.(2)(a) of the "California Exhaust Emission Standards and Test Procedures for 2009 and Subsequent Model Zero-Emission Vehicles, and 2001 and Subsequent Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," incorporated by reference in section 1962.1(h). Utility Factor (UF) based on the charge depletion range (R_{cd}) shall be determined according to the 0-100 mile 4th order curve fit from SAE J1711, issued March 1999, p52.

(B) ***Alternative Procedures.*** As an alternative to determining the zero-emission VMT allowance in accordance with the preceding section 1962.1(c)(3)(A), a manufacturer may submit for Executive Officer approval an alternative procedure for determining the zero-emission VMT potential of the vehicle as a percent of total VMT, along with an engineering evaluation that adequately substantiates the zero-emission VMT determination. For example, an alternative procedure may provide that a vehicle with zero emissions of one regulated pollutant (e.g., NOx) and not another (e.g., NMOG) will qualify for a zero-emission VMT allowance of 1.5.

(C) ***[RESERVED].***

(4) ***PZEV Allowance for Advanced ZEV Componentry.*** A vehicle that meets the requirements of section 1962.1(c)(2) may qualify for an advanced componentry PZEV allowance as provided in this section 1962.1(c)(4).

(A) ***Use of High Pressure Gaseous Fuel or Hydrogen Storage System.*** A vehicle equipped with a high pressure gaseous fuel storage system capable of refueling at 3600 pounds per square inch or more and operating exclusively on this gaseous fuel shall qualify for an advanced componentry PZEV allowance of 0.2. A vehicle capable of operating exclusively on hydrogen stored in a high pressure system capable of refueling at 3600 pounds per square inch or more, or stored in nongaseous form, shall instead qualify for an advanced componentry PZEV allowance of 0.3.

(B) ***Use of a Qualifying HEV Electric Drive System.***

1. ***Classification of HEVs.*** HEVs qualifying for additional advanced componentry PZEV allowance or allowances that may be used in the AT PZEV category are classified in one of four types of HEVs based on the criteria in the

following table. HEVs must qualify for the Zero-Emission VMT Allowance in section 1962.1(c)(3)(A) and achieve 10 miles or more of all electric UDDS range in addition to meeting the requirements in the following table to qualify for Type F advanced componentry allowance.

Characteristics	*Type C*	*Type D*	*Type E*	*Type F*
Electric Drive System Peak Power Output	≥ 10 kW	≥ 10 kW	≥ 50 kW	Zero Emission VMT allowance; ≥ 10 mile all-electric range
Traction Drive System Voltage	< 60 Volts	≥ 60 Volts	≥ 60 volts	≥ 60 volts
Traction Drive Boost	Yes	Yes	Yes	Yes
Regenerative Braking	Yes	Yes	Yes	Yes
Idle Start/Stop	Yes	Yes	Yes	Yes

2. ***[RESERVED]***

3. ***[RESERVED]***

4. ***Type C HEVs.*** A PZEV that the manufacturer demonstrates to the reasonable satisfaction of the Executive Officer meets all of the criteria for a Type C HEV, and that is equipped with an advanced traction energy storage system – such as lithium ion batteries, nickel metal-hydride batteries, ultracapacitors, or other similar systems – with a design lifetime of at least 10 years, qualifies for an additional advanced componentry allowance of 0.2 in the 2009 through 2011 model years, 0.15 in the 2012 through 2014 model years, and 0.1 in the 2015 and subsequent model years.

5. ***Type D HEVs.*** A PZEV that the manufacturer demonstrates to the reasonable satisfaction of the Executive Officer meets all of the criteria for a Type D HEV qualifies for an additional advanced componentry allowance of 0.4 in the 2009 through 2011 model years, 0.35 in the 2012 through 2014 model years, and 0.25 in the 2015 and subsequent model years.

6. ***Type E HEVs.*** A PZEV that the manufacturer demonstrates to the reasonable satisfaction of the Executive Officer meets all of the criteria for a Type E HEV qualifies for an additional advanced componentry allowance of 0.5 in the 2009 through 2011 model years, 0.45 in the 2012 through 2014 model years, and 0.35 in the 2015 and subsequent model years.

7. ***Type F HEVs.*** A PZEV that the manufacturer demonstrates to the reasonable satisfaction of the Executive Officer meets all of the criteria for a Type F HEV qualifies for an additional advanced componentry allowance of 0.85 in the 2009 through 2011 model years, 0.8 in the 2012 through 2014 model years, and 0.7 in the 2015 and subsequent model years.

8. ***Severability.*** In the event that all or part of section 1962.1(c)(4)(B)1.-7. is found invalid, the remainder of section 1962.1, including the remainder of section 1962.1(c)(4)(B)1.-7. if any, remains in full force and effect.

(5) ***PZEV Allowance for Low Fuel-Cycle Emissions.*** A vehicle that makes exclusive use of fuel(s) with very low fuel-cycle emissions shall receive a PZEV allowance of 0.3. In order to receive the PZEV low fuel-cycle emissions allowance, a manufacturer must demonstrate to the Executive Officer, using peer-reviewed studies or other relevant information, that NMOG emissions associated with the fuel(s) used by the vehicle (on a grams/mile basis) are lower than or equal to 0.01 grams/mile. Fuel-cycle emissions must be calculated based on near-term production methods and infrastructure assumptions, and the uncertainty in the results must be quantified.

(6) ***Calculation of PZEV Allowance.***

(A) ***Calculation of Combined PZEV Allowance for a Vehicle.*** The combined PZEV allowance for a qualifying vehicle in a particular model year is the sum of the PZEV allowances listed in this section 1962.1(c)(6), multiplied by any PZEV introduction phase-in multiplier listed in section 1962.1(c)(7), subject to the caps in section 1962.1(c)(6)(B).

1. ***Baseline PZEV Allowance.*** The baseline PZEV allowance of 0.2 for vehicles meeting the criteria in section 1962.1(c)(2);

2. ***Zero-Emission VMT PZEV Allowance.*** The zero-emission VMT PZEV allowance, if any, determined in accordance with section 1962.1(c)(3);

3. ***Advanced Componentry PZEV Allowance.*** The advanced ZEV componentry ZEV allowance, if any, determined in accordance with section 1962.1(c)(4); and

4. ***Fuel-Cycle Emissions PZEV Allowance.*** The fuel-cycle emissions ZEV allowance, if any, determined in accordance with section 1962.1(c)(5).

(B) ***Caps on the Value of an AT PZEV Allowance.***

1. ***Cap for 2012 and Subsequent Model-Year Vehicles.*** The maximum value an AT PZEV may earn before phase-in multipliers, including the baseline PZEV allowance, is 3.0.

2. *[RESERVED].*

(7) ***PZEV Multipliers.***

(A) *[RESERVED].*

(B) ***Introduction Phase-In Multiplier for PZEVs That Earn a Zero Emission VMT Allowance.*** Each 2009 through 2011 model year PZEV that earns a zero emission VMT allowance under section 1962.1(c)(3) and is produced and delivered for sale in California qualifies for a phase-in multiplier of 3.0.

(d) ***Qualification for ZEV Multipliers and Credits.***

(1) *[RESERVED].*

(2) *[RESERVED].*

(3) *[RESERVED].*

(4) *[RESERVED].*

(5) ***ZEV Credits for 2009 and Subsequent Model Years.***

(A) ***ZEV Tiers for Credit Calculations.*** ZEV credits from a particular ZEV are based on the assignment of a given ZEV into one of the following six ZEV tiers:

ZEV Tier	*UDDS ZEV Range (miles)*	*Fast Refueling Capability*
NEV	No minimum	N/A
Type 0	< 50	N/A
Type I	≥ 50, <75	N/A
Type I.5	≥ 75, <100	N/A
Type II	≥ 100	N/A
Type III	≥ 100	Must be capable of replacing 95 miles (UDDS ZEV range) in ≤ 10 minutes per section 1962.1(d)(5)(B)
OR	≥ 200	N/A
Type IV	≥ 200	Must be capable of replacing 190 miles (UDDS ZEV range) in ≤ 10 minutes per section 1962.1(d)(5)(B)

(B) ***Fast Refueling.*** The "fast refueling capability" requirement for a 2009 and subsequent model-year Type III or IV ZEV in section 1962(d)(5)(A) will be considered met if the Type III ZEV has the capability to accumulate at least 95 miles of UDDS range in 10 minutes or less and the Type IV ZEV has the capability to accumulate at least 190 miles in 15 minutes or less.

(C) ***ZEV Credits for 2009 and Subsequent Model-Year ZEVs.*** A 2009 and subsequent model-year ZEV, other than a NEV or Type 0, earns 1 ZEV credit when it is produced and delivered for sale in California. A 2009 and subsequent model-year ZEV earns additional credits based on the earliest year in which the ZEV is placed in service (not earlier than the ZEV's model year). The following table identifies the total credits that a ZEV in each of the six ZEV tiers will earn, including the credit not contingent on placement in service, if it is placed in service in the specified model year or by June 30 after the end of the specified calendar year.

Total Credit Earned by ZEV Type and Model Year for Production and Delivery for Sale and for Placement		
Tier	*Year in Which ZEV is Placed in Service*	
	2009-2017	2018+
NEV	0.30	0.30
Type 0	1	1
Type I	2	2
Type I.5	2.5	2.5
Type II	3	3
Type III	4	3
Type IV	5	3

(D) ***Multiplier for Certain Type I and Type II ZEVs.*** A 2009 through 2011 model-year Type I and Type II ZEV shall qualify for a multiplier of 1.25 if it is either sold to a motorist or is leased for three or more years to a motorist who is given the option to purchase or re-release the vehicle for two years or more at the end of the first lease term.

(E) ***Counting Specified ZEVs Placed in a Section 177 State.*** As specified in the table below, specified model year Type I, I.5, II, III or IV ZEVs that are certified to the California ZEV standards and are placed in service in a state that is administering the California ZEV requirements pursuant to section 177 of the federal Clean Air Act (42 U.S.C. § 7507) applicable for the ZEV's model year may be counted towards compliance with the California percentage ZEV requirements in section 1962.1(b), including the requirements in section 1962.1(b)(2)(B), as if they were delivered for sale and placed in service in California. Similarly, specified model year Type I, I.5, II, III or IV ZEVs that are certified to the California ZEV standards and are placed in service in California may be counted towards the percentage ZEV requirements of any state that is administering the California ZEV requirements pursuant to section 177 of the federal Clean Air Act, including requirements based on section 1962.1(b)(2)(B).

Vehicle Type	Through Model Year:
Type I, I.5, or II ZEV	2014
Type III or IV ZEV	2017

(e) ***[RESERVED]***

(f) ***[RESERVED]***

(g) ***Generation and Use of ZEV Credits; Calculation of Penalties***

(1) ***Introduction.*** A manufacturer that produces and delivers for sale in California ZEVs or PZEVs in a given model year exceeding the manufacturer's ZEV requirement set forth in section 1962.1(b) shall earn ZEV credits in accordance with this section 1962.1(g).

(2) ***ZEV Credit Calculations.***

(A) ***Credits from ZEVs.*** The amount of g/mi ZEV credits earned by a manufacturer in a given model year from ZEVs shall be expressed in units of g/mi NMOG, and shall be equal to the number of credits from ZEVs produced and delivered for sale in California that the manufacturer applies towards meeting the ZEV requirements for the model year subtracted from the number of ZEVs produced and delivered for sale in California by the manufacturer in the model year and then multiplied by the NMOG fleet average requirement for PCs and LDT1s, and LDT2s as applicable, for that model year.

(B) ***Credits from PZEVs.*** The amount of g/mi ZEV credits from PZEVs earned by a manufacturer in a given model year shall be expressed in units of g/mi NMOG, and shall be equal to the total number of PZEVs produced and delivered for sale in California that the manufacturer applies towards meeting its ZEV requirement for the model year subtracted from the total number of PZEV allowances from PZEVs produced and delivered for sale in California by the manufacturer in the model year and then multiplied by the NMOG fleet average requirement for PCs and LDT1s, and LDT2s as applicable, for that model year.

(C) ***Separate Credit Accounts.*** The number of credits from a manufacturer's [i] ZEVs, [ii] advanced technology PZEVs, and [iii] all other PZEVs shall each be maintained separately.

(3) ***ZEV Credits for MDVs and LDTs Other Than LDT1s.*** ZEVs and PZEVs classified as MDVs or as LDTs other than LDT1s may be counted toward the ZEV requirement for PCs, LDT1s and LDT2s as applicable, and included in the calculation of ZEV credits as specified in this section 1962.1(g) if the manufacturer so designates.

(4) ***ZEV Credits for Advanced Technology Demonstration Programs.*** In model years 2009 through 2014, a vehicle, other than a NEV, which is placed in a California advanced technology demonstration program for a period of two or more years, may earn ZEV credits even if it is not "delivered for sale" or registered with the California Department of Motor Vehicles (DMV). To earn such credits, the manufacturer must demonstrate to the reasonable satisfaction of the Executive Officer that the vehicles will be regularly used in applications appropriate to evaluate issues related to safety, infrastructure, fuel specifications or public education, and that for 50 percent or more of the first two years of placement the vehicle will be situated in California. Such a vehicle is eligible to receive the same allowances and credits that it would have earned if placed in service. To determine vehicle credit, the model-year designation for a demonstration vehicle shall be consistent with the model-year designation for conventional vehicles placed in the same timeframe. Manufacturers may earn credit for as many as six vehicles under this section 1962.1(g)(5). A manufacturer's vehicles in excess of the six-vehicle cap will not be eligible for advanced technology demonstration program credits.

(5) ***ZEV Credits for Transportation Systems.***

(A) ***General.*** In model years 2009 and subsequent, a ZEV placed, for two or more years, as part of a transportation system may earn additional ZEV credits, which may used in the same manner as other credits earned by vehicles of that category, except as provided in section (g)(5)(C) below. In model years 2009 through 2011, an advanced technology PZEV or PZEV placed as part of a transportation system may earn additional ZEV credits, which may be used in the same manner as other credits earned by vehicles of that category, except as provided in section (g)(5)(C) below. A NEV is not eligible to earn credit for transportation systems. To earn such credits, the manufacturer must demonstrate to the reasonable satisfaction of the Executive Officer that the vehicle will be used as a part of a project that uses an innovative transportation system as described in section (g)(5)(B) below.

(B) ***Credits Earned.*** In order to earn additional credit under this section (g)(5), a project must at a minimum demonstrate [i] shared use of ZEVs, AT PZEVs or PZEVs, and [ii] the application of "intelligent" new technologies such as reservation management, card systems, depot management, location management, charge billing and real-time wireless information systems. If, in addition to factors [i] and [ii] above, a project also features linkage to transit, the project may receive further additional credit. For ZEVs only, not including NEVs, a project that features linkage to transit, such as dedicated parking and charging facilities at transit stations, but does not demonstrate shared use or the application of intelligent new technologies, may also receive additional credit for linkage to transit. The maximum credit awarded per vehicle shall be determined by the Executive Officer, based upon an application submitted by the manufacturer and, if appropriate, the project manager. The maximum credit awarded shall not exceed the following:

Type of Vehicle	*Model Year*	*Shared Use, Intelligence*	*Linkage to Transit*
PZEV	through 2011	2	1
AT PZEV	through 2011	4	2
ZEV	2009 through 2011	6	3
ZEV	2012 and subsequent	2	1

(C) ***Cap on Use of Credits.***

1. ***ZEVs.*** Credits earned or allocated by ZEVs pursuant to this section (g)(5), not including all credits earned by the vehicle itself, may be used to satisfy up to one-tenth of a manufacturer's ZEV obligation in any given model year.

2. ***AT PZEVs.*** Credits earned or allocated by AT PZEVs pursuant to this section (g)(5), not including all credits earned by the vehicle itself, may be used to satisfy up to one-twentieth of a manufacturer's ZEV obligation in any given model year, but may only be used in the same manner as other credits earned by vehicles of that category.

3. ***PZEVs.*** Credits earned or allocated by PZEVs pursuant to this section (g)(5), not including all credits earned by the vehicle itself, may be used to satisfy up to one-fiftieth of the manufacturer's ZEV obligation in any given model year, but may only be used in the same manner as other credits earned by vehicles of that category.

(D) ***Allocation of Credits.*** Credits shall be assigned by the Executive Officer to the project manager or, in the absence of a separate project manager, to the vehicle manufacturers upon demonstration that a vehicle has been placed in a project. Credits shall be allocated to vehicle manufacturers by the Executive Officer in accordance with a recommendation submitted in writing by the project manager and signed by all manufacturers participating in the project, and need not be allocated in direct proportion to the number of vehicles placed.

(6) ***Use of ZEV Credits.*** A manufacturer may meet the ZEV requirements in any given model year by submitting to the Executive Officer a commensurate amount of g/mi ZEV credits, consistent with section 1962.1(b). These credits may be earned previously by the manufacturer or acquired from another party, except that credits earned from NEVs offered for sale or placed in service in model years 2001 through 2005 cannot be used to satisfy more than 50 percent of a manufacturer's percentage ZEV obligation that may only be satisfied with credits from ZEVs. The manufacturer's percentage ZEV obligation that may be satisfied by credits from AT PZEVs but not PZEVs is listed in the table below:

AT PZEV Category	
2009	*2010 and beyond*
75%	50%

This limitation applies to credits earned in model years 2001 through 2005 by the same manufacturer or earned in model years 2001 through 2005 by another manufacturer and acquired. The amount of g/mi ZEV credits required to be submitted shall be calculated according to the criteria set forth in this section 1962.1(g).

ZEV credits generated from excess production in model years 2009 and subsequent, including those acquired from another party, may be carried forward and applied to the ZEV minimum floor requirement specified in 1962.1(b)(2)(B)1.b. for two subsequent model years. Beginning with the third subsequent model year, those earned ZEV credits may no longer be used to satisfy the manufacturer's percentage ZEV obligation that may only be satisfied by credits from ZEVs, but may be used to satisfy the manufacturer's percentage ZEV obligation that may be satisfied by credits from Enhanced AT PZEVs, AT PZEVs, or PZEVs. For example, ZEV credit earned in 2010 would retain full flexibility through 2012, at which time that credit could only be used as Enhanced AT PZEV, AT PZEV, or PZEV credits.

(7) ***Requirement to Make Up a ZEV Deficit.***

(A) ***General.*** A manufacturer that produces and delivers for sale in California fewer ZEVs than required in a given model year shall make up the deficit by the end of the third model year by submitting to the Executive Officer a commensurate amount of g/mi ZEV credits. The amount of g/mi ZEV credits required to be submitted shall be calculated by [i] adding the number of ZEVs produced and delivered for sale in California by the manufacturer for the model year to the number of ZEV allowances from partial ZEV allowance vehicles produced and delivered for sale in California by the manufacturer for the model year (for a large volume manufacturer, not to exceed that permitted under section 1962.1(b)(2)), [ii] subtracting that total from the number of ZEVs required to be produced and delivered for sale in California by the manufacturer for the model year, and [iii] multiplying the resulting value by the fleet average requirements for PCs and LDT1s for the model year in which the deficit is incurred.

(8) ***Penalty for Failure to Meet ZEV Requirements.*** Any manufacturer that fails to produce and deliver for sale in California the required number of ZEVs and submit an appropriate amount of g/mi ZEV credits and does not make up ZEV deficits within the specified time period shall be subject to the Health and Safety Code section 43211 civil penalty applicable to a manufacturer that sells a new motor vehicle that does not meet the applicable emission standards adopted by the state board. The cause of action shall be deemed to accrue when the ZEV deficits are not balanced by the end of the specified time period. For the purposes of Health and Safety Code section 43211, the number of vehicles not meeting the state board's standards shall be calculated according to the following equation; provided that the percentage of a large

volume manufacturer's ZEV requirement for a given model year that may be satisfied with partial ZEV allowance vehicles or ZEV credits from such vehicles may not exceed the percentages permitted under section 1962.1(b)(2)(A):

> (No. of ZEVs required to be produced and delivered for sale in California for the model year) - (No. of ZEVs produced and delivered for sale in California for the model year) - (No. of ZEV allowances from partial ZEV allowance vehicles produced and delivered for sale in California for the model year) - [(Amount of ZEV credits submitted for the model year) / (the fleet average requirement for PCs and LDT1s for the model-year)].

(h) ***Test Procedures.*** The certification requirements and test procedures for determining compliance with this section 1962.1 are set forth in "California Exhaust Emission Standards and Test Procedures for 2009 and Subsequent Model Zero-Emission Vehicles, and 2001 and Subsequent Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," adopted by the state board on August 5, 1999, and last amended [Insert date of amendment], which is incorporated herein by reference.

(i) ***ZEV-Specific Definitions.*** The following definitions apply to this section 1962.1.

(1) "Advanced technology PZEV" or "AT PZEV" means any PZEV with an allowance greater than 0.2 before application of the PZEV early introduction phase-in multiplier

(2) "Battery electric vehicle" means any vehicle that operates solely by use of a battery or battery pack, or that is powered primarily through the use of an electric battery or battery pack but uses a flywheel or capacitor that stores energy produced by the electric motor or through regenerative braking to assist in vehicle operation.

(3) "Charge depletion range or R_{cd}" means the distance achieved by a hybrid electric vehicle on a specified driving cycle at the point when the zero emission energy storage device is depleted of off-vehicle charge and regenerative braking derived energy.

(4) "Electric drive system" means an electric motor and associated power electronics which provide acceleration torque to the drive wheels sometime during normal vehicle operation. This does not include components that could act as a motor, but are configured to act only as a generator or engine starter in a particular vehicle application.

(5) "Electric range fraction" means the fraction of electrical energy derived from off-vehicle charging and regenerative braking energy relative to total traction energy used over the charge depletion range on a specified drive cycle.

(6) "Enhanced AT PZEV" means any PZEV that has an allowance of 1.0 or greater per vehicle without multipliers and makes use of a ZEV fuel.

(7) "Equivalent all electric range" means the charge depletion range multiplied by the electric range fraction (EAER = R_{cd} x ERF)

(8) "Neighborhood electric vehicle" means a motor vehicle that meets the definition of Low-Speed Vehicle either in section 385.5 of the Vehicle Code or in 49 CFR 571.500 (as it existed on July 1, 2000), and is certified to zero-emission vehicle standards.

(9) "Placed in service" means having been sold or leased to an end-user and not to a dealer or other distribution chain entity, and having been individually registered for on-road use by the California Department of Motor Vehicles.

(10) "Regenerative braking" means the partial recovery of the energy normally dissipated into friction braking that is returned as electrical current to an energy storage device.

(11) "Type 0, I, I.5, II, III, and IV ZEV" all have the meanings set forth in section 1962.1(d)(5)(A).

(12) "ZEV fuel" means a fuel that provides traction energy in on-road ZEVs. Examples of current technology ZEV fuels include electricity, hydrogen, and compressed air.

(j) ***Abbreviations.*** The following abbreviations are used in this section 1962.1:

"AER" means all-electric range.
"BEV" means battery electric vehicle.
"ERF" means electric range fraction.
"EAER" means equivalent all electric range.
"HEV" means hybrid-electric vehicle.
"HFEDS" means highway fuel economy driving cycle.
"LDT" means light-duty truck.
"LDT1" means a light-truck with a loaded vehicle weight of 0-3750 pounds.
"LDT2" means a "LEV II" light-duty truck with a loaded vehicle weight of 3751 pounds to a gross vehicle weight of 8500 pounds, or a "LEV I" light-duty truck with a loaded vehicle weight of 3751-5750 pounds.
"MDV" means medium-duty vehicle.
"Non-Methane Organic Gases" or "NMOG" means the total mass of oxygenated and non-oxygenated hydrocarbon emissions.
"MY" means model year.

"NEV" means neighborhood electric vehicle.
"NOx" means oxides of nitrogen.
"PC" means passenger car.
"PZEV" means any vehicle that is delivered for sale in California and that qualifies for a partial ZEV allowance of at least 0.2.
"R_{cd}" means charge depletion range
"SOC" means state of charge.
"SULEV" means super-ultra-low-emission-vehicle.
"UDDS" means urban dynamometer driving cycle.
"ULEV" means ultra-low emission vehicle.
"VMT" means vehicle miles traveled.
"ZEV" means zero-emission vehicle.

(k) ***Severability.*** Each provision of this section is severable, and in the event that any provision of this section is held to be invalid, the remainder of this article remains in full force and effect.

(l) ***Public Disclosure.*** Records in the Board's possession for the vehicles subject to the requirements of section 1962.1 shall be subject to disclosure as public records as follows:

(1) Each manufacturer's annual production data and the corresponding credits per vehicle earned for ZEVs (including ZEV type), Enhanced AT PZEVs, AT PEVs, and PZEVs for the 2009 and subsequent model years; and

(2) Annual Credit balances for 2010 and subsequent years for:

(A) Each type of vehicle: ZEVs (minus NEVs), NEVs, Enhanced AT PZEVs, AT PEVs, and PZEVs; and

(B) Advanced technology demonstration programs; and

(C) Transportation systems; and

(D) Credits earned under section 1962.1(d)(5)(C).

Note: Authority cited: Sections 39600, 39601, 43013, 43018, 43101, 43104 and 43105, Health and Safety Code. Reference: Sections 39002, 39003, 39667, 43000, 43009.5, 43013, 43018, 43100, 43101, 43101.5, 43102, 43104, 43105, 43106, 43107, 43204, and 43205.5, Health and Safety Code.

Appendix A: Standards and Test Procedures
Part 7

Proposed Regulation Order Part 7: Adopt the Incorporated "California Exhaust Emission Standards and Test Procedures for 2009 and Subsequent Model Zero-Emission Vehicles, and 2001 and Subsequent Model Hybrid Electric Vehicles, in the Passenger Car, Light-duty Truck and Medium-duty Vehicle Classes (title 13, California Code of Regulations, section 1962.1).

California Environmental Protection Agency
AIR RESOURCES BOARD

CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 2009 AND SUBSEQUENT MODEL ZERO-EMISSION VEHICLES, AND 2001 AND SUBSEQUENT MODEL HYBRID ELECTRIC VEHICLES, IN THE PASSENGER CAR, LIGHT-DUTY TRUCK AND MEDIUM-DUTY VEHICLE CLASSES

Adopted: [Insert date of adoption]

Note: This document is incorporated by reference in California Code of Regulations (CCR), title 13, section 1962.1 and is shown without underline as permitted by CCR, title 1, section 8.

45-day Notice 02/08/08
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CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 2009 AND SUBSEQUENT MODEL ZERO-EMISSION VEHICLES, AND 2001 AND SUBSEQUENT MODEL HYBRID ELECTRIC VEHICLES, IN THE PASSENGER CAR, LIGHT-DUTY TRUCK AND MEDIUM-DUTY VEHICLE CLASSES

A. Applicability

The emission standards and test procedures in this document are applicable to 2009 and subsequent model-year zero-emission passenger cars, light-duty trucks and medium-duty vehicles, and 2001 and subsequent model-year hybrid electric passenger cars, light-duty trucks and medium-duty vehicles. The general procedures and requirements necessary to certify a vehicle for sale in California are contained in the "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles" (hereinafter "LDV/MDV TPs"), and apply except as amended herein. A manufacturer may elect to certify a 2000 model-year hybrid electric vehicle under these standards and test procedures and the LDV/MDV TPs.

B. Definitions

In addition to the following, these test procedures incorporate by reference the definitions and abbreviations set forth in the Title 40 Code of Federal Regulations § 86.1803-01, the definitions and abbreviations set forth in the LDV/MDV TPs, and the definitions set forth in section 1900, title 13, CCR.

"Advanced technology PZEV" or "AT PZEV" means any PZEV with an allowance greater than 0.2 before application of the PZEV early introduction phase-in multiplier.

"All-Electric Range Test" means a test sequence used to determine the range of an electric vehicle or of a hybrid electric vehicle without the use of its auxiliary power unit. The All-Electric Range Test cycle consists of the Highway Fuel Economy Schedule and the Urban Dynamometer Driving Schedule (see section E of these test procedures).

"Auxiliary power unit" means a device that converts consumable fuel energy into mechanical or electrical energy. Some examples of auxiliary power units are internal combustion engines, gas turbines, or fuel cells.

"Battery electric vehicle" or "BEV" means any vehicle that operates solely by use of a battery or battery pack, or that is powered primarily through the use of an electric battery or battery pack but uses a flywheel or capacitor that stores energy produced by the electric motor or through regenerative braking to assist in vehicle operation.

"Battery or Battery pack" means any electrical energy storage device consisting of any number of individual battery modules or cells that is used to propel a battery electric or hybrid electric vehicle. These terms may also generically refer to capacitor and flywheel energy storage devices in the context of hybrid electric vehicles.

"Battery state-of-charge" means the quantity of electrical energy remaining in the battery relative to the maximum rated capacity of the battery expressed in percent.

"Charge-depleting" means that the battery of a hybrid electric vehicle ultimately fully discharges and impairs vehicle operation as the vehicle continuously operates over a given driving cycle when no off-vehicle charging is performed and the consumable fuel is regularly replenished. Hybrid electric vehicles are required to be classified as either charge-sustaining or charge-depleting over each driving cycle (i.e. UDDS, HFEDS, US06, or SC03).

"Charge depletion range or R_{cd}" means the distance achieved by a hybrid electric vehicle on a specified driving cycle at the point when the zero emission energy storage device is depleted of off-vehicle charge and regenerative braking derived energy.

"Charge-sustaining" means that the battery of a hybrid electric vehicle ultimately does not fully discharge and impair vehicle operation as the vehicle continuously operates over a given driving cycle when no off-vehicle charging is performed and the consumable fuel is regularly replenished. Hybrid electric vehicles are required to be classified as either charge-sustaining or charge-depleting over each driving cycle (i.e. UDDS, HFEDS, US06, or SC03).

"Consumable fuel" means any solid, liquid, or gaseous matter that releases energy when consumed by an auxiliary power unit.

"Electric drive system" means an electric motor and associated power electronics which provide acceleration torque to the drive wheels sometime during normal vehicle operation. This does not include components that could act as a motor, but are configured to act only as a generator or engine starter in a particular vehicle application.

"Electric range fraction" means the fraction of electrical energy derived from off-vehicle charging and regenerative braking energy relative to total traction energy used over the charge depletion range on a specified drive cycle.

"Enhanced AT PZEV" means any PZEV that has an allowance of 1.0 or greater per vehicle without multipliers and makes use of a ZEV fuel

"Equivalent all electric range" means the charge depletion range multiplied by the electric range fraction (EAER = R_{cd} x ERF).

"Fuel-fired heater" means a fuel burning device that creates heat for the purpose of warming the passenger compartment of a vehicle but does not contribute to the propulsion of the vehicle.

"HFEDS" means highway fuel economy driving schedule. See 40 CFR 600.109(b).

"Hybrid electric vehicle" or "HEV" means any vehicle that can draw propulsion energy from both of the following on-vehicle sources of stored energy: 1) a consumable fuel and 2) an energy storage device such as a battery, capacitor, or flywheel.

"Neighborhood Electric Vehicle" or "NEV" means a motor vehicle that meets the definition of "low-speed vehicle" either in section 385.5 of the Vehicle Code or in 49 CFR 571.500 (as it existed on July 1, 2000), and is certified to zero-emission vehicle standards.

"Off-vehicle charge capable" means having the capability to charge a battery from an off-vehicle electric energy source that cannot be connected or coupled to the vehicle in any manner while the vehicle is being driven.

"Placed in service" means having been sold or leased to an end-user and not just to a dealer or other distribution chain entity, and having been individually registered for on-road use by the California Department of Motor Vehicles.

"PZEV" means any vehicle that is delivered for sale in California and that qualifies for a partial ZEV allowance of at least 0.2.

"Regenerative braking" means the partial recovery of the energy normally dissipated into friction braking that is returned as electrical current to an energy storage device.

"SC03" means the U.S. EPA SC03 driving schedule representing vehicle operation with air conditioning, as set forth in Appendix I of 40 CFR Part 86.

"SOC Net Change Tolerance" means the state-of-charge net change tolerance that is applied to the SOC Criterion for charge-sustaining hybrid electric vehicles when validating an emission test. See section D.8 of these procedures for tolerance specifications.

"SOC Criterion" means the state-of-charge criterion that is applied to charge-sustaining hybrid electric vehicle to validate an emission test. The SOC Criterion requires that no net change in battery energy occurs over a given test cycle, i.e. the final battery state-of-charge that is recorded at the end of the emission test must be equivalent to the initial battery state-of-charge that is set at the beginning of the emission test. The SOC Net Change Tolerance shall be applied to the SOC Criterion.

"Type 0, I, I.5, II, III and IV ZEV" all have the meanings set forth in section C.4.4(a).

"US06" means the US06 driving schedule for aggressive driving as set forth in Appendix I of 40 CFR Part 86.

"UDDS" means urban dynamometer driving schedule as set forth Appendix I of 40 CFR Part 86.

"Zero-emission vehicle" or **"ZEV"** means any vehicle certified to zero-emission standards.

"Zero-emission VMT" means the vehicle miles traveled with zero exhaust emissions of any criteria pollutant (or precursor pollutant).

"ZEV fuel" means a fuel that provides traction energy in on-road ZEVs. Examples of current technology ZEV fuels include electricity, hydrogen, and compressed air.

C. Zero-Emission Vehicle Standards.

1. ZEV Emission Standard. The Executive Officer shall certify new 2009 and subsequent model passenger cars, light-duty trucks and medium-duty vehicles as ZEVs if the vehicles produce zero exhaust emissions of any criteria pollutant (or precursor pollutant) under any and all possible operational modes and conditions.

2. Percentage ZEV Requirements

2.1 General Percentage ZEV Requirement.

(a) *Basic Requirement.* The minimum percentage ZEV requirement for each manufacturer is listed in the table below as the percentage of the PCs and LDT1s, and LDT2s to the extent required by section C.2.2(c), produced by the manufacturer and delivered for sale in California that must be ZEVs, subject to the conditions in section C.2.2.

Model Years	*Minimum ZEV Requirement*
2009 through 2011	11 %
2012 through 2014	12 %
2015 through 2017	14 %
2018 and subsequent	16 %

(b) *Calculating the Number of Vehicles to Which the Percentage ZEV Requirement is Applied.* A manufacturer's production volume of PCs and LDT1s, and LDT2s as applicable, produced and delivered for sale in California to comply with a given model year ZEV requirement will be based on a three-year average of the manufacturer's volume of PCs and LDT1s, and LDT2s as applicable, produced and delivered for sale in California in the prior fourth, fifth and sixth years (e.g. 2010 model-year ZEV requirements will be based on California production volumes of PCs and LDT1s, and LDT2s as applicable, for the 2004 to 2006 model years). This production averaging is used to determine ZEV requirements only, and has no effect on a manufacturer's size determination. As an alternative to the three year averaging of prior year production described above, a manufacturer may elect to base its ZEV obligation on the number of PCs and LDT1s, and LDT2s to the extent required by section C.2.1(c), produced by the manufacturer and delivered for sale in California that same model year. In applying the ZEV requirement, a PC, LDT1, or LDT2 as applicable, that is produced by a small volume manufacturer, but is marketed in California by another manufacturer under the other manufacturer's nameplate, shall be treated as having been produced by the marketing manufacturer.

(c) *Phase-in of ZEV Requirements for LDT2s.* Beginning with the ZEV requirements for the 2009 model year, a manufacturer's LDT2 production shall be included in determining the manufacturer's overall ZEV requirement under section C.2.1(a) in the increasing percentages shown in the table below.

2009	2010	2011	2012+
51%	68%	85%	100%

(d) *Exclusion of ZEVs in Determining a Manufacturer's Sales Volume.* In calculating for purposes of section C2.1(b) and (c) the volume of PCs, LDT1s and LDT2s a manufacturer has produced and delivered for sale in California, the manufacturer shall exclude the number of ZEVs produced by the manufacturer, or by a subsidiary in which the manufacturer has a greater than 50 percent ownership interest, and delivered for sale in California.

2.2 Requirements for Large Volume Manufacturers.

(a) *Primary Requirements for Large Volume Manufacturers through Model Year 2011.* In the 2009 through 2011 model years, a large-volume manufacturer must meet at least 22.5 percent of its ZEV requirement with ZEVs or ZEV credits generated by such vehicles, and at least another 22.5 percent with ZEVs, advanced technology PZEVs, or credits generated by such vehicles. The remainder of the large-volume manufacturer's ZEV requirement may be met using PZEVs or credits generated by such vehicles.

(b) *Alternative Requirements for Large Volume Manufacturers.*

(1) *Minimum Floor for Production of Type III ZEVs.*

(A) *[RESERVED]*

(B) *Requirement For the 2009-2011 Model Years.* A large volume manufacturer electing to be subject to the alternative compliance requirements during model years 2009 through 2011 must produce, deliver for sale, and place in service in California enough 2009-2011 model-year Type III ZEVs to generate ZEV credits sufficient to meet a cumulative percentage ZEV requirement of 0.65 percent of the manufacturer's average annual California sales of PCs and LDT1s over the three year period from model years 2003 through 2005, or submit an equivalent number of credits generated by such vehicles. The manufacturer may meet this requirement with [i] 2009-2011 model-year Type I or Type II ZEVs, provided that 2 Type I ZEVs or 1.33 Type II ZEVs or 0.8 Type IV ZEVs will equal one Type III ZEV.

(C) *[RESERVED]*

(D) *[RESERVED]*

(E) *[RESERVED]*

(F) *Exclusion of Additional Credits for Transportation Systems.* Any additional credits for transportation systems generated in accordance with section C.7.5 shall not be counted towards compliance with this section C.2.2(b)(1)(B).

(G) *Carry-over of Excess Credits.* ZEV credits generated from excess production in model years 2005 through 2008 may be carried forward and applied to the 2009 through 2011 minimum floor requirement specified in 1962.1(b)(2)(B)1.b. provided that the value of these carryover credits shall be based on the model year in which the credits are used. Beginning in 2012, these credits may no longer be used to meet the ZEV requirement; they may be used as Enhanced AT PZEV, AT PZEV, or PZEV credits. ZEV credits earned in model year 2009 and subsequent would be allowed to be carried forward for two years for application to the ZEV requirement. For example, ZEV credit earned in 2010 would retain full flexibility through 2012, at which time that credit could only be used as Enhanced AT PZEV, AT PZEV, or PZEV credits, and could not be used to satisfy the ZEV credit obligation, which may only be satisfied with credit generated from ZEVs.

(H) *Failure to Meet Requirement for Production of Type III ZEVs.* A manufacturer that, after electing to be subject to the alternative requirements in section C.2.2(b) for any model year from 2009 through 2011, fails to meet the requirement in section C.2.2(b)(1)(B) by the end of the specified three year period in which the model year falls, shall be treated as subject to the primary requirements in section C.2.1(a) for all model years in the specified three year period.

(I) *Rounding Convention.* The number of Type III ZEVs needed for a manufacturer under section C.2.2(b)(1)(B) shall be rounded to the nearest whole number.

(2) *Compliance With Percentage ZEV Requirements.* In the 2009 through 2011 model years, a large volume manufacturer electing to be subject to the alternative compliance requirements in a given model year must meet at least 45 percent of its ZEV requirement for that model year with ZEVs, advanced technology PZEVs, or credits generated from such vehicles. The remainder of the large volume manufacturer's ZEV requirement may be met using PZEVs or credits generated from such vehicles.

(3) *Sunset of Alternative Requirements After the 2011 Model Year.* The alternative requirements in section C.2.2(b) are not available after the 2011 model year.

(c) *Election of the Primary or Alternative Requirements for Large Volume Manufacturers.* A large volume manufacturer shall be subject to the primary ZEV requirements for the 2009 model year unless it notifies the Executive Officer in writing prior to the start of the 2005 model year that it is electing to be subject to the alternative compliance requirements for that model year. Thereafter, a manufacturer shall be subject to the same compliance option as applied in the previous model year unless it notifies the Executive Officer in writing prior to the start of a new model year that it is electing to switch to the other compliance option for that new model year. However, a large volume manufacturer that has previously elected to be subject to the primary ZEV requirements for one or more of the model years in the three year periods identified in

section C.2.2(b)(1)(A)-(D) may prior to the end of the three year period elect to become subject to the alternative compliance requirements for the full three year period upon a demonstration that it has complied with all of the applicable requirements for that period in section C.2.2(b)(1)(B).

(d) ***Requirements for Large Volume Manufacturers in Model Years 2012 through 2017.***. In the 2012 through 2017 model years, a large-volume manufacturer must meet the ZEV total percent requirement as shown in the table below with ZEVs or ZEV credits generated by such vehicles. The entire requirement may be met solely with ZEVs. Optionally, a manufacturer may choose to meet or exceed the minimum ZEV floor and then satisfy the remainder of the manufacturer requirement using Enhanced AT PZEVs, AT PZEVs, and PZEVs. The following table enumerates the total percent ZEV requirement and the maximum component percentages for the optional Enhanced AT PZEV, AT PZEV, and PZEV categories that may be used to meet the total percentage ZEV requirement.

Years	Total ZEV Percent Requirement	Minimum ZEV floor percentage range	Enhanced AT PZEVs percentage range	AT PZEVs	PZEVs up to
2012 – 2014	12	0.3 – 3.0	0.0 – 2.7	3.0	6.0
2015 – 2017	14	3.0 – 6.0	0.0 – 3.0	2.0	6.0

(e) ***Requirements for Large Volume Manufacturers in Model Year 2018 and Subsequent***. In the 2018 and subsequent model years, a large-volume manufacturer must meet a ZEV total percent requirement of 16 percent. The maximum portion of a large volume manufacturer's percentage ZEV requirement that may be satisfied by PZEVs that are not advanced technology PZEVs, or credits generated by such vehicles, is limited to 6 percent of the manufacturer's applicable California PC, LDT1, and LDT2 production volume; advanced technology PZEVs or credits generated by such vehicles may be used to meet up to one-half of the manufacturer's remaining ZEV requirement.

2.3 Requirements for Intermediate Volume Manufacturers. In 2009 and subsequent model years, an intermediate volume manufacturer may meet its ZEV requirement with up to 100 percent PZEVs or credits generated by such vehicles.

2.4 Requirements for Small Volume Manufacturers and Independent Low Volume Manufacturers. A small volume manufacturer or an independent low volume manufacturer is not required to meet the percentage ZEV requirements. However, a small volume manufacturer or an independent low volume manufacturer may earn and market credits for the ZEVs or PZEVs it produces and delivers for sale in California.

2.5 Counting ZEVs and PZEVs in Fleet Average NMOG Calculations. For purposes of calculating a manufacturer's fleet average NMOG value and NMOG credits under sections 1960.1(g)(2) and 1961(b) and (c), title 13, CCR, a vehicle certified as a

ZEV is counted as one ZEV, and a PZEV is counted as one SULEV certified to the 150,000 mile standards, regardless of any ZEV or PZEV multipliers.

2.6 [RESERVED].

2.7 Changes in Small Volume, Independent Low Volume, and Intermediate Volume Manufacturer Status.

(a) *Increases in California Production Volume.* In 2009 and subsequent model years, if a small volume manufacturer's average California production volume exceeds 4,500 units of new PCs, LDTs, and MDVs based on the average number of vehicles produced and delivered for sale for the three previous consecutive model years, or if an independent low volume manufacturer's average California production volume exceeds 10,000 units of new PCs, LDTs, and MDVs based on the average number of vehicles produced and delivered for sale for the three previous consecutive model years, the manufacturer shall no longer be treated as a small volume, or independent low volume manufacturer, as applicable, and shall comply with the ZEV requirements for independent low volume or intermediate volume manufacturers, as applicable, beginning with the sixth model year after the last of the three consecutive model years.

If an intermediate volume manufacturer's average California production volume exceeds 60,000 units of new PCs, LDTs, and MDVs based on the average number of vehicles produced and delivered for sale for the three previous consecutive model years, the manufacturer shall no longer be treated as an intermediate volume manufacturer and shall, beginning with the sixth model year after the last of the three consecutive model years, meet the ZEV requirements with PZEVs, of which at least one-fourth would have to be AT PZEVs and shall, beginning with the ninth model year after the last of the three consecutive model years, meet the ZEV regulation requirements with PZEVs, of which at least one-third would have to be AT PZEVs. The manufacturer would comply with all ZEV requirements for large volume manufacturers beginning with the twelfth model year after the last of the three consecutive model years.

The lead time shall be four rather than six years where a manufacturer ceases to be a small or intermediate volume manufacturer in 2003 or subsequent years due to the aggregation requirements in majority ownership situations, except that if the majority ownership in the manufacturer was acquired prior to the 2001 model year, the manufacturer must comply with the stepped-up ZEV requirements starting in the 2010 model year.

(b) *Decreases in California Production Volume.* If a manufacturer's average California production volume falls below 4,500, 10,000 or 60,000 units of new PCs, LDTs, and MDVs, as applicable, based on the average number of vehicles produced and delivered for sale for the three previous consecutive model years, the manufacturer shall be treated as a small volume, independent low volume, or intermediate volume

manufacturer, as applicable, and shall be subject to the requirements for a small volume, independent low volume, or intermediate volume manufacturer beginning with the next model year. In determining small volume manufacturer status, vehicles produced by one manufacturer and marketed in California by another manufacturer under the other manufacturer's nameplate shall be treated as part of the California production volume of the sales of the marketing manufacturer.

(c) *Calculating California Production Volume in Change of Ownership Situations.* Where a manufacturer experiences a change in ownership in a particular model year, the change will affect application of the aggregation requirements on the manufacturer starting with the next model year. The manufacturer's small or intermediate volume manufacturer status for the next model year shall be based on the average California production volume in the three previous consecutive model years of those manufacturers whose production volumes must be aggregated for that next model year. For example, where a change of ownership during the 2010 model year results in a requirement that the production volume of Manufacturer A be aggregated with the production volume of Manufacturer B, Manufacturer A's status for the 2011 model year will be based on the production volumes of Manufacturers A and B in the 2008-2010 model years. Where the production volume of Manufacturer A must be aggregated with the production volumes of Manufacturers B and C for the 2010 model year, and during that model year a change in ownership eliminates the requirement that Manufacturer B's production volume be aggregated with Manufacturer A's, Manufacturer A's status for the 2011 model year will be based on the production volumes of Manufacturers A and C in the 2008-2010 model years. In either case, the lead time provisions in section 2.5(a) and (b) will apply.

3. Partial ZEV Allowance Vehicles (PZEVs).

3.1 Introduction. This section C.3 sets forth the criteria for identifying vehicles delivered for sale in California as PZEVs. A PZEV is a vehicle that cannot be certified as a ZEV but qualifies for a PZEV allowance of at least 0.2.

3.2 Baseline PZEV Allowance. In order for a vehicle to be eligible to receive a PZEV allowance, the manufacturer must demonstrate compliance with all of the following requirements. A qualifying vehicle will receive a baseline PZEV allowance of 0.2.

(a) *SULEV Standards.* Certify the vehicle to the 150,000-mile SULEV exhaust emission standards for PCs and LDTs in section 1961(a)(1), title 13, CCR. Bi-fuel, fuel-flexible and dual-fuel vehicles must certify to the applicable 150,000-mile SULEV exhaust emission standards when operating on both fuels;

(b) *Evaporative Emissions.* Certify the vehicle to the evaporative emission standards in section 1976(b)(1)(E), title 13, CCR zero-fuel evaporative emissions standards);

(c) *OBD.* Certify that the vehicle will meet the applicable on-board diagnostic requirements in sections 1968.1 or 1968.2, title 13, CCR, as applicable, for 150,000 miles; and

(d) *Extended Warranty.* Extend the performance and defects warranty period set forth in sections 2037(b)(2) and 2038(b)(1) to 15 years or 150,000 miles, whichever occurs first, except that the time period is to be 10 years for a zero emission energy storage device used for traction power (such as a battery, ultracapacitor, or other electric storage device).

3.3 Zero-Emission VMT PZEV Allowance.

(a) *Calculation of Zero Emission VMT Allowance.* A vehicle that meets the requirements of section C.3.2 and has zero-emission vehicle miles traveled ("VMT") capability will generate an additional zero emission VMT PZEV allowance, calculated as follows:

Urban Equivalent All-Electric Range (EAER)	*Zero-emission VMT Allowance*
< 10 miles	0.0
10 miles to 100 miles	EAER x $(1 - UF_{Rcd})/14.6$
>100 miles	1.58

The urban equivalent all-electric range (EAER) and urban charge depletion range (R_{cd}) shall be determined in accordance with section E.3.(2)(a) of these test procedures. Utility Factor (UF) based on the charge depletion range (R_{cd}) shall be determined according to the 0-100 mile 4th order curve fit from SAE J1711, issued March 1999, p52.

(b) *Alternative Procedures.* As an alternative to determining the zero-emission VMT allowance in accordance with the preceding section C.3.3(a), a manufacturer may submit for Executive Officer approval an alternative procedure for determining the zero-emission VMT potential of the vehicle as a percent of total VMT, along with an engineering evaluation that adequately substantiates the zero-emission VMT determination. For example, an alternative procedure may provide that a vehicle with zero-emissions of one regulated pollutant (e.g., NOx) and not another (e.g., NMOG) will qualify for a zero-emission VMT allowance of 1.5.

(c) *[RESERVED].*

3.4 PZEV Allowance for Advanced ZEV Componentry. A vehicle that meets the requirements of section C.3.2 may qualify for an advanced componentry PZEV allowance as provided in this section 3.4.

(a) *Use of High Pressure Gaseous Fuel or Hydrogen Storage System.* A vehicle equipped with a high pressure gaseous fuel storage system capable of refueling at 3600 pounds per square inch or more and operating exclusively on this gaseous fuel shall qualify for an advanced componentry PZEV allowance of 0.2. A vehicle capable of operating exclusively on hydrogen stored in a high pressure system capable of refueling at 3600 pounds per square inch or more, or stored in nongaseous form, shall instead qualify for an advanced componentry PZEV allowance of 0.3.

(b) *Use of a Qualifying HEV Electric Drive System*

(1) *Classification of HEVs.* HEVs qualifying for additional advanced componentry PZEV allowance or allowances that may be used in the AT PZEV category are classified in one of four types of HEVs based on the criteria in the following table. HEVs must qualify for the Zero Emission VMT allowance in section 3.3(a) of this document and achieve 10 miles or more of all electric UDDS range in addition to meeting the requirements in the following table to qualify for Type F advanced componentry allowance.

Characteristics	*Type C*	*Type D*	*Type E*	*Type F*
Electric Drive System Peak Power Output	≥ 10 kW	≥ 10 kW	≥ 50 kW	Zero Emission VMT allowance; ≥ 10 mile all-electric range
Traction Drive System Voltage	< 60 Volts	≥ 60 Volts	≥ 60 volts	≥ 60 volts
Traction Drive Boost	Yes	Yes	Yes	Yes
Regenerative Braking	Yes	Yes	Yes	Yes
Idle Start/Stop	Yes	Yes	Yes	Yes

(2) *[RESERVED].*

(3) *[RESERVED].*

(4) *Type C HEVs.* A PZEV that the manufacturer demonstrates to the reasonable satisfaction of the Executive Officer meets all of the criteria for a Type C HEV, and that is equipped with an advanced traction energy storage system – such as lithium ion batteries, nickel metal-hydride batteries, ultracapacitors, or other similar systems – with a design lifetime of at least 10 years, qualifies for an additional

advanced componentry allowance of 0.2 in the 2009 through 2011 model years, 0.15 in the 2012 through 2014 model years, and 0.1 in the 2015 and subsequent model years.

(5) *Type D HEVs.* A PZEV that the manufacturer demonstrates to the reasonable satisfaction of the Executive Officer meets all of the criteria for a Type D HEV qualifies for an additional advanced componentry allowance of 0.4 in the 2009 through 2011 model years, 0.35 in the 2012 through 2014 model years, and 0.25 in the 2015 and subsequent model years.

(6) *Type E HEVs.* A PZEV that the manufacturer demonstrates to the reasonable satisfaction of the Executive Officer meets all of the criteria for a Type E HEV qualifies for an additional advanced componentry allowance of 0.5 in the 2009 through 2011 model years, 0.45 in the 2012 through 2014 model years, and 0.35 in the 2015 and subsequent model years.

(7) *Type F HEVs.* A PZEV that the manufacturer demonstrates to the reasonable satisfaction of the Executive Officer meets all of the criteria for a Type F HEV qualifies for an additional advanced componentry allowance of 0.85 in the 2009 through 2011 model years, 0.8 in the 2012 through 2014 model years, and 0.7 in the 2015 and subsequent model years.

(8) *Severability.* In the event that all or part of section C.3.4(b)(1)-(7) is found invalid, the remainder of these standards and test procedures, including the remainder of section C.3.4(b)(1)-(7), remains in full force and effect.

3.5 PZEV Allowance for Low Fuel-Cycle Emissions. A vehicle that makes exclusive use of fuel(s) with very low fuel-cycle emissions shall receive a PZEV allowance of 0.3. In order to receive the PZEV low fuel-cycle emissions allowance, a manufacturer must demonstrate to the Executive Officer, using peer-reviewed studies or other relevant information, that NMOG emissions associated with the fuel(s) used by the vehicle (on a grams/mile basis) are lower than or equal to 0.01 grams/mile. Fuel-cycle emissions must be calculated based on near-term production methods and infrastructure assumptions, and the uncertainty in the results must be quantified.

3.6 Calculation of PZEV Allowance.

(a) *Calculation of Combined PZEV Allowance for a Vehicle.* The combined PZEV allowance for a qualifying vehicle in a particular model year is the sum of the PZEV allowances listed in this section C.3.6, multiplied by any PZEV introduction phase-in multiplier listed in section C.3.7, subject to the cap in section C.3.6(b).

(1) *Baseline PZEV Allowance.* The baseline PZEV allowance of 0.2 for vehicles meeting the criteria in section C.3.2;

(2) *Zero Emission VMT PZEV Allowance.* The zero-emission VMT PZEV allowance, if any, determined in accordance with section C.3.3.;

(3) *Advanced ZEV Componentry PZEV Allowance.* The advanced ZEV componentry PZEV allowance, if any, determined in accordance with section C.3.4; and

(4) *Fuel-cycle Emissions PZEV Allowance.* The fuel-cycle emissions PZEV allowance, if any, determined in accordance with section C.3.5.

(b) *Caps on the Value of an AT PZEV Allowance.*

(1) *Cap for 2012 and Subsequent Model-Year Vehicles.* The maximum value an AT PZEV may earn before phase-in multipliers, including the baseline PZEV allowance, is 3.0.

(2) *[RESERVED].*

3.7 PZEV Multipliers

(a) *[RESERVED].*

(b) *Introduction Phase-In Multiplier for PZEVs That Earn a Zero Emission VMT Allowance.* Each 2009 through 2011 model year PZEV that earns a zero emission VMT allowance under section C.3.3 and is produced and delivered for sale in California qualifies for a phase-in multiplier of 3.0.

4. Qualification for ZEV Multipliers and Credits.

4.1 [RESERVED].

4.2 [RESERVED].

4.3 [RESERVED].

4.4 ZEV Credits for 2009 and Subsequent Model Years.

(a) *ZEV Tiers for Credit Calculations.* ZEV credits from a particular ZEV are based on the assignment of a given ZEV into one of the following six ZEV tiers:

ZEV Tier	*UDDS ZEV Range (miles)*	*Fast Refueling Capability*
NEV	No minimum	N/A
Type 0	< 50	N/A
Type I	≥ 50, <75	N/A
Type I.5	≥ 75, <100	N/A
Type II	≥ 100	N/A
Type III	≥ 100	Must be capable of replacing 95% maximum rated energy capacity in ≤ 10 minutes per section 4.4(b)
OR	≥ 200	N/A
Type IV	≥ 200	Must be capable of replacing 190 miles (UDDS ZEV range) in ≤ 15 minutes per section 1962.1(d)(5)(B)

(b) *Fast Refueling.* The "fast refueling capability" requirement for a 2009 and subsequent model-year Type III or IV ZEV in section 1962(d)(5)(A) will be considered met if the Type III ZEV has the capability to accumulate at least 95 miles of UDDS range in 10 minutes or less and the Type IV ZEV has the capability to accumulate at least 190 miles in 15 minutes or less.

(c) *ZEV Credits for 2009 and Subsequent Model-Year ZEVs.* A 2009 and subsequent model-year ZEV, other than a NEV or Type 0, earns 1 ZEV credit when it is produced and delivered for sale in California. A 2009 and subsequent model-year ZEV earns additional credits based on the earliest year in which the ZEV is placed in service (not earlier than the ZEV's model year). The following table identifies the total credits that a ZEV in each of the six ZEV tiers will earn, including the credit not contingent on placement in service, if it is placed in service in the specified model year or by June 30 after the end of the specified calendar year.

Total Credit Earned by ZEV Type and Model Year for Production and Delivery for Sale and for Placement		
Tier	*Year in Which ZEV is Placed in Service*	
	2009-2017	2018+
NEV	0.30	0.30
Type 0	1	1
Type I	2	2
Type I.5	2.5	2.5
Type II	3	3
Type III	4	3
Type IV	5	3

(d) *Multiplier for Certain Type I and Type II ZEVs.* A 2009 through 2011 model-year Type I and Type II ZEV shall qualify for a multiplier of 1.25 if it is either sold to a motorist or is leased for three or more years to a motorist who is given the option to purchase or re-lease the vehicle for two years or more at the end of the first lease term.

(e) *Counting Specified ZEVs Placed in a Section 177 State.* As specified in the table below, specified model year Type I, I.5, II, III or IV ZEVs that are certified to the California ZEV standards and are placed in service in a state that is administering the California ZEV requirements pursuant to section 177 of the federal Clean Air Act (42 U.S.C. § 7507) applicable for the ZEV's model year may be counted towards compliance with the California percentage ZEV requirements in section C.2, including the requirements in section C.2.2(b), as if they were delivered for sale and placed in service in California. Similarly, specified model year Type I, I.5, II, III or IV ZEVs that are certified to the California ZEV standards and are placed in service in California may be counted towards the percentage ZEV requirements of any state that is administering the California ZEV requirements pursuant to section 177 of the federal Clean Air Act, including requirements based on section C.2.2(b).

Vehicle Type	**Through Model Year:**
Type I, I.5, or II ZEV	2014
Type III or IV ZEV	2017

5. [Reserved]

6. [Reserved]

7. Generation and Use of ZEV Credits; Calculation of Penalties

7.1 Introduction. A manufacturer that produces and delivers for sale in California ZEVs or PZEVs in a given model year exceeding the manufacturer's ZEV requirement set forth in section C.2 shall earn ZEV credits in accordance with this section C.7.

7.2 ZEV Credit Calculations.

(a) *Credits from ZEVs.* The amount of g/mi ZEV credits earned by a manufacturer in a given model year from ZEVs shall be expressed in units of g/mi NMOG, and shall be equal to the number of credits from ZEVs produced and delivered for sale in California that the manufacturer applies towards meeting the ZEV requirements for the model year subtracted from the number of ZEVs produced and delivered for sale in California by the manufacturer in the model year and then multiplied by the NMOG fleet average requirement for PCs and LDT1s for that model year.

(b) *Credits from PZEVs.* The amount of g/mi ZEV credits from PZEVs earned by a manufacturer in a given model year shall be expressed in units of g/mi NMOG, and shall be equal to the total number of PZEV allowances from PZEVs produced and delivered for sale in California that the manufacturer applies towards meeting its ZEV requirement for the model year subtracted from the total number of PZEV allowances from PZEVs produced and delivered for sale in California by the manufacturer in the model year and then multiplied by the NMOG fleet average requirement for PCs and LDT1s for that model year.

(c) *Separate Credit Accounts.* The number of credits from a manufacturer's [i] ZEVs, [ii] advanced technology PZEVs, and [iii] all other PZEVs shall each be maintained separately.

7.3 ZEV Credits for MDVs and LDTs eOther tThan LDT1s. ZEVs and PZEVs classified as MDVs or as LDTs other than LDT1s may be counted toward the ZEV requirement for PCs, LDT1s and LDT2s as applicable, and included in the calculation of ZEV credits as specified in this section C.4 if the manufacturer so designates.

7.4 ZEV Credits for Advanced Technology Demonstration Programs. In model years 2009 through 2014, a vehicle, other than a NEV, which is placed in a California advanced technology demonstration program for a period of two or more years, may earn ZEV credits even if it is not "delivered for sale" or registered with the

California Department of Motor Vehicles (DMV). To earn such credits, the manufacturer must demonstrate to the reasonable satisfaction of the Executive Officer that the vehicles will be regularly used in applications appropriate to evaluate issues related to safety, infrastructure, fuel specifications or public education, and that for 50 percent or more of the first two years of placement the vehicle will be situated in California. Such a vehicle is eligible to receive the same allowances and credits that it would have earned if placed in service. To determine vehicle credit, the model-year designation for a demonstration vehicle shall be consistent with the model-year designation for conventional vehicles placed in the same timeframe. Manufacturers may earn credit for as many as six vehicles under this section C.7.4. A manufacturer's vehicles in excess of the six-vehicle cap will not be eligible for advanced technology demonstration program credits.

7.5 ZEV Credits for Transportation Systems.

(a) *General.* In model years 2009 and subsequent, a ZEV placed, for two or more years, as part of a transportation system may earn additional ZEV credits, which may used in the same manner as other credits earned by vehicles of that category, except as provided in section C.7.5(c) below. In model years 2009 through 2011, an advanced technology PZEV or PZEV placed as part of a transportation system may earn additional ZEV credits, which may be used in the same manner as other credits earned by vehicles of that category, except as provided in section C.7.5(c) below. A NEV is not eligible to earn credit for transportation systems. To earn such credits, the manufacturer must demonstrate to the reasonable satisfaction of the Executive Officer that the vehicle will be used as a part of a project that uses an innovative transportation system as described in section C.7.5(b) below.

(b) *Credits Earned.* In order to earn additional credit under this section C.7.5, a project must at a minimum demonstrate [i] shared use of ZEVs, AT PZEVs or PZEVs, and [ii] the application of "intelligent" new technologies such as reservation management, card systems, depot management, location management, charge billing and real-time wireless information systems. If, in addition to factors [i] and [ii] above, a project also features linkage to transit, the project may receive further additional credit. For ZEVs only, not including NEVs, a project that features linkage to transit, such as dedicated parking and charging facilities at transit stations, but does not demonstrate shared use or the application of intelligent new technologies, may also receive additional credit for linkage to transit. The maximum credit awarded per vehicle shall be determined by the Executive Officer, based upon an application submitted by the manufacturer and, if appropriate, the project manager. The maximum credit awarded shall not exceed the following:

Type of Vehicle	*Model Year*	*Shared Use, Intelligence*	*Linkage to Transit*
PZEV	through 2011	2	1
AT PZEV	through 2011	4	2
ZEV	2009 through 2011	6	3
ZEV	2012 and subsequent	2	1

(c) *Cap on Use of Credits.*

(1) *ZEVs.* Credits earned or allocated by ZEVs pursuant to this section C.7.5, not including all credits earned by the vehicle itself, may be used to satisfy up to one-tenth of a manufacturer's ZEV obligation in any given model year.

(2) *AT PZEVs.* Credits earned or allocated by AT PZEVs pursuant to this section C.7.5, not including all credits earned by the vehicle itself, may be used to satisfy up to one-twentieth of a manufacturer's ZEV obligation in any given model year, but may only be used in the same manner as other credits earned by vehicles of that category.

(3) *PZEVs.* Credits earned or allocated by PZEVs pursuant to this section C.7.5, not including all credits earned by the vehicle itself, may be used to satisfy up to one-fiftieth of the manufacturer's ZEV obligation in any given model year, but may only be used in the same manner as other credits earned by vehicles of that category.

(d) *Allocation of Credits.* Credits shall be assigned by the Executive Officer to the project manager or, in the absence of a separate project manager, to the vehicle manufacturers upon demonstration that a vehicle has been placed in a project. Credits shall be allocated to vehicle manufacturers by the Executive Officer in accordance with a recommendation submitted in writing by the project manager and signed by all manufacturers participating in the project, and need not be allocated in direct proportion to the number of vehicles placed.

7.6 Use of ZEV Credits. A manufacturer may meet the ZEV requirements in any given model year by submitting to the Executive Officer a commensurate amount of g/mi ZEV credits, consistent with section C.2. These credits may be earned previously by the manufacturer or acquired from another party, except that credits earned from NEVs offered for sale or placed in service in model years 2001 through 2005 cannot be used to satisfy more than 50 percent of a manufacturer's percentage ZEV obligation that may only be satisfied with credits from ZEVs. The manufacturer's percentage ZEV obligation that may be satisfied by credits from AT PZEVs but not PZEVs is listed in the table below:

AT PZEV Category	
2009	*2010 and beyond*
75%	50%

This limitation applies to credits earned in model years 2001 through 2005 by the same manufacturer or earned in model years 2001 through 2005 by another manufacturer and acquired. The amount of g/mi ZEV credits required to be submitted shall be calculated according to the criteria set forth in this section C.7.

ZEV credits generated from excess production in model years 2009 and subsequent, including those acquired from another party, may be carried forward and applied to the ZEV minimum floor requirement specified in C.2.2.(b)(1)(B). for two subsequent model years. Beginning with the third subsequent model year, those earned ZEV credits may no longer be used to satisfy the manufacturer's percentage ZEV obligation that may only be satisfied by credits from ZEVs, but may be used to satisfy the manufacturer's percentage ZEV obligation that may be satisfied by credits from Enhanced AT PZEVs, AT PZEVs, or PZEVs. For example, ZEV credit earned in 2010 would retain full flexibility through 2012, at which time that credit could only be used as Enhanced AT PZEV, AT PZEV, or PZEV credits.

7.7 Requirement to Make Up a ZEV Deficit.

(a) *General.* A manufacturer that produces and delivers for sale in California fewer ZEVs than required in a given model year shall make up the deficit by the end of the third model year by submitting to the Executive Officer a commensurate amount of g/mi ZEV credits. The amount of g/mi ZEV credits required to be submitted shall be calculated by [i] adding the number of ZEVs produced and delivered for sale in California by the manufacturer for the model year to the number of ZEV allowances from partial ZEV allowance vehicles produced and delivered for sale in California by the manufacturer for the model year (for a large volume manufacturer, not to exceed that permitted under section C.2.1), [ii] subtracting that total from the number of ZEVs required to be produced and delivered for sale in California by the manufacturer for the model year, and [iii] multiplying the resulting value by the fleet average requirements for PCs and LDT1s for the model year in which the deficit is incurred.

7.8 Penalty for Failure to Meet ZEV Requirements. Any manufacturer that fails to produce and deliver for sale in California the required number of ZEVs and submit an appropriate amount of g/mi ZEV credits and does not make up ZEV deficits within the specified time period shall be subject to the Health and Safety Code section 43211 civil penalty applicable to a manufacturer that sells a new motor vehicle that does not meet the applicable emission standards adopted by the state board. The cause of action shall be deemed to accrue when the ZEV deficits are not balanced by the end of the specified time period. For the purposes of Health and Safety Code section 43211, the number of vehicles not meeting the state board's standards shall be calculated according to the following equation, provided that the percentage of a large

volume manufacturer's ZEV requirement for a given model year that may be satisfied with partial ZEV allowance vehicles or ZEV credits from such vehicles may not exceed the percentages permitted under section C.2.1:

(No. of ZEVs required to be produced and delivered for sale in California for the model year) - (No. of ZEVs produced and delivered for sale in California for the model year) - (No. of ZEV allowances from partial ZEV allowance vehicles produced and delivered for sale in California for the model year) - [(Amount of ZEV credits submitted for the model year) / (the fleet average requirement for PCs and LDT1s for the model-year)].

8. Severability. Each provision of these standards and test procedures is severable, and in the event that any provision of these standards and test procedures is held to be invalid, the remainder of the standards and test procedures remains in full force and effect.

9. Public Disclosure. Records in the Board's possession for the vehicles subject to the requirements of section 1962.1 shall be subject to disclosure as public records as follows:

(a) Each manufacturer's annual production data and the corresponding credits per vehicle earned for ZEVs (including ZEV type), Enhanced AT PZEVs, AT PEVs, and PZEVs for the 2009 and subsequent model years; and

(b) Annual Credit balances for 2010 and subsequent years for:

(1) Each type of vehicle: ZEVs (minus NEVs), NEVs, Enhanced AT PZEVs, AT PEVs, and PZEVs; and

(2) Advanced technology demonstration programs; and

(3) Transportation systems; and

(4) Credits earned under section 1962.1(d)(5)(C).

D. Certification Requirements

1. Durability and Emission Testing Requirements. All ZEVs are exempt from all mileage and service accumulation, durability-data vehicle, and emission-data vehicle testing requirements.

2. Information Requirements: Application for Certification. Except as noted below, the Part I (40 CFR § 86.1843-01(c)) certification application shall include the following:

2.1 Identification and description of the vehicle(s) covered by the application.

2.2 Identification of the vehicle weight category to which the vehicle is certifying: PC, LDT 0-3750 lbs. LVW, LDT 3751-5750 lbs. LVW, LDT 3751 lbs. LVW - 8500 lbs. GVW, or MDV (state test weight range), and the curb weight and gross vehicle weight rating of the vehicle.

2.3 Identification and description of the propulsion system for the vehicle.

2.4 Identification and description of the climate control system used on the vehicle.

2.5 Projected number of vehicles produced and delivered for sale in California, and projected California sales.

2.6 Identification of the energy usage in kilowatt-hours per mile from:

(a) the battery output (DC energy) (to be submitted with the Part II certification application (40 CFR § 86.1843-01(d));

(b) the point when electricity is introduced from the electrical outlet (AC energy); and

(c) the operating range in miles of the vehicle when tested in accordance with the All-Electric Range Test set forth in section E, below.

2.7 For those ZEVs and HEVs that use fuel-fired heaters, the manufacturer shall provide:

(a) a description of the control system logic of the fuel-fired heater, including an evaluation of the conditions under which the fuel-fired heater can be operated and an evaluation of the possible operational modes and conditions under which evaporative emissions can exist;

(b) the exhaust emissions value per mile produced by the auxiliary fuel-fired heater operated between 68°F and 86°F; and

(c) the test plan which describes the procedure used to determine the mass emissions of the fuel-fired heater.

2.8 All information necessary for proper and safe operation of the vehicle, including information on the safe handling of the battery system, emergency procedures to follow in the event of battery leakage or other malfunctions that may affect the safety of the vehicle operator or laboratory personnel.

2.9 Method for determining battery state-of-charge, battery charging capacity and recharging procedures, and any other relevant information as determined by the Executive Officer.

2.10 Battery specific energy data and calculations as specified in section E.4 of these procedures including the weight of the battery system and the three hour discharge rate (C/3) energy capacity.

2.11 Vehicle and battery break-in period as specified in section E.2 of these test procedures.

2.12 Labeling shall conform with the requirements specified in section 1965, title 13, CCR and the California Motor Vehicle Emission Control and Smog Index Label Specifications.

2.13 For a ZEV, extended range HEV or PZEV that qualifies to receive one or more multipliers under sections C.3 - C.7, the manufacturer shall provide all information relevant to the vehicle's qualification for, and the estimated value of, the multiplier(s). The Executive Officer may request additional information needed to appropriately characterize the vehicle. Based on the submitted information and other relevant data, the Executive Officer shall assign to the vehicle the highest multiplier(s) for which the manufacturer has demonstrated the vehicle qualifies at that time.

2.14 Where a manufacturer plans to require any scheduled maintenance for a PZEV before 150,000 miles, the manufacturer must submit information demonstrating the need for each scheduled maintenance item before 150,000 miles, including actual in-use data, engineering evaluation of the durability of the part, or other relevant information. The manufacturer may require such maintenance for a PZEV only upon the Executive Officer's determination, prior to certification, the manufacturer has demonstrated the need for the scheduled maintenance; this determination may not unreasonably be denied.

3. ZEV Reporting Requirements. In order to verify the status of each manufacturer's compliance with the ZEV requirements for a given calendar year, each manufacturer shall submit a report to the Executive Officer at least annually, by May 1 of the calendar year following the close of the model year, that identifies the necessary delivery and placement data of all vehicles generating ZEV credits or allowances, and all transfers and acquisitions of ZEV credits. The manufacturer may update the report by September 1 to cover activities occurring between April 1 and June 30.

E. Test Procedures

The "as adopted or amended dates" of the 40 CFR Part 86 regulations referenced by this document are the dates identified in the "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles" incorporated by reference in section 1961(d), title 13, CCR.

1. Electric Dynamometer. All ZEVs must be tested using a 48-inch single roll electric dynamometer meeting the requirements of 40 CFR Subpart B, § 86.108-00(b)(2).

2. Vehicle and Battery Break-In Period. A manufacturer shall use good engineering judgment in determining the proper stabilized emissions mileage test point and report same according to the requirements of section D.2.11 above.

3. All-Electric Range Test. All 2001 and subsequent ZEVs and only off-vehicle charge capable hybrid electric vehicles shall be subject to the All-Electric Range Test specified below for the purpose of determining the energy efficiency and operating range of a ZEV or of an off-vehicle charge capable hybrid electric vehicle operating without the use of its auxiliary power unit. For hybrid electric vehicles, the manufacturer may elect to conduct the All-Electric Range Test prior to vehicle preconditioning in the exhaust and evaporative emission test sequence specified in the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" as incorporated by reference in section 1976, Title 13, CCR.

3.1 **Cold soak**. The vehicle shall be stored at an ambient temperature not less than 68°F (20°C) and not more than 86°F (30°C) for 12 to 36 hours. During this time, the vehicle's battery shall be charged to a full state-of-charge.

3.2 **Driving schedule.**

3.2.1 **Determination of All-Electric Range-Urban.**

(a) At the end of the cold soak period, the vehicle shall be placed, either driven or pushed, onto a dynamometer and operated through successive Urban Dynamometer Driving Schedules (UDDS), 40 CFR, Part 86, Appendix I, which is incorporated herein by reference. A 10-minute soak shall follow each UDDS cycle.

(b) For vehicles with a maximum speed greater than or equal to the maximum speed on the UDDS cycle, this test sequence shall be repeated until the vehicle is no longer able to maintain either the speed or time tolerances in 40 CFR § 86.115-00 (b)(1) and (2), or the manufacturer determines that the test should be terminated for safety reasons, e.g. excessively high battery temperature, abnormally low battery voltage, etc. For off-vehicle charge capable hybrid electric vehicles, this determination shall be performed without the use of the auxiliary power unit.

(c) For vehicles with a maximum speed less than the maximum speed on the UDDS cycle, the vehicle shall be operated at maximum available power (or full throttle) when the vehicle cannot achieve the speed trace within the speed and time tolerances specified in 40 CFR § 86.115-00(b)(1) and (2). The test shall be terminated when the vehicle speed when operated at maximum available power (or full throttle) falls below 95 percent of the maximum speed initially achieved on the UDDS cycle or when the battery state-of-charge is depleted to the lowest level allowed by the manufacturer, or the manufacturer determines that the test should be terminated for safety reasons, e.g. excessively high battery temperature, abnormally low battery voltage, etc., whichever occurs first. For off-vehicle charge capable hybrid electric vehicles, this determination shall be performed without the use of the auxiliary power unit.

3.2.2 **Determination of All-Electric Range-Highway.**

(a) At the end of the cold soak period, the vehicle shall be placed, either driven or pushed, onto a dynamometer and operated through two successive Highway Fuel Economy Driving Schedules (HFEDS), 40 CFR, Part 600, Appendix I, which is incorporated herein by reference. There shall be a 15 second zero speed with key on and brake depressed between two cycles and a 10-minute soak following the two HFEDS cycles.

(b) For vehicles with a maximum speed greater than or equal to the maximum speed on the HFEDS cycle, this test sequence shall be repeated until the vehicle is no longer able to maintain either the speed or time tolerances in 40 CFR § 86.115-00 (b)(1) and (2), or the manufacturer determines that the test should be terminated for safety reasons, e.g. excessively high battery temperature, abnormally low battery voltage, etc. For off-vehicle charge capable hybrid electric vehicles, this determination is optional and shall be performed without the use of the auxiliary power unit.

(c) For vehicles with a maximum speed less than the maximum speed on the HFEDS cycle, the vehicle shall be operated at maximum available power (or full throttle) when the vehicle cannot achieve the speed trace within the speed and time tolerances specified in 40 CFR § 86.115-00(b)(1) and (2). The test shall be terminated when the vehicle speed when operated at maximum available power (or full throttle) falls below 95 percent of the maximum speed initially achieved on the HFEDS cycle or when the battery state-of-charge is depleted to the lowest level allowed by the manufacturer, or the manufacturer determines that the test should be terminated for safety reasons, e.g. excessively high battery temperature, abnormally low battery voltage, etc., whichever occurs first. For off-vehicle charge capable hybrid electric vehicles, this determination shall be performed without the use of the auxiliary power unit.

(d) NEVs are exempt from the all-electric range highway test.

3.2.3 **Recording requirements.** Once the vehicle is no longer able to maintain the speed and time requirements specified in (2) above, or once the auxiliary power unit turns on, in the case of an off-vehicle charge capable hybrid electric vehicle, the vehicle shall be brought to an immediate stop and the following data recorded:

(a) mileage accumulated during the All-Electric Range Test;
(b) Net DC energy from the battery that was expended during the All-Electric Range Test (may be reported as the total DC battery energy output and the total DC battery energy input during the All-Electric Range Test);
(c) AC energy required to fully charge the battery after the All-Electric Range Test from the point where electricity is introduced from the electric outlet to the battery charger; and
(d) DC energy required to fully charge the battery after the All-Electric Range Test from the point where electricity is introduced from the battery charger to the battery.

Battery charging shall begin within 1 hour after terminating the All-Electric Range Test.

3.2.4 **Regenerative braking**. Regenerative braking systems may be utilized during the range test. The braking level, if adjustable, shall be set according to the manufacturer's specifications prior to the commencement of the test. The driving schedule speed and time tolerances specified in (2) shall not be exceeded due to the operation of the regenerative braking system.

4. Determination of Battery Specific Energy for ZEVs

Determine the specific energy of batteries used to power a ZEV in accordance with the U.S. Advanced Battery Consortium's Electric Vehicle Battery Procedure Manual (January 1996), Procedure No. 2, "Constant Current Discharge Test Series," using the C/3 rate. The weight calculation must reflect a completely functional battery system as defined in the Appendix of the Manual, including pack(s), required support ancillaries (e.g., thermal management), and electronic controller.

5. Determination of the Emissions of the Fuel-fired Heater

The exhaust emissions result of the fuel-fired heater shall be determined by operating at a maximum heating capacity with a cold start between 68°F and 86°F for a period of 20 minutes and dividing the grams of emissions by 20. The resulting grams per minute shall be multiplied by 3.0 minutes per mile for a grams per mile value.

6. Hybrid Electric Vehicle FTP Emission Test Provisions

Alternative procedures may be used if shown to yield equivalent results and if approved in advance by the Executive Officer of the Air Resources Board.

6.1 Vehicle Preconditioning

To be conducted pursuant to the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" as incorporated by reference herein with the following supplemental requirements:

6.1.1 Battery state-of-charge shall be set prior to initial fuel drain and fill before vehicle preconditioning.

6.1.2 For hybrid electric vehicles that do not allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at a level that causes the hybrid electric vehicle to operate the auxiliary power unit for the maximum possible cumulative amount of time during the preconditioning drive.

6.1.3 For hybrid electric vehicles that allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at a level that satisfies one of the following conditions:

(i) If the hybrid electric vehicle is charge-sustaining over the UDDS, battery state-of-charge shall be set at the lowest level allowed by the manufacturer.

(ii) If the hybrid electric vehicle is charge-depleting over the UDDS, battery state-of-charge shall be set at the level recommended by the manufacturer for activating the auxiliary power unit when operating in urban driving conditions.

6.1.4 After setting battery state-of-charge, the hybrid electric vehicle shall be pushed or towed to a work area for fuel drain and fill according to sections D.1.1. and D.1.2. of the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" as incorporated by reference herein.

6.1.5 Following fuel drain and fill, the vehicle shall be pushed or towed into position on a dynamometer and preconditioned. If the auxiliary power unit is capable of being manually activated, the auxiliary power unit shall be manually activated at the beginning of and operated throughout the preconditioning drive.

6.1.6 Within five minutes of completing preconditioning drive, battery state-of-charge shall be set at a level that satisfies one of the following conditions:

(i) If the hybrid electric vehicle does not allow manual activation of the auxiliary power unit and is charge-sustaining over the UDDS, then set battery state-of-charge to a level such that the SOC Criterion (see section B., Definitions, of these procedures) would be satisfied for the dynamometer procedure (section 6.2 of these procedures). If off-vehicle

charging is required to increase battery state-of-charge for proper setting, off-vehicle charging shall occur during 12 to 36 hour soak period.

(ii) If the hybrid electric vehicle does not allow manual activation of the auxiliary power unit and is charge-depleting over the UDDS, then no battery state-of-charge adjustment is permissible.

(iii) If the hybrid electric vehicle does allow manual activation of the auxiliary power unit, then set battery state-of-charge to manufacturer recommended level for activating the auxiliary power unit when the hybrid electric vehicle is operating in urban driving conditions.

6.2 Dynamometer Procedure

To be conducted pursuant to 40 CFR § 86.135-00 with the following revisions:

6.2.1 Amend subparagraph (a): Overview. The dynamometer run consists of two tests, a "cold" start test, after a minimum 12-hour and a maximum 36-hour soak pursuant to the provisions of the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" as incorporated by reference herein, and a "hot" start test following the "cold" start test by 10 minutes. Vehicle startup (with all accessories turned off), operation over the UDDS and vehicle shutdown make a complete cold start test. Vehicle startup and operation over the UDDS and vehicle shutdown make a complete hot start test. The exhaust emissions are diluted with ambient air in the dilution tunnel as shown in Figure B94-5 and Figure B94-6. A dilution tunnel is not required for testing vehicles waived from the requirement to measure particulates. Four particulate samples are collected on filters for weighing; the first sample plus backup is collected during the cold start test (including shutdown); the second sample plus backup is collected during the hot start test (including shutdown). Continuous proportional samples of gaseous emissions are collected for analysis during each test. For hybrid electric vehicles with gasoline-fueled, natural gas-fueled and liquefied petroleum gas-fueled Otto-cycle auxiliary power units, the composite samples collected in bags are analyzed for THC, CO, CO_2, CH_4 and NO_x. For hybrid electric vehicles with petroleum-fueled diesel-cycle auxiliary power units (optional for natural gas-fueled, liquefied petroleum gas-fueled and methanol-fueled diesel-cycle vehicles), THC is sampled and analyzed continuously pursuant to the provisions of § 86.110. Parallel samples of the dilution air are similarly analyzed for THC, CO, CO_2, CH_4 and NO_x. For hybrid electric vehicles with natural gas-fueled, liquefied petroleum gas-fueled and methanol-fueled auxiliary power units, bag samples are collected and analyzed for THC (if not sampled continuously), CO, CO_2, CH_4 and NO_x. For hybrid electric vehicles with methanol-fueled auxiliary power units, methanol and formaldehyde samples are taken for both exhaust emissions and dilution air (a single dilution air formaldehyde sample, covering the total test period may be

collected). Parallel bag samples of dilution air are analyzed for THC, CO, CO_2, CH_4 and NO_x.

6.2.2 Delete subparagraph (d).

6.2.3 Amend subparagraph (h): The driving distance, as measured by counting the number of dynamometer roll or shaft revolutions, shall be determined for the cold start test and hot start test. The revolutions shall be measured on the same roll or shaft used for measuring the vehicle's speed.

6.3 Dynamometer Test Run, Gaseous and Particulate Emissions

To be conducted pursuant to 40 CFR § 86.137-96 with the following revisions:

6.3.1 Amend subparagraph (a): General. The dynamometer run consists of two tests, a cold start test, after a minimum 12-hour and a maximum 36-hour soak pursuant to the provisions of the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" as incorporated by reference herein, and a hot start test following the cold start test by 10 minutes. The vehicle shall be stored prior to the emission test in such a manner that precipitation (e.g., rain or dew) does not occur on the vehicle. The complete dynamometer test consists of a cold start drive of 7.5 miles (12.1 km) and a hot start drive of 7.5 miles (12.1 km). The vehicle is allowed to stand on the dynamometer during the 10 minute time period between the cold and hot start tests.

6.3.2 Amend subparagraph (b)(9): Start the gas flow measuring device, position the sample selector valves to direct the sample flow into the exhaust sample bag, the methanol exhaust sample, the formaldehyde exhaust sample, the dilution air sample bag, the methanol dilution air sample and the formaldehyde dilution air sample (turn on the petroleum-fueled diesel-cycle THC analyzer system integrator, mark the recorder chart, start particulate sample pump No. 1, and record both gas meter or flow measurement instrument readings, if applicable), and turn the key on. If the auxiliary power unit is capable of being manually activated, the auxiliary power unit shall be activated at the beginning of and operated throughout the UDDS.

6.3.2 Delete subparagraph (13).

6.3.3 Amend subparagraph (14): Turn the vehicle off 2 seconds after the end of the last deceleration (at 1,369 seconds).

6.3.4 Amend subparagraph (15): Five seconds after the vehicle is shutdown, simultaneously turn off gas flow measuring device No. 1 and if applicable, turn off the hydrocarbon integrator No. 1, mark the hydrocarbon

recorder chart, turn off the No. 1 particulate sample pump and close the valves isolating particulate filter No. 1, and position the sample selector valves to the "standby" position. Record the measured roll or shaft revolutions (both gas meter or flow measurement instrumentation readings), and reset the counter. As soon as possible, transfer the exhaust and dilution air samples to the analytical system and process the samples pursuant to § 86.140, obtaining a stabilized reading of the exhaust bag sample on all analyzers within 20 minutes of the end of the sample collection phase of the test. Obtain methanol and formaldehyde sample analyses, if applicable, within 24 hours of the end of the sample period. (If it is not possible to perform analysis on the methanol and formaldehyde samples within 24 hours, the samples should be stored in a dark cold (4□C to 10□C) environment until analysis. The samples should be analyzed within fourteen days.) If applicable, carefully remove both pairs of particulate sample filters from their respective holders, and place each in a separate petri dish, and cover.

6.3.3 Amend subparagraph (18): Repeat the steps in paragraphs (b)(2) through (b)(17) of this section for the hot start test. The step in paragraph (b)(9) of this section shall begin between 9 and 11 minutes after the end of the sample period for the cold start test.

6.3.4 Delete subparagraph (19).

6.3.5 Delete subparagraph (20).

6.3.6 Amend subparagraph (21): As soon as possible, and in no case longer than one hour after the end of the hot start phase of the test, transfer the four particulate filters to the weighing chamber for post-test conditioning, if applicable. For hybrid electric vehicles that do not allow manual activation of the auxiliary power unit and are charge-sustaining over the UDDS, a valid test shall satisfy the SOC Criterion (see Definitions, section B of these procedures).

6.3.7 Amend subparagraph (24): Vehicles to be tested for evaporative emissions will proceed pursuant to the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" as incorporated by reference herein.

6.4 Calculations - Exhaust Emissions

To be conducted pursuant to 40 CFR § 86.144-94 with the following revisions:

6.4.1 Amend subparagraph (a): For light-duty vehicles and light duty trucks:

$$Y_{wm} = 0.43 * \frac{Y_c}{D_c} + 0.57 * \frac{Y_h}{D_h}$$

Where:

(1) Y_{wm} = Weighted mass emissions of each pollutant, i.e., THC, CO, THCE, NMHC, NMHCE, CH_4, NO_x, or CO_2, in grams per vehicle mile.

(2) Y_c = Mass emissions as calculated from the cold start test, in grams per test.

(3) Y_h = Mass emissions as calculated from the hot start test, in grams per test.

(4) D_c = The measured driving distance from the cold start test, in miles.

(5) D_h = The measured driving distance from the hot start test, in miles.

6.5 Calculations - Particulate Emissions

To be conducted pursuant to 40 CFR § 86.145-82 with the following revisions:

6.5.1 Amend subparagraph (a): The final reported test results for the mass particulate (M_p) in grams/mile shall be computed as follows:

$$M_p = 0.43 * \frac{M_{pc}}{D_c} + 0.57 * \frac{M_{ph}}{D_h}$$

Where:

(1) M_{pc} = Mass of particulate determined from the cold start test, in grams per vehicle mile. (See § 86.110-94 for determination.)

(2) M_{ph} = Mass of particulate determined from the hot start test, in grams per vehicle mile. (See § 86.110-94 for determination.)

(3) D_c = The measured driving distance from the cold start test, in miles.

(4) D_h = The measured driving distance from the hot start test, in miles.

7. Hybrid Electric Vehicle Highway Emission Test Provisions

To be conducted pursuant to 40 CFR § 600.111-93 with the following revisions:

7.1 Amend subparagraph (b)(2): The highway fuel economy test is designated to simulate non-metropolitan driving with an average speed of 48.6 mph and a maximum speed of 60 mph. The cycle is 10.2 miles long with 0.2 stop per mile and consists of warmed-up vehicle operation on a chassis dynamometer through a specified driving cycle. A proportional part of the diluted exhaust emission is collected

continuously for subsequent analysis of THC, CO, CO_2, and NO_x using a constant volume (variable dilution) sampler. Diesel dilute exhaust is continuously analyzed for hydrocarbons using a heated sample line and analyzer. Methanol and formaldehyde samples are collected and individually analyzed for methanol-fueled vehicles.

7.2 Amend subparagraph (f)(3): Only one exhaust sample and one background sample are collected and analyzed for THC (except diesel hydrocarbons which are analyzed continuously), CO, CO_2, and NO_x. Methanol and formaldehyde samples (exhaust and dilution air) are collected and analyzed for methanol-fueled vehicles.

7.3 Add subparagraph (f)(5): Battery state-of-charge shall be set prior to performing the HFEDS preconditioning cycle. For hybrid electric vehicles that do not allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at a level that causes the hybrid electric vehicle to operate the auxiliary power unit for the maximum possible cumulative amount of time during the HFEDS preconditioning cycle. For hybrid electric vehicles that allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at a level that satisfies one of the following conditions:

(i) If the hybrid electric vehicle is charge-sustaining over the HFEDS, battery state-of-charge shall be set at the lowest level allowed by the manufacturer.

(ii) If the hybrid electric vehicle is charge-depleting over the HFEDs, battery state-of-charge shall be set at the level recommended by the manufacturer for activating the auxiliary power unit when operating in highway driving conditions.

7.4 Amend subparagraph (h)(5): Operate the vehicle over one HFEDS preconditioning cycle according to the dynamometer driving schedule specified in 600.109(b). If the auxiliary power unit is capable of being manually activated, the auxiliary power unit shall be manually activated at the beginning of and operated throughout the HFEDS preconditioning cycle.

7.5 Amend subparagraph (h)(6): When the vehicle reaches zero speed at the end of the HFEDS preconditioning cycle, the driver has 17 seconds to prepare for the HFEDS emission measurement cycle of the test. Reset and enable the roll revolution counter. During the idle period, one of the following conditions shall apply:

(i) For hybrid electric vehicles that do not allow the auxiliary power unit to be manually activated and are charge-sustaining over the HFEDS, the vehicle shall be momentarily turned off for 5 seconds and turned back on during the idle period. The battery state-of-charge shall be recorded after the hybrid electric vehicle has fully turned on.

(ii) For hybrid electric vehicles that do not allow the auxiliary power unit to be manually activated and are charge-depleting over the HFEDS, the vehicle shall remain turned on during the idle period.

(iii) For hybrid electric vehicles that allow the auxiliary power unit to be manually activated, the vehicle shall remain turned on with the auxiliary power unit operating during the idle period.

7.6 Add subparagraph (h)(9): At the conclusion of the HFEDS emission test, one of the following conditions shall apply:

(i) For hybrid electric vehicles that do not allow the auxiliary power unit to be manually activated and are charge-sustaining over the HFEDS, record the battery state-of-charge to determine if the SOC Criterion (see Definitions, section B of these procedures) is satisfied. If the SOC Criterion is not satisfied, then repeat dynamometer test run from subparagraph (h)(6). A total of three highway emission tests shall be allowed to satisfy the SOC Criterion. Manufacturers may elect to repeat dynamometer test run from subparagraph (h)(6) if battery energy level increased significantly relative to the initial battery state-of-charge set at the beginning of the HFEDS emission test.

(ii) For hybrid electric vehicles that do not allow the auxiliary power unit to be manually activated and are charge-depleting over the HFEDS, the emission test is completed.

(iii) For hybrid electric vehicles that allow the auxiliary power unit to be manually activated, the emission test is completed.

8. Hybrid Electric Vehicle SFTP Emission Test Provisions

8.1 US06 Vehicle Preconditioning

To be conducted pursuant to 40 CFR § 86.132-00 with the following revisions:

8.1.1 Amend subparagraph (n): Aggressive Driving Test (US06) Preconditioning. (1) If the US06 test follows the exhaust emission FTP or evaporative testing, the refueling step may be deleted and the vehicle may be preconditioned using the fuel remaining in the tank (see paragraph (c)(2)(ii) of this section). The test vehicle may be pushed or driven onto the test dynamometer provided that battery state-of-charge has not been set; otherwise, if battery state-of-charge is set prior to securing vehicle on dynamometer, vehicle shall be pushed or towed into position on dynamometer. Battery state-of-charge shall be set prior to performing the US06 preconditioning cycle. For hybrid electric vehicles that do not allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at a level that causes the hybrid electric

vehicle to operate the auxiliary power unit for the maximum possible cumulative amount of time during the US06 preconditioning drive. For hybrid electric vehicles that allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at a level that satisfies one of the following conditions:

(i) If the hybrid electric vehicle is charge-sustaining over the US06, battery state-of-charge shall be set at the lowest level allowed by the manufacturer. The auxiliary power unit shall be manually activated at the beginning of and operated throughout the US06 preconditioning cycle.

(ii) If the hybrid electric vehicle is charge-depleting over the US06, battery state-of-charge shall be set at the level recommended by the manufacturer for activating the auxiliary power unit when operating in highway driving conditions. The auxiliary power unit shall be manually activated at the beginning of and operated throughout the US06 preconditioning cycle.

8.1.2 Delete subparagraphs (n)(1)(i) and (n)(1)(ii).

8.2 US06 Emission Test

To be conducted pursuant to 40 CFR § 86.159-00 with the following revisions:

8.2.1 Amend subparagraph (a): Overview. The dynamometer operation consists of a single, 600 second test on the US06 driving schedule, as described in appendix I, paragraph (g), of this part. The hybrid electric vehicle is preconditioned in accordance with § 86.132-00, to bring it to a warmed-up stabilized condition. This preconditioning is followed by a 1 to 2 minute idle period that proceeds directly into the US06 driving schedule during which continuous proportional samples of gaseous emissions are collected for analysis. If engine stalling should occur during testing, follow the provisions of § 86.136-90 (engine starting and restarting). For hybrid electric vehicles with gasoline-fueled Otto-cycle auxiliary power units, the composite samples collected in bags are analyzed for THC, CO, CO_2, CH_4 and NO_x. For hybrid electric vehicles with petroleum-fueled diesel-cycle auxiliary power units, THC is sampled and analyzed continuously according to the provisions of § 86.110. Parallel bag samples of dilution air are analyzed for THC, CO, CO_2, CH_4 and NO_x.

8.2.2 Amend subparagraph (b)(2): Position (vehicle shall be pushed or towed if battery state-of-charge is set prior to securing to dynamometer otherwise vehicle may be driven as well) the test vehicle on the dynamometer and restrain.

8.2.3 Amend subparagraph (d): Practice runs over the prescribed driving schedule may be performed at test point, provided that battery state-of-charge setting is conducted after practice and an emission sample is not taken, for the purpose of finding the appropriate throttle action to maintain the proper speed-time relationship, or to permit sampling system adjustment.

8.2.4 Amend subparagraph (f)(2)(i): Immediately after completion of the US06 preconditioning cycle, idle the vehicle. The idle period is not to be less than one minute or not greater than two minutes. During the idle period, one of the following conditions shall apply:

(i) For hybrid electric vehicles that do not allow the auxiliary power unit to be manually activated and are charge-sustaining over the US06, the vehicle shall be momentarily turned off for 5 seconds and turned back on during the idle period. The battery state-of-charge shall be recorded after the hybrid electric vehicle has fully turned on.

(ii) For hybrid electric vehicles that do not allow the auxiliary power unit to be manually activated and are charge-depleting over the US06, the vehicle shall remain turned on during the idle period.

(iii) For hybrid electric vehicles that allow the auxiliary power unit to be manually activated, the vehicle shall remain turned on with the auxiliary power unit operating during the idle period.

8.2.5 Amend subparagraph (f)(2)(ix): At the conclusion of the US06 emission test, one of the following conditions shall apply:

(i) For hybrid electric vehicles that do not allow manual activation of the auxiliary power unit and are charge-sustaining over the US06, record the battery state-of-charge to determine if the SOC Criterion (see Definitions, section B of these procedures) is satisfied. If the SOC Criterion is not satisfied, then repeat dynamometer test run from subparagraph (f)(2)(i). A total of three US06 emission tests shall be allowed to satisfy the SOC Criterion. Manufacturers may elect to repeat dynamometer test run from subparagraph (f)(2)(i) if battery energy level increased significantly relative to the initial battery state-of-charge set at the beginning of US06 emission test.

(ii) For hybrid electric vehicles that do not allow the auxiliary power unit to be manually activated and are charge-depleting over the US06, turn off vehicle 2 seconds after the end of the last deceleration.

(iii) For hybrid electric vehicles that allow the auxiliary power unit to be manually activated, turn off vehicle 2 seconds after the end of the last deceleration.

8.3 SC03 Vehicle Preconditioning

To be conducted pursuant to 40 CFR § 86.132-00 with the following revisions:

8.3.1 Amend subparagraph (o): Air Conditioning Test (SC03) Preconditioning. (1) If the SC03 test follows the exhaust emission FTP or evaporative testing, the refueling step may be deleted and the vehicle may be preconditioned using the fuel remaining in the tank (see paragraph (c)(2)(ii) of this section). The test vehicle may be pushed or driven onto the test dynamometer provided that battery state-of-charge has not been set; otherwise, if battery state-of-charge is set prior to securing vehicle on dynamometer, vehicle shall be pushed or towed into position on dynamometer. Battery state-of-charge shall be set prior to performing the SC03 preconditioning cycle. For hybrid electric vehicles that do not allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at a level that causes the hybrid electric vehicle to operate the auxiliary power unit for the maximum possible cumulative amount of time during the SC03 preconditioning drive. For hybrid electric vehicles that allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at a level that satisfies one of the following conditions:

(i) If the hybrid electric vehicle is charge-sustaining over the SC03, battery state-of-charge shall be set at the lowest level allowed by the manufacturer. The auxiliary power unit shall be manually activated at the beginning of and operated throughout the SC03 preconditioning cycle.

(ii) If the hybrid electric vehicle is charge-depleting over the SC03, battery state-of-charge shall be set at the level recommended by the manufacturer for activating the auxiliary power unit when operating in highway driving conditions. The auxiliary power unit shall be manually activated at the beginning of and operated throughout the SC03 preconditioning cycle.

8.3.2 Delete subparagraphs (o)(1)(i) and (o)(1)(ii).

8.4 SC03 Emission Test

To be conducted pursuant to 40 CFR § 86.160-00 with the following revisions:

8.4.1 Amend subparagraph (a): Overview. The dynamometer operation consists of a single, 594 second test on the SC03 driving schedule, as described in appendix I, paragraph (h), of this part. The hybrid electric vehicle is preconditioned in accordance with § 86.132-00 of this subpart, to bring the vehicle to a warmed-up stabilized condition. This preconditioning is followed by

a 10 minute vehicle soak (vehicle turned off) that proceeds directly into the SC03 driving schedule, during which continuous proportional samples of gaseous emissions are collected for analysis. The entire test, including the SC03 preconditioning cycle, vehicle soak, and SC03 emission test, is either conducted in an environmental test facility or under test conditions that simulates testing in an environmental test cell (see Sec. 86.162-00 (a) for a discussion of simulation procedure approvals). The environmental test facility must be capable of providing the following nominal ambient test conditions of: 95°F air temperature, 100 grains of water/pound of dry air (approximately 40 percent relative humidity), a solar heat load intensity of 850 W/m^2, and vehicle cooling air flow proportional to vehicle speed. Section 86.161-00 discusses the minimum facility requirements and corresponding control tolerances for air conditioning ambient test conditions. The vehicle's air conditioner is operated or appropriately simulated for the duration of the test procedure (except for the 10 minute vehicle soak), including the preconditioning. If engine stalling should occur during testing, follow the provisions of § 86.136-90 (engine starting and restarting). For hybrid electric vehicles with gasoline-fueled Otto-cycle auxiliary power units, the composite samples collected in bags are analyzed for THC, CO, CO_2, CH_4 and NO_x. For hybrid electric vehicles with petroleum-fueled diesel-cycle auxiliary power units, THC is sampled and analyzed continuously according to the provisions of § 86.110. Parallel bag samples of dilution air are analyzed for THC, CO, CO_2, CH_4 and NO_x.

8.4.2 Amend subparagraph (b)(2): Position (vehicle shall be pushed or towed if battery state-of-charge is set prior to securing to dynamometer otherwise vehicle may be driven as well) the test vehicle on the dynamometer and restrain.

8.4.3 Amend subparagraph (c)(9): Start vehicle (with air conditioning system also running). If the auxiliary power unit of the hybrid electric vehicle is capable of being manually activated, the auxiliary power unit shall be manually activated at the beginning of and operated throughout the SC03 emission test. Fifteen seconds after the vehicle starts, begin the initial vehicle acceleration of the driving schedule.

8.4.4 Amend subparagraph (c)(12): Turn the vehicle off 2 seconds after the end of the last deceleration.

8.4.5 Amend subparagraph (d)(7): Start vehicle (with air conditioning system also running). If the auxiliary power unit of the hybrid electric vehicle is capable of being manually activated, the auxiliary power unit shall be manually activated at the beginning of and operated throughout the SC03 emission test. Fifteen seconds after the vehicle starts, begin the initial vehicle acceleration of the driving schedule.

8.4.6 Amend subparagraph (d)(10): At the conclusion of the US06 emission test, one of the following conditions shall apply:

(i) For hybrid electric vehicles that do not allow the auxiliary power unit to be manually activated and are charge-sustaining over the SC03, record the battery state-of-charge to determine if the SOC Criterion (see Definitions, section B of these procedures) is satisfied. If the SOC Criterion is not satisfied, then turn off cooling fan(s), allow vehicle to soak in the ambient conditions of paragraph (c)(5) of this section for 10 minutes, and repeat dynamometer test run from subparagraph (d). A total of three SC03 emission tests shall be attempted to satisfy the SOC Criterion. Manufacturers may elect to repeat dynamometer test run from subparagraph (d) following a 10 minute soak in the ambient conditions of paragraph (c)(5) of this section if battery energy level increased significantly relative to the initial battery state-of-charge set at the beginning of SC03 emission test.

(ii) For hybrid electric vehicles that do not allow the auxiliary power unit to be manually activated and are charge-depleting over the SC03, turn off vehicle 2 seconds after the end of the last deceleration.

(iii) For hybrid electric vehicles that allow the auxiliary power unit to be manually activated, turn off vehicle 2 seconds after the end of the last deceleration.

9. State-of-Charge Net Change Tolerances

9.1 For hybrid electric vehicles that use a battery as an energy storage device, the following state-of-charge net change tolerance shall apply:

$$(\text{Amp-hr}_{final})_{max} = (\text{Amp-hr}_{initial}) + 0.01 \frac{(NHV_{fuel} * m_{fuel})}{(V_{system} * K_1)}$$

$$(\text{Amp-hr}_{final})_{min} = (\text{Amp-hr}_{initial}) - 0.01 \frac{(NHV_{fuel} * m_{fuel})}{(V_{system} * K_1)}$$

Where:

$(\text{Amp-hr}_{final})_{max}$	=	Maximum allowed Amp-hr stored in battery at the end of the test
$(\text{Amp-hr}_{final})_{min}$	=	Minimum allowed Amp-hr stored in battery at the end of the test
$(\text{Amp-hr}_{initial})$	=	Battery Amp-hr stored at the beginning of the test
NHV_{fuel}	=	Net heating value of consumable fuel, in Joules/kg

m_{fuel} = Total mass of fuel consumed during test, in kg

K_1 = Conversion factor, 3600 seconds/hour

V_{system} = Battery DC bus voltage (open circuit)

9.2 For hybrid electric vehicles that use a capacitor as an energy storage device, the following state-of-charge net change tolerance shall apply:

$$(V_{final})_{max} = \sqrt{(V_{initial})^2 + 0.01 * \frac{(2*NHV_{fuel}*m_{fuel})}{C}}$$

$$(V_{final})_{min} = \sqrt{(V_{initial})^2 - 0.01 * \frac{(2*NHV_{fuel}*m_{fuel})}{C}}$$

Where:

$(V_{final})max$ = The stored capacitor voltage allowed at the end of the test

$(V_{final})min$ = The stored capacitor voltage allowed at the end of the test

$(V_{initial})^2$ = The square of the capacitor voltage stored at the beginning of the test

NHV_{fuel} = Net heating value of consumable fuel, in Joules/kg

m_{fuel} = Total mass of fuel consumed during test, in kg

C = Rated capacitance of the capacitor, in Farads

9.3 For hybrid electric vehicles that use an electro-mechanical flywheel as an energy storage device, the following state-of-charge net change tolerance shall apply:

$$(rpm_{final})_{max} = \sqrt{(rpm_{initial})^2 + 0.01 * \frac{(2*NHV_{fuel} * m_{fuel})}{(1*K_3)}}$$

$$(rpm_{final})_{min} = \sqrt{(rpm_{initial})^2 - 0.01 * \frac{(2*NHV_{fuel} * m_{fuel})}{(1*K_3)}}$$

Where:

$(rpm_{final})max$	=	The maximum flywheel rotational speed allowed at the end of the test
$(rpm_{final})min$	=	The minimum flywheel rotational speed allowed at the end of the test
$(rpm_{initial})^2$	=	The squared flywheel rotational speed at the beginning of the test
NHV_{fuel}	=	Net heating value of consumable fuel, in Joules/kg
m_{fuel}	=	Total mass of fuel consumed during test, in kg
K_3	=	Conversion factor, $4\square^2/(3600\ sec^2\text{-}rpm^2)$
I	=	Rated moment of inertia of the flywheel, in $kg\text{-}m^2$

CALIFORNIA AIR RESOURCES BOARD

NOTICE OF PUBLIC MEETING TO CONSIDER REVISIONS TO THE CARL MOYER INCENTIVE PROGRAM GUIDELINES

The California Air Resources Board (Board or ARB) will conduct a public meeting at the time and place noted below to consider revisions to the Carl Moyer Memorial Air Quality Standards Attainment Program (Carl Moyer Program), including the Agricultural Assistance Program Guidelines.

DATE: March 27, 2008

TIME: 9:00 a.m.

PLACE: California Environmental Protection Agency
Air Resources Board
Byron Sher Auditorium
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., Thursday, March 27, 2008, and may continue at 8:30 a.m., Friday, March 28, 2008. This item may not be considered until March 28, 2008. Please consult the agenda for the meeting, which will be available at least 10 days before March 27, 2008, 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:

Since 1998, the Carl Moyer Program has filled a critical niche in California's strategy to achieve clean air. The Carl Moyer Program provides grant funding for the incremental cost of cleaner-than-required engines, equipment, and emission reduction technologies. Because it is an incentive program, participation in the Carl Moyer Program is voluntary. The Carl Moyer Program plays a complementary role to California's regulatory program by funding emission reductions that are surplus, i.e., early and/or in excess of what is required by regulation. The program accelerates the turnover of old highly-polluting engines, reduces the costs to the regulated community, speeds the commercialization of advanced emission controls, and reduces air pollution impacts on environmental justice communities.

The Carl Moyer Program, enacted into State law under Health and Safety Code section 44275 et seq., is implemented through the cooperative efforts of ARB and local California air pollution control/air quality management districts (districts). Every year, ARB distributes State funds to participating districts. Such districts follow ARB Carl Moyer Program Guidelines to select, fund, and monitor specific clean air projects in their areas. The Carl Moyer Program Guidelines spell out basic requirements for administrative procedures, eligibility criteria for projects in different source categories, cost-effectiveness criteria, and reporting practices. The Guidelines also include guidelines for administering the Agricultural Assistance Program. While the Guidelines incorporate criteria specified in State law and provide basic standards for program implementation, local districts enjoy considerable flexibility in implementing the Carl Moyer Program. For instance, districts may impose additional or more stringent eligibility requirements for projects in their districts. Districts may also focus their funds on specific project categories in order to coordinate with other incentive funds such as Goods Movement Emission Reduction Program bond funds, funds generated from Department of Motor Vehicle fees, and other local funds. This flexibility allows air districts to tailor the use of Carl Moyer Program funds to meet local air quality objectives while still ensuring the proper and responsible use of State funds.

State law (Health and Safety Code section 44287) provides for ARB to revise the Carl Moyer Program Guidelines when necessary to improve the ability of the program to achieve its goals. The Guidelines were last updated in November 2005 to reflect numerous significant revisions to the program mandated by changes in State law, including expansion of the program and the addition of more pollutants and source categories that would be eligible for funding. To incorporate new legislation, new State regulations, and programmatic recommendations made by the Department of Finance and the Bureau of State Audits, it is necessary to revise the Carl Moyer Program Guidelines again.

From March through November 2007, ARB staff held three public workshops to gather public comments regarding proposed revisions to the Carl Moyer Program Guidelines. ARB also convened two work groups – one to develop changes to Carl Moyer Program administrative procedures and one to develop detailed criteria regarding a new off-road equipment replacement category. The Program Administration Work Group met 13 times in various regions of the State from April 2007 through January 2008. Many of those meetings were held with subgroups that consisted solely of ARB and air district staff, including a subgroup that focused on the particular needs of rural districts. The Off-Road Replacement Equipment Work Group met seven times in different regions of the State from April though December 2007.

The ARB also convened an Advisory Group to provide input for addressing key policy issues left unresolved by the public workshops and the work groups. The Advisory Group, led by ARB Board Member Sandra Berg, consisted of representatives from air districts, environmental groups, industry groups, private consultants, and other interested organizations. The Advisory Group met twice – once in December 2007 and once in

January 2008 and addressed numerous issues regarding streamlining Carl Moyer Program requirements, coordinating the Carl Moyer Program with the Goods Movement Emission Reduction Program, and revising the minimum project life. The Advisory Group also reached broad agreement regarding allowing near-term flexibility in the retrofit requirement for off-road projects; such flexibility has been incorporated into these proposed 2008 Guideline revisions.

Board action on these proposed Carl Moyer Program Guideline revisions is exempt from the Admininstrative Procedure Act and instead is subject to specific procedures specified in statute (Health and Safety Code section 44287(a)). Those procedures require the ARB to make draft Guidelines available to the public 45 days before final adoption and to hold at least one public meeting to consider public comments before final adoption. The staff's proposed revisions were made available to the public on February 8, 2008, opening the required 45-day public comment period prior to the public hearing.

Status of Carl Moyer Program Funding:

Over its first seven years, the Carl Moyer Program provided $170 million to clean up approximately 7,500 engines throughout California. This achieved emission reductions of about 24 tons per day of oxides of nitrogen and one ton per day of toxic diesel particulate matter. Legislative changes in 2004 provided continued funding for the Carl Moyer Program up to $141 million per year Statewide through 2015.

Proposed Revisions:

The following sections highlight the major revisions proposed for the Carl Moyer Program Guidelines.

Program Administration

ARB staff is proposing numerous changes to the Carl Moyer Program administrative procedures to reflect ARB's and the local air districts' increasing experience with implementing the program. Changes are also proposed to address recommendations made by the Department of Finance Office of State Audits and Evaluations and the Bureau of State Audits to increase program specificity and oversight. The proposed revisions clarify and simplify administrative requirements to the maximum extent possible while at the same time maintaining the program's core principles of achieving real, surplus, quantifiable and enforceable emission reductions that are creditable in the State Implementation Plan.

In past Guideline revisions, the Board has directed the Executive Officer to develop technical amendments to the Guidelines (known as Program Advisories) as appropriate to ensure that the Guidelines remain up-to-date and reflect current ARB regulations. ARB staff is proposing that the Board continue to delegate this authority to the Executive Officer. Typically, ARB has revised the Guidelines biennially. In order to

make administration of the Carl Moyer Program easier, ARB staff is proposing that in the future, proposed revisions to the Guidelines be brought to the Board every four years. The Executive Officer would continue to use Program Advisories to update the Guidelines as necessary between Guideline revisions.

New Off-Road Equipment Replacement Category

Criteria for a new project category, off-road equipment replacement, are proposed to be added to the Carl Moyer Program Guidelines. This new category would allow Carl Moyer Program funding for accelerating the turnover of old, highly-polluting off-road equipment and replacing such equipment with newer, cleaner equipment. This new category includes specific project criteria to address requirements of Senate Bill 467 (Statutes of 2005). ARB staff will closely monitor the implementation of the provisions of this new project category and will make revisions as needed.

Updates to Source Categories to Reflect New ARB Regulations

The Carl Moyer Program can only fund projects that are surplus to regulatory requirements. Therefore, each time ARB adopts a new regulation for a source type covered under the program, it potentially affects the source's eligibility for funding under the Carl Moyer Program. The proposed Carl Moyer Program Guideline revisions update the project criteria for each covered source category to reflect relevant new regulations adopted since the previous revision to the Guidelines.

Other Changes to Existing Source Categories

In addition to reflecting recently adopted ARB regulations, a number of changes are proposed for the existing source categories to make it easier for applicants and air districts to identify potential projects and funding opportunities. Relevant information is clearly presented in the beginning sections of each source category chapter to enable easier use.

Staff is also proposing to add criteria for several new project types, including zero-emission shore side power projects (also known as cold ironing) in the marine vessels category and retrofit projects in the large spark-ignited equipment category. For the agricultural sources category, staff is proposing that non-engine agricultural projects be eligible for funding with approval from ARB on a case-by-case basis.

Coordination with the Goods Movement Emission Reduction Program

The Goods Movement Emission Reduction Program (Goods Movement Program) is a $1 billion bond program created by voter-approved Proposition 1B in 2006 and clarified by Senate Bill 88 (Statutes of 2007). The Goods Movement Program is designed to provide grants to equipment owners to upgrade to cleaner technologies in order to reduce emissions associated with the movement of freight along California's four major trade corridors: Los Angeles/Inland Empire, Central Valley, Bay Area, and the San Diego/Border Region. Targeted emission sources include the trucks, locomotives,

ships, harbor craft and cargo-handling equipment that transport goods through these corridors.

Because the Goods Movement Program is directed at some of the same sources that can participate in the Carl Moyer Program, the proposed revisions to the Carl Moyer Program Guidelines incorporate considerations that ensure that the two programs are complementary to the maximum extent possible, do not compete for projects, and make the best use of public funds. In some cases, this means directing projects for consideration for funding under the Goods Movement Program first, and providing the opportunity for Carl Moyer Program funding only if such bond funding is not available.

Cost-Effectiveness

The Carl Moyer Program only funds projects that fall below a specified cost-effectiveness limit. Cost-effectiveness is a measure of the cost of a project for each ton of surplus emission reductions achieved. Section 44283 of the Health and Safety Code directs the ARB to adjust the cost-effectiveness limit to reflect inflation. The proposed Guideline revisions would adjust the cost-effectiveness cap from $14,300 to $16,000 per weighted ton of emission reductions to account for an approximately 11 percent inflation rate from 2004 to December 2007.

Other proposed changes include updating the data tables used in emission reduction calculations and changing the method for calculating the incremental cost of some projects.

AVAILABILITY OF DOCUMENTS AND AGENCY CONTACT PERSON

The proposed revisions to the Carl Moyer Program Guidelines will be presented by ARB staff at the Board meeting. Copies of the proposed revisions may be obtained from the Board's Public Information Office, 1001 I Street, Sacramento, California 95814, (916) 322-2990, at least 45 days prior to the scheduled meeting. The draft document will also be available electronically on the ARB's website at www.arb.ca.gov/msprog/moyer/moyer.htm. Further inquiries regarding this matter should be directed to Mr. Joe Calavita, Air Pollution Specialist, at (916) 445-4586 or by e-mail at jcalavit@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 meeting must be received **no later than 12:00 noon, March 26, 2008,** and addressed to the following:

Postal mail: Clerk of the Board, Air Resources Board
1001 I Street, Sacramento, California 95814

Electronic submittal: http://www.arb.ca.gov/lispub/comm/bclist.php

Facsimile submittal: (916) 322-3928

Please note that under the California Public Records Act (Government Code section 6250 et seq.), your written and oral comments, attachments, and associated contact information (e.g., your address, phone, email, etc.) become part of the public record and can be released to the public upon request. Additionally, this information may become available via Google, Yahoo, and any other search engines.

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 Guideline revisions.

CALIFORNIA AIR RESOURCES BOARD

James Goldstene
Executive Officer

Date: 02/08/08

THE CARL MOYER PROGRAM GUIDELINES

Appendices

Proposed 2008 Revision

Release Date: February 8, 2008
Meeting Date: March 27, 2008

Air Resources Board
California Environmental Protection Agency

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APPENDIX A

ACRONYMS

AAP	Agricultural Assistance Program
AB	Assembly Bill
ABT	Average Banking and Trading
AC	Alternating Current
AECP	Alternative Emission Control Plan
AESS	Automatic Engine Start-Stop
Ah	Amp-hour
APCD	Air Pollution Control District
APCO	Air Pollution Control Officer
APU	Auxiliary Power Unit
AQMD	Air Quality Management District
ARB	California Air Resources Board
ASM	Acceleration Simulation Mode
ATCM	Airborne Toxic Control Measure
ATE	Advanced Travel Center Electrification
AVL	Automatic Vehicle Locator
BACT	Best Available Control Technology
BAR	Bureau of Automotive Repair
bhp	Brake Horsepower
BNSF	Burlington Northern and Santa Fe Railroad
BTU	British Thermal Unit
C/E	Cost Effectiveness
CAF	Confined Animal Facility
CARL	Clean Air Reporting Log
CCR	California Code of Regulations
CI	Compression Ignition
CNG	Compressed Natural Gas
CO	Carbon Monoxide
COG	Council of Governments
CRF	Capital Recovery Factor
DC	Direct Current
DDHS	Diesel Driven Heating System
DECS	Diesel Emission Control Strategy
DMV	Department of Motor Vehicles
DOC	Diesel Oxidation Catalyst
DOE	Department of Energy
DPF	Diesel Particulate Filter
E/S	Electric Standby
ECF	Energy Consumption Factor
ECF	Energy Consumption Factor

EF	Emission Factor
EGR	Exhaust Gas Recirculation
EMFAC	ARB's On-Road Motor Vehicle Emission Inventory Model
EMU	Electronic Monitoring Unit
EO	Executive Order
EQIP	Environmental Quality Incentives Program
ERCs	Emission Reduction Credits
ES	Emission Standards
FBC	Fuel-Borne Catalyst
FCF	Fuel Correction Factor
FEL	Family Emission Limit
FTA	Federal Transit Administration
FTF	Flow-Through Filter
FTP	Federal Test Procedure
FY	Fiscal Year
g	gram
g/bhp-hr	gram per brake horsepower-hour
gal	Gallon
GPS	Geographic Positioning System
GSE	Ground Support Equipment
GTL	Gas-to-Liquid
GVWR	Gross Vehicle Weight Rating
HC	Hydrocarbons
HD	Heavy-Duty
HDDE	Heavy-Duty Diesel Engine
HDT	Heavy-Duty Truck
HDV	Heavy-Duty Vehicle
HEB	Hybrid-Electric Bus
HHDV	Heavy Heavy-Duty Vehicle
hp	Horsepower
hr	Hour
HSC	California Health and Safety Code
HVAC	Heating, Ventilation and Air Conditioning
IC	Internal Combustion
ICE	Internal Combustion Engine
ILD	Idle Limiting Device
IMO	International Maritime Organization
IPI Team	Incentive Program Implementation Team
IRS	Internal Revenue Service
ISO	International Standards Organization
kW	Kilowatt
lbs	Pounds
LDV	Light-Duty Vehicle
LETRU	Low Emission Transport Refrigeration Unit
LEV	Low Emission Vehicle
LF	Load Factor

LHD	Light Heavy-Duty
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas – commonly called Propane
LSI	Large Spark Ignition
MDO	Marine Diesel Oil
MGO	Marine Gas Oil
MHDV	Medium Heavy-Duty Vehicle
mi	Mile
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
MV Fee	Motor Vehicle Registration Fee
MY	Model Year
NADA	National Automotive Dealership Association
NMHC	Non-Methane Hydrocarbons
NOFA	Notice of Funds Available
NOx	Oxides of Nitrogen
OBD II	On-Road Diagnostics, Phase II
OEM	Original Equipment Manufacturer
PAH	Polycyclic Aromatic Hydrocarbons
PEM	Proton Exchange Membrane
PG&E	Pacific Gas and Electric
PM	Particulate Matter
PM10	Inhalable Particulate Matter
RFP	Request for Proposals
ROG	Reactive Organic Gas
RSD	Remote Sensing Device
SB	Senate Bill
SCAB	South Coast Air Basin
SCAQMD	South Coast Air Quality Management District
SCE	Southern California Edison
SCR	Selective Catalytic Reduction
SIP	State Implementation Plan
SMAQMD	Sacramento Metropolitan Air Quality Management District
SOF	Soluble Organic Fraction
SOFC	Solid Oxide Fuel Cell
SOP	Statement of Principles
SORE	Small Off Road Engine
STB	Surface Transportation Board
STD	Standard
SULEV	Super Ultra Low Emission Vehicle
SUV	Sport-Utility Vehicle
SWCV	Solid Waste Collection Vehicle
TAC	Toxic Air Contaminant
TFV	Transit Fleet Vehicle
THC	Total Hydrocarbon
TIP	Transportation Implementation Plan

tpd	Tons Per Day
TRU	Transport Refrigeration Unit
TSE	Truck Stop Electrification
TSI	Two Speed Idle
U.S. EPA	U.S. Environmental Protection Agency
UB	Urban Bus
ULETRU	Ultra Low Emission Transport Refrigeration Unit
ULEV	Ultra Low Emission Vehicle
UP	Union Pacific Railroad
V	Volt
VAVR	Voluntary Accelerated Vehicle Retirement
VIN	Vehicle Identification Number
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compound
VVR	Voluntary Vehicle Repair
yr	Year
ZEB	Zero Emission Bus

APPENDIX B

TABLES FOR EMISSION REDUCTION AND COST-EFFECTIVENESS CALCULATIONS

This appendix presents tables summarizing the data needed to calculate the emission reductions and cost-effectiveness of potential projects. Included are data such as engine emission factors, load factors, and other conversion factors used in the calculations discussed in Appendix C: Cost-Effectiveness Calculation Methodology and Appendix E: Example Calculations.

Table B-1
Capital Recovery Factors (CRF) for Various Project Life
At Four Percent Discount Rate

Project Life	CRF
1*	1.040
2*	0.530
3	0.360
4	0.275
5	0.225
6	0.191
7	0.167
8	0.149
9	0.134
10	0.123
11	0.114
12	0.107
13	0.100
14	0.095
15	0.090
16	0.086
17	0.082
18	0.079
19	0.076
20	0.074

* Note: For agricultural projects only.

HEAVY-DUTY ON-ROAD PROJECTS

Table B-2
Heavy-Duty Diesel Engines 2004-2009
Converted Emission Standards (g/bhp-hr)

EO Certification Level	Converted Emission Standards		
NOx + NMHC	Diesel NOx[e]	Diesel ROG[e]	Alternative Fuel NOx
2.5[a]	2.21	0.12	2.00
1.8[b]	1.59	0.09	1.44
1.5[b]	1.33	0.07	1.20
1.2[b]	1.06	0.06	0.96
0.9[b]	0.80	0.04	0.72
0.6[b]	0.53	0.03	0.48
0.3[b]	0.27	0.01	0.24
PM10	Diesel PM10		Alternative Fuel PM10
0.10[c]	0.072		0.100
0.03[b]	0.022		0.030
0.02[b]	0.014		0.020
0.01[b,d]	0.007		0.010

a – 2004-2006 emission standard for all on-road heavy duty engines except diesel urban buses.
b – 2004-2006 optional emission standards for all on-road heavy duty engines except diesel urban buses.
c – 2004-2006 emission standard for all on-road heavy duty engines except urban buses.
d – 2004-2006 emission standard for all urban buses.
e - Emission standards were converted where appropriate, using the NMHC and NOx fraction default values and the ultra low-sulfur diesel fuel correction factors listed in Tables B-26 and B-27, respectively.

Table B-3
Heavy-Duty Alternative Fuel Engines
Converted Emission Standards (g/bhp-hr)

Model Year	NOx	PM10
1988 – 1989	6.0	0.60
1990	6.0	0.60
1991 – 1993	5.0	0.25
1994 – 1997	5.0	0.10
1998 - September 2002	4.0	0.10
October 2002 – 2006	2.0	0.10
2007	1.2	0.01
2010	0.2	0.01

Table B-4
Diesel Medium Heavy-Duty Vehicles 14,001-33,000 lbs GVWR
Emission Factors (g/mile) [a]

Model Year	NOx	ROG	PM10
Pre-1984	17.21	0.29	0.792
1984 – 1986	16.65	0.29	0.72
1987 – 1990	14.6	0.18	0.504
1991 – 1993	12.18	0.16	0.288
1994 – 1997	10.7	0.1	0.216
1998 – 2002	9.77	0.08	0.144
2003+	5.39	0.08	0.216
2004 – 2006	5.12	0.08	0.216
2007 – 2009	2.79	0.05	0.024
2010+	0.51	0.02	0.024

a - Emission factors were converted using the ultra low-sulfur diesel fuel correction factors listed in Table B-27.

Table B-5
Diesel Heavy Heavy-Duty Vehicles 33,000+ lbs GVWR
Emission Factors (g/mile) [a]

Model Year	NOx	ROG	PM10
Pre-1987	21.39	1.04	1.249
1987 – 1990	21.11	0.81	1.354
1991 – 1993	18.23	0.54	0.562
1994 – 1997	17.95	0.4	0.367
1998 – 2002	17.58	0.51	0.403
2003 – 2006	11.63	0.26	0.252
2007 – 2009	6.36	0.23	0.028
2010+	1.06	0.18	0.028

a - Emission factors were converted using the ultra low-sulfur diesel fuel correction factors listed in Table B-27.

Table B-6
Diesel Urban Buses
Converted Emission Standards (g/bhp-hr)

Model Year	NOx	ROG	PM10
1987 – 1990[a]	5.58	1.17	0.432
1991 – 1993[a]	4.65	1.17	0.072
1994 – 1995[a]	4.65	1.17	0.050
1996 – 2002[a]	3.72	1.17	0.036
2003[a,b]	2.21	0.12	0.007
2004 – 2006[c]	-	-	-
2007 – 2009	1.20	0.19	0.010
2010	0.20	0.19	0.010

a - Emission standards were converted where appropriate, using the NMHC and NOx fraction default values and the ultra low-sulfur diesel fuel correction factors listed in Tables B-26 and B-27, respectively.
b - NOx+NMHC emission standard converted to NOx and ROG.
c - No diesel buses have been certified to the 0.5 g/bhp-hr for the 2004-2006 model year emission standard.

Table B-7
Natural Gas Urban Buses
Converted Emission Standards (g/bhp-hr)

Model Year	NOx	PM10
1991 – 1993	5.00	0.100
1994 – 1995	5.00	0.070
1996 – 1997	4.00	0.050
1998 – 2002[b]	2.50	0.050
2003 – 2006[a,b,c]	1.44	0.020
2007 – 2009	1.20	0.010
2010+	0.20	0.010

a - NOx+NMHC emission standard converted to NOx only.
b - A majority of the natural gas urban buses have been certified to the optional standards. Therefore, these values are based on the optional standards.
c - Many natural gas urban buses have been certified to optional standards below this level.

Table B-8
Conversion Factors for NOx, ROG and PM10
Heavy-Duty Vehicle Projects (bhp-hr/mile)

Model Year	Medium Heavy-Duty 14,001-33,000 lbs.	Heavy Heavy-Duty 33,000 lbs. +	Urban Bus 33,000 lbs. +
Pre-1989	1.9	3.1	4.0
1990 - 1993	1.8	3.0	4.0
1994 - 1995	1.8	2.9	4.0
1996+	1.8	2.9	4.0

Table B-9
TRU and APU Default Load Factors

Category	Horsepower	Load Factor
Transport Refrigeration Units	<25	0.64
	25 – 50	0.53
Auxiliary Power Unit	<25	0.74

Table B-10
TRU and APU Emission Factors (g/bhp-hr)

Horsepower	Tier / Model Year	NOx	ROG	PM10
< 11	Pre-1995	9.30	1.80	0.720
	1995 – 1999	8.70	1.26	0.410
	Tier 1	5.76	0.82	0.376
	Tier 2	4.14	0.59	0.304
	Tier 4	4.14	0.59	0.152
11 – 24	Pre-1995	6.44	2.21	0.550
	1995 – 1999	6.44	1.08	0.413
	Tier 1	5.49	0.77	0.306
	Tier 2	4.33	0.69	0.306
	Tier 4	4.33	0.69	0.152
25 - 49	Uncontrolled pre-1988	6.51	2.21	0.547
	Uncontrolled 1988 +	6.42	2.17	0.547
	Tier 1	5.26	1.74	0.480
	Tier 2	4.63	0.29	0.280
	Tier 4 Interim	4.55	0.12	0.128
	Tier 4 Final	2.75	0.12	0.008

OFF-ROAD PROJECTS AND NON-MOBILE AGRICULTURAL PROJECTS

Table B-11
Off-Road Diesel Engines Default Load Factors

Category	Equipment Type	Load Factor
Airport Ground Support	Aircraft Tug	*0.80*
	Air Conditioner	*0.75*
	Air Start Unit	*0.90*
	Baggage Tug	0.55
	Belt Loader	0.50
	Cargo Loader	0.50
	Forklift	*0.30*
	Ground Power Unit	0.75
	Lift	0.50
	Service Truck	*0.20*
	Other GSE	*0.50*
Mobile Agricultural	Agricultural Mowers	0.43
	Agricultural Tractors	0.70
	Balers	0.58
	Combines	0.70
	Hydro Power Units	0.48
	Sprayers	0.50
	Swathers	0.55
	Tillers	0.78
	Other Agricultural	0.51
Construction	Cranes	0.43
	Crawler Tractors	0.64
	Crushing/Proc. Equipment	0.78
	Excavators	0.57
	Graders	0.61
	Off-Highway Tractors	0.65
	Off-Highway Trucks	0.57
	Pavers	0.62
	Other Paving	0.53
	Rollers	0.56
	Rough Terrain Forklifts	*0.60*
	Rubber Tired Dozers	0.59
	Rubber Tired Loaders	0.54
	Scrapers	0.72
	Signal Boards	0.78
	Skid Steer Loaders	0.55
	Surfacing Equipment	0.45

Category	Equipment Type	Load Factor
Construction	Tractors/Loaders/Backhoes	0.55
	Trenchers	0.75
	Other Construction Equipment	0.62
Industrial	Aerial Lifts	0.46
	Forklifts	0.30
	Sweepers/Scrubbers	0.68
	Other General Industrial	0.51
	Other Material Handling	0.59
Logging	Fellers/Bunchers	0.71
	Skidders	0.74
Oil Drilling	Drill Rig	0.75
	Lift (Drilling)	0.60
	Swivel	0.60
	Workover Rig (Mobile)	0.75
	Other Workover Equipment	0.60
Cargo Handling	Container Handling Equipment	0.59
	Cranes	0.43
	Excavators	0.57
	Forklifts	0.3
	Other Cargo Handling Equipment	0.51
	Sweeper/Scrubber	0.68
	Tractors/Loaders/Backhoes	0.55
	Yard Trucks	0.65
Non-Mobile Agricultural Engines	Irrigation Pump	0.65
	Other	0.51
Other	All	0.43

Table B-12
Uncontrolled Off-Road Diesel Engines
Emission Factors (g/bhp-hr)

Horsepower	Model Year	NOx	ROG	PM10
25 – 49	pre-1988	6.51	2.21	0.547
	1988 +	6.42	2.17	0.547
50 – 119	pre-1988	12.09	1.73	0.605
	1988 +	8.14	1.19	0.497
120+	pre-1970	13.02	1.59	0.554
	1970 – 1979	11.16	1.20	0.396
	1980 – 1987	10.23	1.06	0.396
	1988 +	7.60	0.82	0.274

Table B-13
Controlled Off-Road Diesel Engines
Emission Factors (g/bhp-hr)

Tier	Horsepower	NOx	ROG	PM10
1	25 – 49	5.26	1.74	0.480
	50 – 119	6.54	1.19	0.552
	120 – 174	6.54	0.82	0.274
	175 +	5.93	0.38	0.108
2	25 – 49	4.63	0.29	0.280
	50 – 119	4.75	0.23	0.192
	120 – 174	4.17	0.19	0.128
	175 – 250	4.15	0.12	0.088
	251+	3.79	0.12	0.088
3	50 – 120	2.74	0.12	0.160
	121 – 750	2.32	0.12	0.112
4 Interim	25 – 49	4.55	0.12	0.128
	50 – 120	2.40	0.11	0.056
	121 – 174	2.15	0.11	0.008
	175 – 750	1.29	0.08	0.008
	>750	2.24	0.12	0.048
4 Final	25 – 49	2.75	0.12	0.008
	50 – 120	1.33	0.08	0.008
	121 – 750	0.26	0.06	0.008
	>750	2.24	0.06	0.016

Emission factors were converted using the ultra low-sulfur diesel fuel correction factors listed in Table B-28.

LARGE SPARK IGNITION ENGINES

Table B-14
Off-Road LSI Equipment Default Load Factors

Category	Equipment Type	Load Factor
Agriculture	Agricultural Tractors	0.62
	Balers	0.55
	Combines	0.74
	Sprayers	0.50
	Swathers	0.52
	Other Agricultural Equipment	0.55
Airport Ground Support	A/C Tug	0.80
	Baggage Tug	0.55
	Belt Loader	0.50
	Bobtail	0.55
	Cargo Loader	0.50
	Forklift	0.30
	Ground Power Unit	0.75
	Lift	0.50
	Passenger Stand	0.59
	Other GSE	0.50
Construction	Asphalt Pavers	0.66
	Bore/Drill Rigs	0.79
	Concrete/Industrial Saws	0.78
	Cranes	0.47
	Paving Equipment	0.59
	Rollers	0.62
	Rough Terrain Forklifts	0.63
	Rubber Tired Loaders	0.54
	Skid Steer Loaders	0.58
	Tractors/Loaders/Backhoes	0.48
	Trenchers	0.66
	Other Construction	0.48
Industrial	Aerial Lifts	0.46
	Forklifts	0.30
	Sweepers/Scrubbers	0.71
	Other Industrial	0.54

Table B-15
Off-Road LSI Engines
Emission Factors (g/bhp-hr)

Horsepower	Fuel	Model Year	NOx	ROG	PM10
25 – 49	Gasoline	Uncontrolled – pre-2004	8.01	3.81	0.060
		Controlled 2001-2006	1.33	0.72	0.060
		Controlled 2007-2009	0.89	0.48	0.060
		Controlled 2010+	0.27	0.14	0.060
	Alt Fuel	Uncontrolled – pre-2004	13.00	0.90	0.060
		Controlled 2001-2006	1.95	0.09	0.060
		Controlled 2007-2009	1.30	0.06	0.060
		Controlled 2010+	0.39	0.02	0.060
50 – 120	Gasoline	Uncontrolled – pre-2004	11.84	2.66	0.060
		Controlled 2001-2006	1.78	0.26	0.060
		Controlled 2007-2009	1.19	0.18	0.060
		Controlled 2010+	0.36	0.05	0.060
	Alt Fuel	Uncontrolled – pre-2004	10.51	1.02	0.060
		Controlled 2001-2006	1.58	0.11	0.060
		Controlled 2007-2009	1.05	0.07	0.060
		Controlled 2010+	0.32	0.02	0.060
>120	Gasoline	Uncontrolled – pre-2004	12.94	1.63	0.060
		Controlled 2001-2006	1.94	0.16	0.060
		Controlled 2007-2009	1.29	0.11	0.060
		Controlled 2010+	0.39	0.03	0.060
	Alt Fuel	Uncontrolled – pre-2004	10.51	0.90	0.060
		Controlled 2001-2006	1.58	0.09	0.060
		Controlled 2007-2009	1.05	0.06	0.060
		Controlled 2010+	0.32	0.02	0.060

Table B-16
Emission Factors for Off-Road LSI Engine Retrofits
Verified to Absolute Emission Number (g/bhp-hr)

Manufacturers of LSI retrofit systems may verify to a percent emission reduction or absolute emissions. If a retrofit system is verified to a percent reduction, the emission factors will be that verified percent of the appropriate emissions factors in Table B-15. If a retrofit system is verified to an absolute emission number, use the following table for the emission factors.

Fuel	Verified Value	NOx	ROG	PM10
Gasoline	3.0 g/bhp-hr	1.78	0.26	0.060
	2.5 g/bhp-hr	1.48	0.22	0.060
	2.0 g/bhp-hr	1.19	0.18	0.060
	1.5 g/bhp-hr	0.89	0.13	0.060
	1.0 g/bhp-hr	0.59	0.09	0.060
	0.6 g/bhp-hr	0.36	0.05	0.060
	0.5 g/bhp-hr	0.30	0.04	0.060
Alt Fuel	3.0 g/bhp-hr	1.58	0.10	0.060
	2.5 g/bhp-hr	1.32	0.09	0.060
	2.0 g/bhp-hr	1.05	0.07	0.060
	1.5 g/bhp-hr	0.79	0.05	0.060
	1.0 g/bhp-hr	0.53	0.03	0.060
	0.6 g/bhp-hr	0.32	0.02	0.060
	0.5 g/bhp-hr	0.26	0.02	0.060

Table B-17
Off-Road LSI Engines Certified to Optional Standards
Emission Factors (g/bhp-hr)

Horsepower	Fuel	Optional Standard	NOx	ROG	PM10
25-50	Gasoline	1.50	0.67	0.36	0.060
		1.00	0.44	0.24	0.060
		0.60	0.27	0.14	0.060
		0.40	0.18	0.10	0.060
		0.20	0.09	0.05	0.060
		0.10	0.04	0.02	0.060
	Alt Fuel	1.50	0.98	0.05	0.060
		1.00	0.65	0.03	0.060
		0.60	0.39	0.02	0.060
		0.40	0.26	0.01	0.060
		0.20	0.13	0.01	0.060
		0.10	0.07	0.00	0.060
50-120	Gasoline	1.50	0.89	0.13	0.060
		1.00	0.59	0.09	0.060
		0.60	0.36	0.05	0.060
		0.40	0.24	0.04	0.060
		0.20	0.12	0.02	0.060
		0.10	0.06	0.01	0.060
	Alt Fuel	1.50	0.79	0.05	0.060
		1.00	0.53	0.03	0.060
		0.60	0.32	0.02	0.060
		0.40	0.21	0.01	0.060
		0.20	0.11	0.01	0.060
		0.10	0.05	0.00	0.060
>120	Gasoline	1.50	0.97	0.08	0.060
		1.00	0.65	0.05	0.060
		0.60	0.39	0.03	0.060
		0.40	0.26	0.02	0.060
		0.20	0.13	0.01	0.060
		0.10	0.06	0.01	0.060
	Alt Fuel	1.50	0.79	0.05	0.060
		1.00	0.53	0.03	0.060
		0.60	0.32	0.02	0.060
		0.40	0.21	0.01	0.060
		0.20	0.11	0.01	0.060
		0.10	0.05	0.00	0.060

LOCOMOTIVES

Table B-18
Locomotive Emission Factors (g/bhp-hr)

Engine Model Year	Type	NOx[a]	ROG[b]	PM10[a]
Pre-1973	Line-haul and Passenger	12.22	0.51	0.275
	Switcher	16.36	1.06	0.378
1973-2001 Tier 0	Line-haul and Passenger	8.08	0.51	0.275
	Switcher	11.84	1.06	0.378
2002-2004 Tier 1	Line-haul and Passenger	6.30	0.49	0.275
	Switcher	9.31	1.06	0.370
2005-2011 Tier 2	Line-haul and Passenger	4.70	0.27	0.138
	Switcher	6.86	0.54	0.163

Emission factors based upon U.S. EPA Locomotive Emission Standards – Regulatory Support Document (April, 1998).
a - NOx and PM10 emission factors have been adjusted by a factor of 0.94 and 0.86, respectively, to account for use of California ultra-low sulfur diesel fuel.
b - ROG = HC * 1.053

Table B-19
Locomotive Idle-Limiting Device Factors

Type	Factor
Switchers	0.90
Line-Haul	0.97
Passenger	0.97

Note: Factors based on assumption ILD reduces locomotive engine idling by 50 percent.

MARINE VESSELS

Table B-20a
Uncontrolled Harbor Craft Propulsion Engine
Emission Factors (g/bhp-hr)

Horsepower	Model Year	ROG	NOx	PM
25-50	all	1.32	7.57	0.520
51-120	pre-1997	1.04	14.27	0.575
	1997+	0.71	9.70	0.524
121-250	pre-1971	0.95	15.36	0.527
	1971-78	0.79	14.27	0.451
	1979-83	0.72	13.17	0.376
	1984+	0.68	12.07	0.376
251+	pre-1971	0.91	15.36	0.506
	1971-78	0.76	14.27	0.431
	1979-83	0.68	13.17	0.363
	1984-94	0.65	12.07	0.363
251-750	1995+	0.49	8.97	0.260
751+	1995+	0.60	12.07	0.363

Table B-20b
Controlled Harbor Craft Propulsion Engine
Emission Factors (g/bhp-hr)

Tier	Horsepower	ROG	NOx	PM
1	25-50	1.30	6.93	0.580
	51-120	0.71		0.524
	121 +	0.49	8.97	0.290
2	25-50	1.30	5.04	0.240
	51-120	0.71		
	121-175	0.49	4.84	0.176
	176-750			0.120
	751 +		5.24	0.160
3	25-50	1.30	5.04	0.176
	51-120	0.71		
	121-175	0.49	3.60	0.077
	176-1900		3.87	0.068
	1901 +		4.14	0.085

Table B-21a
Uncontrolled Harbor Craft Auxiliary Engine
Emission Factors (g/bhp-hr)

Horsepower	Model Year	ROG	NOx	PM
25-50	all	1.58	6.42	0.460
51-120	pre-1997	1.23	12.09	0.508
	1997+	0.85	8.14	0.417
121-250	pre-1971	1.13	13.02	0.466
	1971-78	0.94	12.09	0.399
	1979-83	0.86	11.16	0.333
	1984-95	0.82	10.23	0.333
	1996+	0.59	7.75	0.255
251-750	pre-1971	1.08	13.02	0.448
	1971-78	0.90	12.09	0.381
	1979-83	0.81	11.16	0.321
	1984-94	0.77	10.23	0.321
	1995+	0.58	7.60	0.230
751 +	pre-1971	1.08	13.02	0.448
	1971-78	0.90	12.09	0.381
	1979-86	0.81	11.16	0.321
	1987-98	0.72	10.23	0.321
	1999+	0.58	7.75	0.255

Table B-21b
Controlled Harbor Craft Auxiliary Engine
Emission Factors (g/bhp-hr)

Tier	Horsepower	ROG	NOx	PM
1	25-50	1.54	6.54	0.511
	51-120	0.85	6.93	0.464
	121+	0.58		0.255
2	25-50	1.54	5.04	0.240
	51-120	0.85		
	121-175	0.58	4.84	0.176
	176-750			0.120
	751 +		5.24	0.160
3	25-50	1.54	5.04	0.176
	51-120	0.85		
	121-175	0.58	3.60	0.077
	176-750		3.78	0.068
	751-1900		3.87	
	1901+		4.14	0.085

Table B-22
Harbor Craft Load Factors

Vessel Type	Propulsion Engine	Auxiliary Engine
Commercial Fishing	0.27	0.43
Charter Fishing	0.52	
Ferry/Excursion	0.42	
Crew & Supply	0.45	
Pilot	0.51	
Tow	0.68	
Work	0.45	
Other	0.52	
Tug	0.50	0.31

Table B-23
Shore Power
Default Emission Rates (g/kW-hr)

Pollutant	Emission Rate
NOx	13.9
ROG	0.49
PM (marine gas oil fuel with 0.11- 0.5 % sulfur content)	0.38
PM (marine gas oil fuel with <= 0.10 % sulfur content)	0.25

Table B-24
Shore Power
Default Power Requirements

Ship Category	Ship Size / Type Default (TEU)	Power Requirement (kW)
Container Vessel	<1,000	1,000
	1,000 – 1,999	1,300
	2,000 – 2,999	1,600
	3,000 – 3,999	1,900
	4,000 – 4,999	2,200
	5,000 – 5,999	2,300
	6,000 – 6,999	2,500
	7,000 – 7,999	2,900
	8,000 – 9,999	3,300
	10,000 – 12,000	3,700
Passenger Vessel	No Default Value – Use Actual Power Requirement*	
Reefer	Break Bulk	1,300
	Fully containerized	3,300

* The average power requirement for passenger vessels is 7,400 kW (ARB Oceangoing Vessel Survey, 2005)

ALL ENGINES

Table B-25
Fuel Consumption Rate Factors (bhp-hr/gal)

Category	Horsepower	Fuel Consumption Rate
Non- Mobile Agricultural Engines	> 50 hp	17.5
Other	< 750 hp	18.5
	≥ 750 hp	20.8

REFERENCES

The information in these tables has already been incorporated into the preceding emission factor tables. These tables are included for informational purposes.

Table B-26
Pollutant Fractions
NOx+NMHC Standards

Diesel Engines		Alternative Fuel Engines	
NOx	NMHC	NOx	NMHC
0.95	0.05	0.80	0.20

Table B-27
Fuel Correction Factors
On-Road Diesel Engines

Model Year	NOx	PM10	HC
Pre- 2007	0.93	0.72	0.72
2007+	0.93	0.80	0.72

Table B-28
Fuel Correction Factors
Off-Road Diesel Engines

Model Year	NOx	PM10
Pre-Tier 1	0.930	0.720
Tier 1+	0.948	0.800

APPENDIX C

COST-EFFECTIVENESS CALCULATION METHODOLOGY

I. Introduction

To receive Carl Moyer Program funding, each project must meet the maximum cost-effectiveness limit of $16,000 per weighted ton of surplus NOx, ROG, and PM10 (PM10 means combustion PM) emissions reduced. Only Carl Moyer Program funding, funding under the district's fiduciary budget authority, or funding provided by a port authority (to meet the match fund requirement) are included in determining the cost-effectiveness of surplus emission reductions. For more details see Part IV: Administration of the Carl Moyer Program.

II. General Cost-Effectiveness Calculations

The cost-effectiveness of a project is determined by dividing the annual cost of the potential project by the annual weighted surplus emission reductions that will be achieved by the project as shown in formula C-1 below.

Formula C-1: Cost-Effectiveness of Weighted Surplus Emission Reductions ($/ton):

$$\frac{\textit{Annualized Cost (\$/yr)}}{\textit{Annual Weighted Surplus Emission Reductions (tons/yr)}}$$

Descriptions on how to calculate annual emission reductions and annualized cost are provided in the following sections.

A. Calculating the Annual Weighted Surplus Emission Reductions

Annual weighted emission reductions are estimated by taking the sum of the project's annual surplus pollutant reductions following formula C-2 below. This will allow projects that reduce one, two, or all three of the covered pollutants to be evaluated for eligibility to receive Carl Moyer Program funding. While NOx and ROG emissions are given equal weight; emissions of combustion PM10 (such as diesel exhaust PM10 emissions) have been identified as a toxic air contaminant and thus carry a greater weight in the calculation.

Formula C-2: Annual Weighted Surplus Emission Reductions:

*NOx reductions (tons/yr) + ROG reductions (tons/yr) + [20 * (PM10 reductions (tons/yr)]*

The result of formula C-2 is used to complete formula C-1 to determine the cost-effectiveness of surplus emission reductions.

In order to determine the annual surplus emission reductions by pollutant, formula C-3 below must be completed for each pollutant (NOx, ROG, and PM10), for the baseline technology and the reduced technology, totaling up to 6 calculations:

1. Annual emissions of NOx for the baseline technology
2. Annual emissions of NOx for the reduced technology
3. Annual emissions of ROG for the baseline technology
4. Annual emissions of ROG for the reduced technology
5. Annual emissions of PM10 for the baseline technology
6. Annual emissions of PM10 for the reduced technology

These calculations are completed for each pollutant by multiplying the engine emission factor or converted emission standard (found in Appendix B) by the annual activity level and by other adjustment factors as specified for the calculation methodologies presented.

The **baseline technology** is the technology applied under normal business practices, such as, an engine certified by ARB to the current emission standards for new purchases; or the existing engine in a vehicle or equipment for repowers and retrofits.

The **reduced technology** is the newer technology used by the applicant to obtain surplus emission reductions. The newer technology may be one of the following:

- For a new purchase it would be the engine certified by ARB to reduce NOx emissions by at least 30 percent less than the current NOx emission standard, or certified by ARB to the optional NOx or NOx+NMHC emission standard. Locomotive and marine vessel new purchases have slightly different criteria. Please see the specific source category cost-effectiveness criteria for more information.
- For a repower it would be the replacement engine certified by ARB (for locomotives and marine vessels it would be EPA verified) to a minimum of 15 percent less than the NOx emissions from the baseline technology (existing engine).
- For a NOx retrofit it would be an ARB-verified retrofit technology that will reduce NOx emissions by a minimum of 15 percent from the NOx emissions of the baseline technology.
- For a PM retrofit it would be the ARB-verified diesel emission control strategy (DECS) that reduces PM emissions as level 1 (25 percent reduction), level 2 (50 percent reduction), or level 3 (85 percent reduction).

Since the emission factor or converted standard is given in units of grams, a conversion from grams to tons is also required, as described in formula C-3 below.

Formula C-3: Estimated Annual Emissions by Pollutant (tons/yr):

*Emission Factor or Converted Emission Standard (g/bhp-hr) * Annual Activity * Adjustment Factor(s) * Percent Operation in CA * ton/907,200g*

The Carl Moyer Program allows the emissions reductions from a project to be calculated using the following activity factors on an annual basis:

- Hours of operation,
- Fuel consumption, or
- Miles traveled.

Specific activity factors allowed for each project category may differ and are identified in the source category chapters of the Carl Moyer Program Guidelines.

1. Calculating Annual Emissions Based on Hours of Operation

When actual annual hours of equipment operation are the basis for determining emission reductions, the equipment activity level must be based on a properly functioning hour meter (See Part I, Chapter 2 and the relative source category chapter for additional information on this topic). In addition, the horsepower rating of the engine and an engine load factor found in Appendix B must be used. A default load factor of 0.43 is used for those projects where no specific equipment load factor is available in Appendix B. The method for calculating emission reductions based on hours of operation is described in formula C-4 below.

Formula C-4: Estimated Annual Emissions based on hours of Operation (tons/yr):

*Emission Factor or Converted Emission Standard (g/bhp-hr) * Horsepower * Load Factor * Activity (hrs/yr) * Percent Operation in CA * ton/907,200g*

The engine load factor is an indicator of the nominal amount of work done by the engine for a particular application. It is given as a fraction of the rated horsepower of the engine and varies with engine application. For projects in which the horsepower of the baseline technology and reduced technology are different by more than 25 percent, the load factor must be adjusted following formula C-5 below. It is important to understand the replacement load factor must never exceed 100 percent in cases where the reduced technology engine is significantly smaller than the baseline technology engine.

Formula C-5: Replacement Load Factor:

$$Load\ Factor_{baseline} * hp_{baseline}/hp_{reduced}$$

2. Calculating Annual Emissions Based on Fuel Consumption

When annual fuel consumption is used for determining emission reductions, the equipment activity level must be based on annual fuel usage within California provided by the applicant. Fuel records must be maintained by the engine owner as described in the relative source category chapter for additional information on this topic.

An energy consumption factor (ECF) must be used to convert emissions given in g/bhp-hr to units of grams of emissions per gallon of fuel used (g/gal). The ECF is a number that combines the effects of engine efficiency and the energy content of the fuel used in that engine into an approximation of the amount of work output by an engine for each unit of fuel consumed. The ECF is found in Table B-25 in Appendix B. Formula C-6 below is the formula for calculating annual emissions based on annual fuel consumed.

Formula C-6: Estimated Annual Emissions based on Fuel Consumed using Emission Factors or Converted Emission Standard (tons/yr):

*Emission Factor or Converted Emission Standard (g/bhp-hr) * ECF (hp-hr/gal) * Activity (gal/yr) * Percent Operation in CA * ton/907,200g*

For on-road projects, if the emission factor is in g/mile, a unit conversion factor (bhp-hr/mile) found in Table B-8 in Appendix B must be used to convert from g/mile to g/bhp-hr. This is completed by dividing the emission factor (g/mile) by the conversion factor (bhp-hr/mile) resulting in (g/bhp-hr). Formula C-7 below is used to calculate annual emissions for fuel based on-road calculations.

Formula C-7: Estimated Annual Emissions based on Fuel Consumed using On-Road Emission Factors (tons/yr):

*[On-Road Emission Factor (g/mile)/Unit Conversion Factor (bhp-hr/mile)] * ECF (hp-hr/gal) * Activity (gal/yr) * Percent Operation in CA * ton/907,200g*

3. Calculating Annual Emissions Based on Annual Miles Traveled

Calculations based on annual miles traveled are only used for on-road projects. Mileage records must be maintained by the engine owner as described in Part 1, Chapter 3: On-road Heavy-Duty Vehicles.

Calculations Using Emission Factors: There is no conversion since the emission factors for on-road projects provided are given in units of g/mile. Formula C-8 describes the method for calculating pollutant emissions based on emission factors and miles traveled.

Formula C-8: Estimated Annual Emissions based on Mileage using Emission Factors (tons/yr):

*Emission Factor (g/mile) * Activity (miles/yr) * Percent Operation in CA * ton/907,200g*

Calculating Annual Emissions Based on Converted Standards: The unit conversion factor found in Table B-8 in Appendix B is used to convert the units of

the converted emission standard (g/bhp-hr) to g/mile. Formula C-9 describes the method for calculating pollutant emissions using converted emission standards.

Formula C-9: Estimated Annual Emissions based on Mileage using Converted Emission Standards (tons/yr):

*Converted Emission Standard (g/bhp-hr) * Unit Conversion (bhp-hr/mile) * Activity (miles/yr) * Percent Operation in CA * ton/907,200g*

4. Calculating Annual Surplus Emission Reductions by Pollutant

The final step in this portion of the calculations is to determine the annual surplus emission reductions by pollutant. For new purchases and repower projects, subtract the annual emissions for the reduced technology from the annual emissions for the baseline technology following formula C-10 below.

Formula C-10: Annual Surplus Emission Reductions by Pollutant (tons/yr) for Repowers and New Purchases:

Annual Emissions for the Baseline Technology –
Annual Emissions for the Reduced Technology

For retrofits, multiply the baseline technology pollutant emissions by the percent of emission reductions that the ARB-verified reduced technology is verified to following formula C-11 below.

Formula C-11: Annual Surplus Emission Reductions by Pollutant (tons/yr) for Retrofits:

*Annual Emissions for the Baseline Technology **
Reduced Technology Verification Percent

Calculations must be done for each pollutant, NOx, PM10, and ROG, giving a total of three calculations.

For fleet modernization projects the baseline will be the newer vehicle emissions.

The annual surplus emission reductions by pollutant would be used in Formula C-2 to calculate the annual surplus emission reductions.

B. Determining the Annualized Cost

Annualized cost is the amortization of the one-time incentive grant amount for the life of the project to yield an estimated annual cost. The annualized cost is calculated by multiplying the incremental cost by the capital recovery factor (CRF). The resulting annualized cost is used to complete formula C-12 to determine the cost-effectiveness of surplus emission reductions.

Formula C-12: Annualized Cost ($):

*CRF * incremental cost ($)*

1. Calculating the CRF

The CRF is the level of earnings reasonably expected by investing state funds in various financial instruments over the length of a Carl Moyer Program project. The CRF uses an interest rate and project life to determine the rate at which earnings could reasonably be expected if the same funds were invested over a length of time equaling the project life. The CRF is calculated following formula C-13 below.

Formula C-13: Capitol Recovery Factor (CRF):

$$[(1 + i)^n (i)] / [(1 + i)^n - 1]$$

Where
i = discount rate (4 percent)
n = project life (at least 3 years see specific project criteria for default maximums)

The discount rate of 4 percent reflects the prevailing earning potential for state funds that could reasonably be expected by investing state funds in various financial instruments over the length of the minimum project life of Carl Moyer Program projects.

Table B-1 in Appendix B lists the CRF for various project lives using a discount rate of 4 percent. Use the result from formula C-13 to complete formula C-12 to determine the annualized cost of a project.

2. Calculating the Incremental Cost

In previous guidelines, incremental cost was determined by calculating the difference in cost between the new reduced technology and the baseline technology, making it necessary for the applicant to receive quotes for both the reduced and the baseline technologies. ARB staff decided to streamline this process by applying maximum eligible percent funding amounts to define incremental cost, eliminating the need to receive quotes for the baseline technology. An applicant would only need to provide an estimate of the cost of the reduced technology. Therefore, the incremental cost is determined by multiplying the cost of the reduced technology by the maximum eligible percent funding amount (from applicable chapter), as described in formula C-14 below.

Formula C-14: Incremental Cost ($):

*Cost of Reduced Technology ($) * Maximum Eligible Percent Funding Amount*

Generally the cost of the baseline vehicle for a new purchase is assumed to be a certain percentage of the cost of a new vehicle meeting reduced emissions from the standard. The cost of the baseline technology for a repower is assumed to be a percentage of the

new engine. For retrofits, there is no baseline technology cost; hence the entire cost of the retrofit may be eligible for funding.

For fleet modernization projects, the incremental cost is determined by adjusting the value given to the vehicle by the National Automotive Dealership Association (N.A.D.A.), as described in formula C-15 below.

Formula C-15: Incremental Cost for Fleet Modernization Projects ($):

When the replacement vehicle is not new:

N.A.D.A value

where the N.A.D.A value is the retail value of the used vehicle * 50 percent.

When the replacement vehicle is new:

*Invoice of the New Vehicle * 50 percent*

Use the results from formula C-14 or C-15 to complete formula C-12 to determine the annualized cost of a project.

III. List of Formulas

For an easy reference, the necessary formulas to calculate the cost-effectiveness of surplus emission reductions for a project funded through the Carl Moyer Program are provided below.

Formula C-1: Cost-Effectiveness of Weighted Surplus Emission Reductions ($/ton):

$$\frac{\text{Annualized Cost (\$/yr)}}{\text{Annual Weighted Surplus Emission Reductions (tons/yr)}}$$

Formula C-2: Annual Weighted Surplus Emission Reductions:

NOx reductions (tons/yr) + ROG reductions (tons/yr) + [20 * PM10 reductions (tons/yr)]

Formula C-3: Estimated Annual Emissions by Pollutant (tons/yr):

Emission Factor or Converted Emission Standard (g/bhp-hr) * Annual Activity * Adjustment Factor(s) * Percent Operation in CA* (ton/907,200g)

Formula C-4: Estimated Annual Emissions based on hours of Operation (tons/yr):

Emission Factor or Converted Emission Standard (g/bhp-hr) * Horsepower * Load Factor * Activity (hrs/yr) * Percent Operation in CA * ton/907,200g

Formula C-5: Replacement Load Factor:

Load Factor $_{baseline}$ * hp $_{baseline}$/hp $_{reduced}$

Formula C-6: Estimated Annual Emissions based on Fuel Consumed using Emission Factors or Converted Emission Standard (tons/yr):

Emission Factor or Converted Emission Standard (g/bhp-hr) * ECF (hp-hr/gal) * Activity (gal/yr) * Percent Operation in CA * ton/907,200g

Formula C-7: Estimated Annual Emissions based on Fuel Consumed using On-Road Emission Factors (tons/yr):

[On-Road Emission Factor (g/mile)/Unit Conversion Factor (bhp-hr/mile)] * ECF (hp-hr/gal) * Activity (gal/yr) * Percent Operation in CA * ton/907,200g

Formula C-8: Estimated Annual Emissions based on Mileage using Emission Factors (tons/yr):

Emission Factor (g/mile) * Activity (miles/yr) * Percent Operation in CA * ton/907,200g

Formula C-9: Estimated Annual Emissions based on Mileage using Converted Emission Standards (tons/yr):

Converted Emission Standard (g/bhp-hr) * Unit Conversion Factor (bhp-hr/mile) * Activity (miles/yr) * Percent Operation in CA * ton/907,200g

Formula C-10: Annual Surplus Emission Reductions by Pollutant (tons/yr) for Repowers and New Purchases:

Annual Emissions for the Baseline Technology –
Annual Emissions for the Reduced Technology

Formula C-11: Annual Surplus Emission Reductions by Pollutant (tons/yr) for Retrofits:

Annual Emissions for the Baseline Technology *
Reduced Technology Verification Percent

Formula C-12: Annualized Cost ($):

CRF * incremental cost ($)

Formula C-13: Capitol Recovery Factor (CRF):

$$[(1 + i)^n (i)] / [(1 + i)^n - 1]$$

Where i = discount rate (4 percent) and n = project life (at least 3 years see specific project criteria for default maximums)

Formula C-14: Incremental Cost ($):

Cost of Reduced Technology ($) * Maximum Eligible Percent Funding Amount

Formula C-15: Incremental Cost for Fleet Modernization Projects ($):

When the replacement vehicle is not new:

N.A.D.A value

where the N.A.D.A value is the retail value of the used vehicle * 50 percent.

When the replacement vehicle is new:

Invoice of the New Vehicle * 50 percent

APPENDIX D

LIGHT-DUTY VEHICLE COST-EFFECTIVENESS CALCULATION METHODOLOGY

A. Conventional VAVR Projects

Emission reductions from conventional VAVR projects were calculated using the VAVR regulation methodology. They are equal to the retired vehicle's emission rates minus those of the replacement vehicle with the difference multiplied by the average vehicle miles traveled by light duty vehicles in the year of vehicle retirement and by the three year project life. The retired vehicle's emission rates are equal to those for gasoline-powered, light-duty vehicles for the model year of the retired vehicle in the year of vehicle retirement. Replacement vehicle emissions are the fleet average emissions for all gasoline-powered light-duty vehicles for model years 1990 through the year of vehicle retirement. Emission rates and average vehicle miles traveled are generated by the ARB's motor vehicle emissions model. NOx, ROG, CO, and PM emission reductions over the 3 year project life by vehicle model year are located in Tables D-1, 2, 3, and 4.

Emission reductions for diesel-powered vehicles were estimated using a similar methodology. Because of very limited data and only minor differences in emission rates from one year to another, average emission reductions were only estimated for two model year ranges for all four calendar years. Replacement vehicle emission rates were the same as those used for gasoline-powered vehicles. Average NOx, ROG, CO, and PM emission reductions over the 3 year project life by model year range are located in Table D-15. There are no evaporative emission reductions for retiring a diesel-powered vehicle.

B. High Emitter VAVR Projects

Emission Reductions = $[ER_{retired} - ER_{replace}] * VMT * Life$

Where:

	$ER_{retired}$	=	Emission rate of retired vehicle
	$ER_{replace}$	=	Emission rate of replacement vehicle
	VMT	=	Vehicle miles traveled
	Life	=	Project life = 3 years

1. Exhaust Emission Rates of Retired Vehicle

For retired vehicles exempt from Smog Check (pre-1976), ROG_{exh}, NOx, and CO emission rates for the full 3 year credit life equal the pollutant concentrations measured by the Smog Check test at the time of vehicle retirement converted to FTP emission rates using the conversions listed in Table D-5.

For year 1 of the 3 year project life, ROG_{exh}, NOx, and CO emission rates for most post-1975 retired vehicles equal the pollutant concentrations measured by the Smog Check test at the time of vehicle retirement converted to FTP emission rates as described in

Table D-5. However, Two Speed Idle (TSI) test results from high emitting vehicles that are not testable by the ASM Smog Check test may be used to estimate ROG_{exh} emission rates when converted to FTP emission rates as described in Table D-6.

For years 2 and 3 of the 3 year project life, ROG_{exh}, NOx, and CO emission rates for most post-1975 vehicles equal the Smog Check pass/fail cutpoints for the retired vehicle's model year and vehicle class converted to FTP emission rates as described in Table D-5. The most recent Smog Check pass/fail cutpoints are located at www.smobcheck.ca.gov/ftp/pdfdocs/asm_ph43.pdf and in Table D-7. For high emitting vehicles that are not testable by the ASM Smog Check test, ROG_{exh} emission rates are equal to the TSI pass/fail cutpoints for the retired vehicle's model year and vehicle class converted to FTP emission rates as described in Table D-6. The most recent TSI pass/fail cutpoints are located in Table D-8.

VMT is the average VMT of the retired vehicle's model year based on the ARB's motor vehicle emission model and is listed in Table D-9. Districts may also use the average vehicle miles traveled by the retired vehicle over the immediately prior two years as long as the district documents the mileage, and the odometer is in good working order.

2. Exhaust Emission Rates of Replacement Vehicle

Emission rates for an unknown replacement vehicle equal the fleet average emission rates of gasoline-powered light-duty vehicles for model years 1990 through the year of vehicle retirement in the year retired using the ARB's latest approved motor vehicle emissions model. Emission rates by the year of vehicle retirement are in Table D-10.

High emitting vehicle projects may also generate extra emission reductions for the documented purchase of an ARB-certified LEV or cleaner replacement vehicle as defined in Title 13, CCR, Division 3, Chapter 1, Article 1, Sections 1960.1 and 1961. Default emission rates for LEV's are located in Tables D-11, 12, 13, and 14.

3. Evaporative Emission Reductions

Districts may include an evaporative emission reduction element in a high emitting vehicle project. If no evaporative testing is conducted, default evaporative emission reductions are estimated from the retired vehicle's model year as listed in Tables D-1, 2, 3, and 4.

Districts also may conduct evaporative testing on vehicles identified as high emitting vehicles to determine if they are also high evaporative emitting vehicles.

- Low pressure evaporative testing must be conducted according to manufacturer's standard operating procedures and BAR protocols using equipment certified by BAR or submitted for BAR certification, if BAR-certified equipment is not available.

- Only high emitting vehicles that fail the low pressure evaporative test are eligible to receive extra emission reduction credit if retired or receive evaporative control

repairs that result in passing the low pressure evaporative test. Extra emission reductions equal 14.5 pounds of ROG per vehicle per year.

4. Particulate Matter Emission Reductions

District project plans that include a PM emission reduction component must also include verification that the methodology for measuring PM is scientifically valid, documentation that the results are reproducible, and a complete copy of the methodology.

C. High Emitter VRV Projects

$$\text{Emission Reductions} = [ER_{pre} - ER_{post}] * VMT * Life$$

Where:

ER_{pre}	=	Emission rate of pre-repaired vehicle
ER_{post}	=	Emission rate of vehicle after repair
VMT	=	Vehicle miles traveled
Life	=	Project life = 1 year

1. Exhaust Emissions

Emission reductions are calculated as the difference between the pre and post-repair Smog Check test results converted to FTP emission rates using the conversion equations in Table D-5 with the difference multiplied by the VMT and the one year project life. Two Speed Idle (TSI) test results from vehicles not testable by the ASM Smog Check test may be used when converted to FTP ROG_{exh} emission rates as described in Table D-6.

VMT is the average VMT of the vehicle's model year based on the ARB's motor vehicle emission model and is listed in Table D-9. Districts may also use the average of the vehicle miles traveled by the vehicle over the immediately prior two years as long as the district documents the mileage, and the odometer is in good working order.

The credit life for exhaust and evaporative repairs is one (1) year.

2. Evaporative Emission Reductions

Districts may conduct evaporative testing on vehicles identified as high emitting vehicles to determine if they are also high evaporative emitting vehicles.

- Low pressure evaporative testing must be conducted according to manufacturer's standard operating procedures and BAR protocols using equipment certified by BAR or submitted for BAR certification, if BAR-certified equipment is not available.

- Vehicles that fail low pressure evaporative tests are eligible to receive extra emission reductions where reductions equal the average emission reductions for repairing evaporative system failures or 14.5 pounds of ROG per vehicle per year.

Evaporative repairs must bring the vehicle's emissions into compliance with the low pressure fuel evaporative test to be creditable and fundable.

3. Particulate Matter Emission Reductions

District project plans that include a PM emission reduction component must also include verification that the methodology for measuring PM is scientifically valid, documentation that the results are reproducible, and a complete copy of the methodology.

D. Modifications to Calculation Methodology

Air districts may propose modifications to the calculation methodology to reflect unique project elements but must provide a technical justification to support any modification in their project plan. The district must receive written approval from the ARB prior to using the modified methodology, and emission reductions for all vehicles retired or repaired must be calculated according to the ARB-approved methodology.

E. Cost-Effectiveness Calculations

1. General Requirements

Funds spent on outreach, data analysis, and database development are administrative costs. Costs incurred to identify and diagnose high emitting vehicles may not result in any benefits, as some vehicles may not be eligible or some owners may choose to not participate. These costs are distributed across successfully retired or repaired vehicles. However, VAVR and VRV projects individually must meet the cost-effectiveness limit. Districts may propose validated modifications to the calculation methodology to reflect unique project elements that must be detailed in the district's plan which must document that the proposed modifications are technically sound. The district must have written ARB approval prior to using an alternative methodology.

State funds used for administrative costs are not included in cost-effectiveness calculations. However, they must be accounted for relative to the administrative limits associated with each funding source.

2. Additional High Emitter Project Requirements

The district must include State or DMV funds expended on project-related costs to identify and retire/repair high emitting vehicles in the cost-effectiveness calculations.

- Project-related costs are those used to identify high emitting vehicles, run Smog Check tests, diagnose vehicles, and retire or repair vehicles.

- Programmatic costs which cannot be attributed to retiring or repairing a specific vehicle shall be distributed across each vehicle repaired or retired in proportion to the programmatic costs for each vehicle within each program.

- The project cost-effectiveness shall be calculated separately for VAVR and VRV projects and for each year of project funding. The results shall be reported in the district's annual and final reports for that year of funding.

If a district has a cap on the amount paid for repairs, vehicle owners may pay for repairs that exceed the district cap. Funds contributed by vehicle owners are not included in the cost-effectiveness calculation.

TABLE D-1						
Retired Vehicle Emission Reductions, CY2008 (lbs/3 yr)						
MY	ROG			CO	NOx	PM10
	Exhaust	Evap	Total	Exhaust	Exhaust	Exhaust
Pre 1966	325.9	235.1	560.9	3595.8	187.9	0.54
1966	284.1	239.9	524.0	3313.3	179.7	0.69
1967	289.2	242.7	531.9	3374.6	183.8	0.70
1968	296.5	247.3	543.8	3462.7	188.0	0.69
1969	304.1	249.8	553.9	3553.5	193.3	1.06
1970	310.4	178.6	489.0	3669.0	199.6	0.53
1971	323.4	175.6	499.1	3674.2	201.1	0.60
1972	337.8	172.2	510.0	3686.3	203.8	0.80
1973	345.4	174.2	519.6	3709.4	205.9	1.26
1974	326.6	135.2	461.8	3424.0	185.1	1.41
1975	256.5	124.8	381.4	3256.4	173.2	0.36
1976	121.7	119.6	241.3	2759.5	134.1	1.81
1977	109.7	92.7	202.4	2784.3	118.0	1.21
1978	109.3	95.5	204.8	2764.6	117.8	1.36
1979	95.3	93.8	189.1	1863.5	105.5	1.09
1980	77.3	72.6	149.8	1616.4	99.8	1.16
1981	64.2	66.2	130.4	1330.5	78.8	2.00
1982	60.8	63.1	124.0	1310.3	84.0	1.59
1983	47.6	59.1	106.7	1138.0	87.3	1.37
1984	45.7	52.9	98.6	1105.0	87.4	1.24
1985	36.7	47.7	84.4	819.1	82.5	1.44
1986	36.5	44.7	81.2	791.2	84.7	1.33
1987	35.7	57.3	93.0	739.0	81.9	1.16
1988	35.2	60.9	96.1	693.3	80.4	1.23
1989	36.8	41.5	78.4	748.3	67.2	1.13
1990	38.2	38.3	76.5	773.0	55.6	1.13
1991	38.8	34.2	72.9	766.3	57.6	1.10
1992	39.2	32.2	71.3	767.1	58.5	1.07
1993	31.7	30.8	62.5	566.5	55.3	1.05
1994	21.0	28.6	49.7	337.4	42.2	0.97
1995	16.6	23.6	40.2	242.8	29.6	0.88
1996	12.0	17.6	29.6	233.4	23.7	0.74
1997	9.3	11.4	20.8	223.6	17.9	0.64
1998	4.6	-0.7	3.9	198.1	12.5	0.57
1999	0.1	-2.1	-2.0	171.9	6.0	0.43
2000	-4.0	-3.6	-7.6	143.6	-0.6	0.29
Source: Emfac2007 V2.3 Nov 1, 2006						

TABLE D-2						
Retired Vehicle Emission Reductions, CY2009 (lbs/3 yr)						
MY	ROG			CO	NOx	PM10
	Exhaust	Evap	Total	Exhaust	Exhaust	Exhaust
Pre 1966	321.8	233.1	554.9	3499.2	186.2	0.76
1966	282.1	236.3	518.4	3229.2	178.8	0.12
1967	286.5	240.6	527.1	3288.1	182.5	0.12
1968	294.7	243.1	537.9	3373.8	186.5	0.10
1969	301.6	247.4	549.0	3465.2	192.0	0.62
1970	308.4	176.3	484.7	3577.0	197.9	0.67
1971	321.3	174.4	495.7	3581.9	200.0	0.75
1972	336.1	170.8	506.9	3593.3	202.5	0.96
1973	343.4	172.9	516.4	3612.9	204.4	0.93
1974	328.8	135.1	463.9	3352.4	186.4	0.87
1975	257.8	128.1	385.9	3213.7	176.9	0.45
1976	118.6	118.5	237.1	2658.1	131.2	2.05
1977	106.4	92.3	198.7	2667.3	116.9	1.26
1978	106.9	93.2	200.1	2644.1	116.4	1.42
1979	92.5	91.9	184.4	1740.4	103.4	1.14
1980	75.5	72.0	147.5	1520.7	98.9	1.23
1981	61.7	66.1	127.8	1230.7	77.7	2.11
1982	59.5	62.3	121.8	1216.9	83.2	1.69
1983	46.4	59.1	105.4	1042.5	86.4	1.47
1984	44.8	52.5	97.3	1012.0	86.6	1.36
1985	36.2	47.6	83.8	737.7	82.0	1.18
1986	35.5	44.4	79.9	701.9	83.4	1.32
1987	35.8	57.8	93.6	664.6	82.3	1.17
1988	35.4	63.0	98.4	619.0	80.8	1.10
1989	37.0	44.3	81.3	671.2	68.0	1.14
1990	38.1	41.1	79.2	691.4	56.4	1.17
1991	38.5	36.6	75.1	681.4	58.2	1.14
1992	39.1	34.8	73.9	681.6	59.5	1.12
1993	32.0	33.2	65.2	483.0	56.4	1.07
1994	21.5	30.9	52.4	255.8	43.4	1.00
1995	17.3	25.7	43.0	162.1	31.1	0.92
1996	13.1	19.4	32.4	151.9	25.2	0.81
1997	10.6	13.1	23.7	141.7	19.7	0.72
1998	5.9	0.7	6.5	114.2	14.5	0.64
1999	1.4	-0.7	0.7	86.2	8.3	0.52
2000	-2.7	-2.1	-4.8	56.7	2.1	0.38
Source: Emfac2007 V2.3 Nov 1, 2006						

TABLE D-3						
Retired Vehicle Emission Reductions, CY 2010 (lbs/3 yr)						
MY	ROG			CO	NOx	PM10
	Exhaust	Evap	Total	Exhaust	Exhaust	Exhaust
pre 1967	280.4	233.6	514.0	3200.7	176.5	0.21
1967	285.6	236.1	521.7	3258.3	180.3	0.20
1968	292.1	537.3	829.4	3342.6	185.6	0.18
1969	300.3	245.1	545.4	3433.9	191.1	0.75
1970	306.0	174.5	480.4	3547.9	196.1	0.82
1971	320.2	171.9	492.1	3551.7	199.0	0.93
1972	334.3	169.2	503.5	3562.9	201.5	1.17
1973	341.6	171.8	513.3	3583.3	202.5	1.11
1974	330.6	136.2	466.8	3338.2	187.9	0.17
1975	258.8	122.8	381.7	3230.5	179.4	0.58
1976	116.9	117.3	234.1	2636.0	129.4	1.31
1977	105.7	92.6	198.3	2635.6	114.5	1.45
1978	105.3	92.3	197.6	2600.5	115.1	1.49
1979	91.0	90.4	181.4	1706.4	103.0	1.20
1980	73.5	149.5	223.0	1481.2	97.6	1.29
1981	60.9	65.0	126.0	1213.7	77.7	1.61
1982	57.8	61.2	119.0	1194.5	82.3	1.79
1983	45.2	58.4	103.7	1029.3	85.8	1.17
1984	43.8	52.5	96.4	996.9	86.1	1.46
1985	35.8	47.4	83.2	734.5	81.3	1.30
1986	35.1	43.6	78.7	701.5	83.0	1.30
1987	35.0	59.0	93.9	658.3	81.1	1.29
1988	35.6	64.8	100.4	627.0	81.4	1.11
1989	37.1	46.7	83.9	677.5	68.8	1.20
1990	38.3	43.9	82.2	697.2	57.6	1.20
1991	38.7	39.2	77.9	686.3	59.2	1.20
1992	39.2	37.3	76.4	685.3	60.3	1.14
1993	32.2	35.8	68.1	491.0	57.5	1.14
1994	22.1	33.3	55.4	269.8	44.9	1.07
1995	17.9	27.8	45.7	176.5	32.5	0.99
1996	14.1	21.4	35.4	168.7	26.6	0.87
1997	11.6	14.7	26.4	158.8	21.3	0.79
1998	7.1	2.0	9.1	134.1	16.4	0.72
1999	2.6	0.7	3.2	107.3	10.4	0.59
2000	-1.5	-0.6	-2.1	79.8	4.5	0.46
Source: Emfac2007 V2.3 Nov 1, 2006						

Table D-4						
Retired Vehicle Emission Reductions, CY 2011 (lbs/3 yr)						
MY	ROG			CO	NOx	PM10
	Exhaust	Evap	Total	Exhaust	Exhaust	Exhaust
1967	283.9	232.7	516.6	3229.5	179.1	0.30
1968	292.3	234.8	527.1	3310.0	183.9	0.27
1969	299.3	239.4	538.7	3400.8	188.3	0.12
1970	305.2	174.7	480.0	3514.1	194.9	0.98
1971	319.6	171.5	491.1	3519.8	196.4	1.11
1972	334.8	168.3	503.2	3530.2	199.2	0.70
1973	342.5	169.9	512.4	3550.6	200.5	0.65
1974	335.2	135.2	470.4	3321.7	188.4	0.26
1975	263.3	126.8	390.1	3233.9	180.5	0.33
1976	115.9	114.9	230.9	2611.1	128.2	0.40
1977	104.4	89.5	193.9	2609.3	113.3	1.67
1978	103.7	92.8	196.5	2566.0	113.1	1.09
1979	89.7	88.6	178.3	1676.3	101.1	1.26
1980	72.0	70.2	142.2	1457.4	96.6	1.35
1981	59.1	63.7	122.8	1189.8	76.4	1.07
1982	57.4	60.6	118.0	1182.7	82.1	1.89
1983	44.8	58.3	103.1	1014.1	85.2	1.25
1984	43.4	51.9	95.3	990.1	85.8	1.33
1985	35.5	47.2	82.8	733.1	80.9	1.22
1986	35.0	43.5	78.6	702.3	82.8	1.42
1987	34.8	60.0	94.8	661.6	80.9	1.28
1988	34.9	67.2	102.1	623.5	80.3	1.23
1989	37.5	49.3	86.9	685.6	69.6	1.26
1990	38.7	46.5	85.2	705.0	58.6	1.12
1991	39.2	41.9	81.1	695.2	60.4	1.24
1992	39.5	40.1	79.6	693.2	61.4	1.25
1993	32.6	38.7	71.2	498.4	58.6	1.24
1994	22.7	36.2	58.9	283.3	46.5	1.15
1995	18.6	30.2	48.8	192.6	34.1	1.07
1996	15.0	23.4	38.3	185.0	28.1	0.97
1997	12.6	16.6	29.2	175.4	22.8	0.86
1998	8.1	3.4	11.5	151.4	18.0	0.80
1999	3.7	2.1	5.8	127.1	12.3	0.67
2000	-0.4	0.7	0.3	100.7	6.5	0.56
Source: Emfac2007 V2.3 Nov 1, 2006						

TABLE D-5
ASM-FTP Correlation Equations

Pre-1990 Model Year

FTP_HC = 1.2648 * exp (- 4.67052
+ 0.46382 * hc_term
+ 0.09452 * co_term
+ 0.03577 * no_term
+ 0.57829 * wt_term
- 0.06326 * my_term
+ 0.20932 * trk)

FTP_CO = 1.2281 * exp (- 2.65939
+ 0.08030 * hc_term
+ 0.32408 * co_term
+ 0.03324 * co_term^2
+ 0.05589 * no_term
+ 0.61969 * wt_term
- 0.05339 * my_term
+ 0.31869 * trk)

FTP_NOX = 1.0810 * exp (- 5.73623
+ 0.06145 * hc_term
- 0.02089 * co_term^2
+ 0.44703 * no_term
+ 0.04710 * no_term^2
+ 0.72928 * wt_term
- 0.02559 * my_term
- 0.00109 * my_term^2
+ 0.10580 * trk)

Where:
hc_term = ln ((ASM1_HC*ASM2_HC) ^ 0.5) - 3.72989
co_term = ln ((ASM1_CO*ASM2_CO) ^ 0.5) + 2.07246
no_term = ln ((ASM1_NO*ASM2_NO) ^ 0.5) - 5.83534
MY_Term = model_year - 1982.71
wt_term = ln (vehicle_weight in pounds)
TRK = 0 for a passenger car and 1 for a light-duty truck.

When HC and NO ASM scores = 0, set scores to 1 ppm
FTP_HC = HC FTP emission rate in g/mi
FTP_CO = CO FTP emission rate in g/mi
FTP_NO = NOx FTP emission rate in g/mi

1990 and Newer Model Year

FTP_HC = 1.1754 * exp (- 6.32723
+ 0.24549 * hc_term
+ 0.09376 * hc_term^2
+ 0.06653 * no_term
+ 0.01206 * no_term^2
+ 0.56581 * wt_term
- 0.10438 * my_term
- 0.00564 * my_term^2
+ 0.24477 * trk)

FTP_CO = 1.2055 * exp (0.90704
+ 0.04418 * hc_term^2
+ 0.17796 * co_term
+ 0.08789 * no_term
+ 0.01483 * no_term^2
- 0.12753 * my_term
- 0.00681 * my_term^2
+ 0.37580 * trk)

FTP_NOX = 1.1056 * exp (- 6.51660
+ 0.25586 * no_term
+ 0.04326 * no_term^2
+ 0.65599 * wt_term
- 0.09092 * my_term
- 0.00998 * my_term^2
+ 0.24958 * trk)

Where:
hc_term = ln ((ASM1_HC*ASM2_HC) ^ 0.5) - 2.32393
co_term = ln ((ASM1_CO*ASM2_CO) ^ 0.5) + 3.45963
no_term = ln ((ASM1_NO*ASM2_NO) ^0.5) - 3.71310
MY_Term = model_year - 1993.69
wt_term = ln (vehicle_weight in pounds)
TRK = 0 for a passenger car and 1 for a light-duty truck

When CO ASM scores = 0, set score to 0.01%.
ASM1_HC = ASM 5015 mode HC concentration in ppm
ASM2_HC = ASM 2525 mode HC concentration in ppm
ASM1_NO = ASM 5015 mode NOx concentration in ppm
ASM2_NO = ASM 2525 mode NOx concentration in ppm
ASM1_CO = ASM 5015 mode CO concentration in %
ASM2_CO = ASM 2525 mode CO concentration in %

Ref: Technical Support Document, Part 2, "Evaluation of the California Enhanced Inspection and Maintenance (Smog Check) Program", (April 2004), Bureau of Automotive Repair and Sierra Research at ww.arb.ca.gov/msprog/smogcheck/jun04/tsd_part2.pdf.

TABLE D-6

Conversion of Two Speed Idle Measurements to FTP Emission Rates

Model Inputs:

HCHT =	HC_High Term =	(ln (High-Speed Idle HC in ppm)) - 2.6995
COHT =	CO_High Term =	(ln (High-Speed Idle CO in %)) + 2.9867
HCLT =	HC_Low Term =	(ln (Low-Speed Idle HC in ppm)) -3.6573
COLT =	CO_Low Term =	(ln (Low-Speed Idle CO in %)) + 2.7987
AGE = years	AGE Term =	TSI Test Date - January 1 of Vehicle Model Year - 9.0570
DISP =	DISP Term =	(ln (Engine Displacement in Liters)) - 0.9873
TRK =		+ 0.5 for light-duty trucks - 0.5 for passenger vehicles
ERG =		+ 0.5 if the vehicle has exhaust gas recirculation - 0.5 if it does not

IM240 Predicted Emission Rates:

IM240 HC (g/mi) = 1.0396169 * EXP(-1.0705335
+ 0.21479968 * COHT
+ 0.23151769 * HCLT
+ 0.035948587 * AGE
+ 0.083671264 * HCLT^2
+ 0.020890310 * COLT^2
+ 0.099280830 * COLT * TRK
+ 0.59513657 * DISP * ERG

FTP Predicted Emission Rate:

FTP HC (g/mi) = 0.094 + 1.194 * IM240 HC (g/mi)

Source: "Techniques for Estimating IM240 and FTP Emission Rates from Two-Speed Idle Emissions Concentrations", May 10, 2001, Technical Notes, Bureau of Automotive Repair

TABLE D-7 ASM Table --- Phase 4.3 ACCELERATED SIMULATION MODE EMISSION STANDARDS (Effective 01/08/2003)													
ESC	Model Year Group	Vehicle Type (by GVWR and LVW)					Pass/Fail Emission Standard						
							ASM 5015			ASM 2525			
		PC	LDT1	LDT2	MDV		HC	CO	NO	HC	CO	NO	
1	1974-	X	X	X		A	235.4	2.56	1301.5	185.4	2.36	1161.5	
						B	436041.7	4453.19	1192593.0	436041.7	4453.19	1192593.0	
2	1975-1980	X				A	123.0	0.91	1016.3	90.3	0.71	876.3	
						B	273316.7	1362.96	1043519.0	273316.7	1362.96	1043519.0	
3	1981-1983	X				A	63.2	0.64	850.0	42.1	0.44	680.0	
						B	234259.3	1064.81	894444.5	212963.0	1064.81	894444.5	
4	1984-1986	X				A	67.0	0.52	850.0	42.1	0.32	680.0	
						B	212963.0	979.63	894444.5	212963.0	979.63	894444.5	
5	1987-1992	X				A	57.0	0.48	608.0	31.7	0.32	547.0	
						B	191666.7	851.85	596296.3	191666.7	979.63	596296.3	
6	1993-1995	X				A	59.0	0.29	617.1	24.3	0.23	547.0	
						B	89951.3	724.07	271314.8	89951.3	851.85	596296.3	
7	1996-2000	X				A	16.8	0.29	260.0	0.5	0.23	547.0	
						B	128501.9	724.07	596296.3	128501.9	851.85	596296.3	
8	2001-2003	X				A	16.8	0.29	260.0	0.5	0.23	547.0	
						B	128501.9	724.07	596296.3	128501.9	851.85	596296.3	
9	2004+	X				A	16.8	0.29	260.0	0.5	0.23	547.0	
						B	128501.9	724.07	596296.3	128501.9	851.85	596296.3	
10	1975-1978		X			A	139.4	1.08	1320.9	105.0	0.88	1180.9	
						B	225000.0	2025.00	745370.4	225000.0	2025.00	745370.4	
11	1979-1983		X			A	139.4	0.88	1315.7	80.0	0.68	1175.7	
						B	225000.0	2025.00	596296.3	150000.0	2025.00	596296.3	
12	1984-1987		X			A	91.3	0.41	945.0	63.1	0.50	840.0	
						B	150000.0	1725.00	525000.0	150000.0	2250.00	1050000.0	
13	1988-1992		X			A	83.0	0.27	875.0	63.1	0.43	735.0	
						B	150000.0	1725.00	525000.0	150000.0	1875.00	525000.0	
14	1993-1995		X			A	68.3	0.30	377.0	33.3	0.40	630.0	
						B	78750.0	1350.00	525000.0	78750.0	1500.00	525000.0	
15	1996-2000		X			A	22.1	0.30	377.0	5.8	0.40	630.0	
						B	112500.0	1350.00	525000.0	112500.0	1500.00	525000.0	
16	2001-2003		X			A	22.1	0.30	377.0	5.8	0.40	630.0	
						B	112500.0	1350.00	525000.0	112500.0	1500.00	525000.0	
17	2004+		X			A	22.1	0.30	377.0	5.8	0.40	630.0	
						B	112500.0	1350.00	525000.0	112500.0	1500.00	525000.0	
18	1975-1978			X		A	139.4	1.08	1320.9	105.0	0.88	1180.9	
						B	225000.0	2025.00	745370.4	225000.0	2025.00	745370.4	
19	1979-1983			X		A	139.4	0.88	1315.7	80.0	0.68	1175.7	
						B	225000.0	2025.00	596296.3	150000.0	2025.00	596296.3	
20	1984-1987			X		A	91.3	0.41	945.0	63.1	0.50	840.0	
						B	150000.0	1725.00	525000.0	150000.0	2250.00	1050000.0	
21	1988-1992			X		A	83.0	0.27	875.0	63.1	0.43	735.0	
						B	150000.0	1725.00	525000.0	150000.0	1875.00	525000.0	
22	1993-1995			X		A	68.3	0.30	377.0	33.3	0.40	630.0	
						B	78750.0	1350.00	525000.0	78750.0	1500.00	525000.0	
23	1996-2000			X		A	22.1	0.30	377.0	5.8	0.40	630.0	
						B	112500.0	1350.00	525000.0	112500.0	1500.00	525000.0	
24	2001-2003			X		A	22.1	0.30	377.0	5.8	0.40	630.0	
						B	112500.0	1350.00	525000.0	112500.0	1500.00	525000.0	
25	2004+			X		A	22.1	0.30	377.0	5.8	0.40	630.0	
						B	112500.0	1350.00	525000.0	112500.0	1500.00	525000.0	
26	1978-				X	A	173.3	2.90	1703.3	123.3	2.70	1563.3	
						B	583333.3	3500.00	1633333.3	583333.3	3500.00	1633333.3	
27	1979-1983				X	A	139.4	0.88	1315.7	80.0	0.68	1175.7	
						B	225000.0	2025.00	596296.3	150000.0	2025.00	596296.3	
28	1984-1987				X	A	91.3	0.41	945.0	63.1	0.50	840.0	
						B	150000.0	1725.00	525000.0	150000.0	2250.00	1050000.0	
29	1988-1992				X	A	83.0	0.27	875.0	63.1	0.43	735.0	
						B	150000.0	1725.00	525000.0	150000.0	1875.00	525000.0	
30	1993-1995				X	A	83.0	0.30	875.0	60.0	0.70	735.0	
						B	150000.0	1350.00	525000.0	150000.0	1500.00	525000.0	
31	1996-2000				X	A	71.2	0.30	875.0	60.0	0.70	735.0	
						B	150000.0	1350.00	525000.0	150000.0	1500.00	525000.0	
32	2001-2003				X	A	71.2	0.30	875.0	60.0	0.70	735.0	
						B	150000.0	1350.00	525000.0	150000.0	1500.00	525000.0	
33	2004+				X	A	71.2	0.30	875.0	60.0	0.70	735.0	
						B	150000.0	1350.00	525000.0	150000.0	1500.00	525000.0	

ESC - Emissions Standard Category
LVW - Loaded vehicle weight
LDT1 - Light-duty truck up through 3750 lbs LVW and GVWR no greater than 6000 lbs
LDT2 - Light-duty truck greater than 3750 lbs LVW and GVWR no greater than 6000 lbs
GVWR - Manufacture's Gross Vehicle Weight Rating
MDV - Medium-duty vehicle, GVWR from 6001 to 8500 lbs
PC - Passenger car
HC - Hydrocarbon, ppm
CO - Carbon Monoxide, %
NO - Nitric Oxide, ppm

Pass/Fail Emission Standards = A + B / VTW, where VTW is vehicle/truck weight

PASS/FAIL STANDARDS – Emission standards used to determine if a vehicle passes the emission inspection. A vehicle passes if the emission levels are equal to or less than the standards for HC, CO, and NOx for ASM 5015 and ASM2525.

TABLE D-8

Emission Standards, Dilution Thresholds, and Maximum Idle RPM Limits for BAR-90 Two-speed Test

(Effective with 1996 ET Software Update)

ESC	MODEL YEAR GROUP	VEHICLE TYPE (by GVWR)					AVERAGE EMISSIONS FOR PASSING VEHICLES				PASS/FAIL STANDARDS				MIN $CO+CO_2$	MAX IDLE RPM
		PC	TRUCK (includes motorhome, minivan, sport utility)													
		<6,001	<6,001	6,001 to 8,500	8,501 to 14,000	>14,001	Idle HC	Idle CO	2500 HC	2500 CO	Idle HC	Idle CO	2500 HC	2500 CO		
1	1966-1967	X	X				212	2.3	182	1.7	700	5.5	600	4.5	8.0	110
2	1968-1970	X	X				192	2.3	163	1.7	650	5.5	600	4.5	8.0	110
3	1971-1974	X	X				147	1.8	123	1.4	550	5.0	400	4.0	8.0	110
4	1975-1980	X					60	0.3	52	0.5	220	2.0	180	1.7	8.0	110
5	1981-1983	X					42	0.1	37	0.2	120	1.5	150	1.5	8.0	110
6	1984-1986	X					37	0.1	31	0.2	120	1.0	150	1.2	7.0	110
7	1987-1992	X					29	0.1	20	0.1	120	1.0	140	1.0	7.0	110
8	1993+	X					17	0.0	12	0.1	100	1.0	130	1.0	8.0	110
9	1975-1978		X				73	0.5	67	0.9	250	2.5	200	3.0	7.0	110
10	1979-1983		X	X			51	0.2	45	0.4	250	2.0	200	2.0	8.0	110
11	1984-1987		X	X			40	0.1	35	0.2	150	1.2	180	1.2	7.0	110
12	1988-1992		X	X			30	0.1	20	0.1	120	1.0	180	1.0	8.0	110
13	1993+		X				17	0.0	13	0.1	100	1.0	170	1.0	7.0	110
14	1993+			X			26	0.0	11	0.1	100	1.0	180	1.1	7.0	120
15	1966-1969			X	X	X	188	2.4	241	1.9	700	5.5	750	5.0	7.0	120
16	1970-1973			X	X	X	152	2.0	200	1.4	550	5.0	600	4.5	8.0	120
17	1974-1978			X	X	X	99	1.1	95	0.9	300	3.0	350	3.5	7.0	120
18	1979-1983				X	X	77	0.8	57	0.6	250	2.2	250	3.0	7.0	120
19	1984-1986				X	X	57	0.7	33	0.3	250	1.5	200	1.6	7.0	120
20	1987-1990				X		51	0.2	34	0.3	220	1.5	200	1.6	7.0	110
21	1991+				X		39	0.1	20	0.2	150	1.2	150	1.5	7.0	110
22	1987-1990					X	60	0.5	32	0.3	250	2.5	200	1.6	7.0	110
23	1991+					X	42	0.3	17	0.2	150	1.5	150	1.5	7.0	110

PC = passenger vehicle ESC -- Emissions Standards Category HC -- Hydrocarbon, ppm CO -- Carbon monoxide, %

MIN. $CO + CO_2$ -- Minimum $CO + CO_2$ dilution threshold MAX. IDLE RPM -- Maximum Idle RPM limits

PASS/FAIL STANDARDS -- Emission standards used to determine if a vehicle passes the emissions portion of the inspection. A vehicle passes if the emission levels are equal to or less than the hydrocarbon or carbon monoxide standard for the idle or 2500 RPM inspection.

Source: www.autorepair.ca.gov/stdhome.asp. Select "reference library", "Publications", then "TSI Cutpoints Table."

Table D-9				
Vehicle Miles Traveled/Yr/Vehicle				
MY	Year of Retirement			
	2008	2009	2010	2011
Pre 1967	5,896	5,793	5,709	5,618
1967	6,017	5,902	5,828	5,734
1968	6,167	6,074	5,975	5,886
1969	6,340	6,239	6,147	6,059
1970	6,518	6,422	6,337	6,243
1971	6,671	6,578	6,471	6,384
1972	6,831	6,730	6,635	6,521
1973	6,943	6,828	6,735	6,627
1974	6,915	6,806	6,709	6,604
1975	7,064	6,926	6,856	6,705
1976	7,104	7,002	6,898	6,806
1977	7,273	7,163	7,054	6,915
1978	7,372	7,254	7,133	7,019
1979	7,476	7,359	7,228	7,089
1980	7,610	7,484	7,360	7,239
1981	7,773	7,644	7,520	7,379
1982	7,906	7,769	7,629	7,518
1983	7,997	7,854	7,719	7,589
1984	8,193	8,042	7,901	7,765
1985	8,342	8,194	8,043	7,900
1986	8,552	8,392	8,242	8,094
1987	8,662	8,502	8,345	8,198
1988	8,827	8,661	8,502	8,345
1989	9,009	8,837	8,671	8,513
1990	9,156	8,975	8,803	8,637
1991	9,386	9,198	9,016	8,847
1992	9,612	9,412	9,220	9,041
1993	9,882	9,661	9,462	9,274
1994	10,128	9,893	9,672	9,473
1995	10,359	10,105	9,870	9,650
1996	10,662	10,383	10,129	9,894
1997	10,961	10,662	10,384	10,130
1998	11,319	10,994	10,695	10,417
1999	11,727	11,369	11,044	10,744
2000	12,103	11,708	11,349	11,023
Source: Emfac2007 V2.3 Nov 1 2006				

TABLE D-10						
Fleet Average Emission Rates for Unknown Replacement Vehicle (g/VMT)**						
Year of	ROG			CO	NOx	PM10
Retirement	Exhaust	Evap	Total	Exhaust	Exhaust	Exhaust
2008	0.1417	0.1341	0.2758	3.2807	0.3430	0.0151
2009	0.1302	0.1340	0.2643	3.0801	0.3167	0.0156
2010	0.1197	0.1336	0.2533	2.8862	0.2919	0.0160
2011	0.1104	0.1328	0.2432	2.7118	0.2690	0.0166
Source: Emfac2007 V2.3 Nov 1 2006				** Fleet Ave. = 1990 through Year of Retirement		

Table D-11						
CY 2008 LDV LEV Emission Rates by MY, g/mi						
MY	ROG			CO	NOx	PM10
	EXH	EVAP	TOTAL	EXH	EXH	EXH
1997	0.1038	0.1009	0.2048	4.0607	0.3616	0.0241
1998	0.0979	0.1246	0.2225	3.8895	0.3581	0.0227
1999	0.0949	0.1070	0.2019	3.8010	0.3476	0.0207
2000	0.0911	0.0895	0.1805	3.6683	0.3355	0.0186
2001	0.0830	0.0712	0.1542	3.3853	0.3223	0.0165
2002	0.0790	0.0510	0.1300	3.2353	0.3327	0.0157
2003	0.0702	0.0380	0.1082	2.8771	0.3072	0.0137
2004	0.0405	0.0278	0.0684	1.6568	0.1522	0.0120
2005	0.0240	0.0171	0.0411	0.9777	0.0847	0.0096
2006	0.0163	0.0138	0.0301	0.6669	0.0518	0.0075
2007	0.0131	0.0113	0.0244	0.5218	0.0388	0.0052
2008	0.0103	0.0090	0.0194	0.4387	0.0342	0.0028
Source: EMFAC2007, V2.3, Nov 1, 2006						

Table D-12						
CY 2009 LDV LEV Emission Rates by MY, g/mi						
MY	ROG			CO	NOx	PM10
	EXH	EVAP	TOTAL	EXH	EXH	EXH
1997	0.1068	0.1148	0.2216	4.1592	0.3653	0.0232
1998	0.1011	0.1427	0.2438	4.0038	0.3632	0.0222
1999	0.0984	0.1248	0.2232	3.9241	0.3536	0.0205
2000	0.0949	0.1068	0.2017	3.8087	0.3436	0.0188
2001	0.0874	0.0895	0.1768	3.5328	0.3318	0.0169
2002	0.0833	0.0711	0.1544	3.3860	0.3424	0.0165
2003	0.0744	0.0491	0.1235	3.0606	0.3154	0.0147
2004	0.0448	0.0355	0.0802	1.8732	0.1678	0.0132
2005	0.0278	0.0220	0.0498	1.1468	0.0970	0.0110
2006	0.0178	0.0168	0.0346	0.7324	0.0566	0.0091
2007	0.0146	0.0138	0.0284	0.5714	0.0427	0.0071
2008	0.0120	0.0113	0.0234	0.4803	0.0380	0.0049
2009	0.0095	0.0090	0.0186	0.4051	0.0289	0.0026
Source: EMFAC2007, V2.3, Nov 1, 2006						

Table D-13						
CY 2010 LDV LEV Emission Rates by MY, g/mi						
MY	ROG			CO	NOx	PM10
	EXH	EVAP	TOTAL	EXH	EXH	EXH
1997	0.1096	0.1288	0.2384	4.2561	0.3687	0.0276
1998	0.1043	0.1615	0.2658	4.1079	0.3680	0.0262
1999	0.1018	0.1354	0.2371	4.0450	0.3591	0.0241
2000	0.0986	0.1245	0.2231	3.9379	0.3501	0.0221
2001	0.0911	0.1068	0.1979	3.6676	0.3389	0.0199
2002	0.0877	0.0893	0.1770	3.5379	0.3526	0.0194
2003	0.0787	0.0683	0.1470	3.2093	0.3251	0.0174
2004	0.0476	0.0456	0.0933	2.0013	0.1732	0.0159
2005	0.0306	0.0275	0.0581	1.2749	0.1060	0.0135
2006	0.0206	0.0208	0.0414	0.8626	0.0646	0.0116
2007	0.0160	0.0167	0.0327	0.6274	0.0465	0.0095
2008	0.0134	0.0138	0.0272	0.5261	0.0418	0.0073
2009	0.0111	0.0113	0.0224	0.4434	0.0321	0.0051
2010	0.0091	0.0090	0.0181	0.3922	0.0284	0.0027
Source: EMFAC2007, V2.3, Nov 1, 2006						

Table D-14						
CY 2011 LDV LEV Emission Rates by MY, g/mi						
MY	ROG			CO	NOx	PM10
	EXH	EVAP	TOTAL	EXH	EXH	EXH
1997	0.1128	0.1439	0.2568	4.3692	0.3736	0.0297
1998	0.1076	0.1807	0.2883	4.2222	0.3730	0.0283
1999	0.1054	0.1620	0.2675	4.1670	0.3649	0.0262
2000	0.1024	0.0000	0.1024	4.0765	0.3566	0.0241
2001	0.0950	0.1247	0.2196	3.8045	0.3459	0.0219
2002	0.0918	0.1067	0.1985	3.6882	0.3610	0.0215
2003	0.0833	0.0857	0.1689	3.3687	0.3359	0.0195
2004	0.0507	0.0636	0.1143	2.1074	0.1792	0.0180
2005	0.0326	0.0347	0.0673	1.3787	0.1102	0.0156
2006	0.0229	0.0258	0.0486	0.9643	0.0693	0.0137
2007	0.0186	0.0206	0.0393	0.7419	0.0518	0.0116
2008	0.0148	0.0167	0.0314	0.5800	0.0457	0.0095
2009	0.0124	0.0137	0.0262	0.4875	0.0354	0.0073
2010	0.0107	0.0113	0.0220	0.4313	0.0317	0.0051
2011	0.0088	0.0090	0.0179	0.3855	0.0281	0.0028
Source: EMFAC2007, V2.3, Nov 1, 2006						

Table D-15		
Retired Diesel-Powered Vehicle Emission Reductions		
Model Year Range	**Pollutant**	**lb/3 yr CY 2008-2011**
Pre 1984	ROG	6.535
	NOx	63.980
	PM	7.745
1984-1992	ROG	2.328
	NOx	50.481
	PM	6.078

Source: Emfac2007 V2.3 Nov 1 2006

APPENDIX E

EXAMPLE CALCULATIONS

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APPENDIX E

EXAMPLE CALCULATIONS

I. On-Road Heavy-Duty Vehicles

This section provides examples of calculations for determining the cost-effectiveness of surplus emission reductions for on-road projects.

Example 1 –Purchase of a New CNG Bus
A transit agency proposes to purchase a new 2008 CNG bus certified to 0.9 g/bhp-hr NOx + NMHC and 0.01 g/bhp-hr PM10 instead of a new bus certified to the current standard of 1.2 g/bhp-hr NOx and 0.01 g/bhp-hr PM10. This new CNG bus is surplus to the ARB Fleet Rule for Transit Agencies. The new bus will operate 100 percent of the time in California.

Baseline Technology Information:
- Baseline technology (application): 2008 urban bus
- Emission standard (Table B-6): 1.2 g/bhp-hr NOx and 0.010 g/bhp-hr PM10
- Activity (application): 60,000 mi/yr
- Percent operated in California (application): 100 percent

Reduced Technology Information:
- Reduced technology (application): 2008 CNG urban bus
- Certified to optional emission standard:
  0.9 g/bhp-hr NOx + NMHC and 0.01 g/bhp-hr PM10
- Converted emission standard for alternative fuel (Table B-2):
  0.72 g/bhp-hr NOx and 0.010 g/bhp-hr PM10
- Conversion factor to convert the standard in g/bhp-hr to g/mi (Table B-8):
  4.0 bhp-hr/mi
- Cost (quote provided with application): $350,000
- New purchase projects are eligible for up to 25 percent of the cost of the new vehicle.

Emission Reduction Calculations:
Formula C-9: Estimated Annual Emissions Based on Mileage using Converted Emission Standards
1. Annual NOx baseline technology emissions
   (1.2 g/bhp-hr *4.0 bhp-hr/mi)(60,000 mi/yr)(ton/907,200 g) = 0.32 tons/yr NOx
2. Annual NOx reduced technology emissions
   (0.72 g/bhp-hr * 4.0 bhp-hr/mi)(60,000 mi/yr)(ton/907,200 g) = 0.19 tons/yr NOx

ROG converted emission standards are not available for the reduced technology, therefore, ROG emission reductions cannot be calculated.

PM 10 converted emission standards are the same for the baseline engine and the reduced technology, therefore there is no change in PM10 emissions.

Formula C-10: Annual Surplus Emission Reductions by Pollutant (tons/yr) for Repowers and New Purchases

- NOx emission benefits = 0.32 tons/yr – 0.19 tons/yr = 0.13 tons/yr NOx

Formula C-2: Annual Weighted Surplus Emission Reductions
0.13 = 0.13 weighted tons/yr

Annualized Cost:
Project Life: 12 years
CRF (Table B-1) = 0.107

Transit agencies receive an 80 percent grant from the Federal Transportation Agency for most new vehicle purchases. This grant must be subtracted before calculating the incremental cost.

Transit agency's cost for reduced technology: $350,000 * 0.20 = $70,000

Formula C-14: Incremental Cost
$70,000 * 25 percent = $17,500

Formula C-12: Annualized Cost
0.107 * $17,500 = $1873/yr

Cost-Effectiveness:
Formula C-1: Cost-Effectiveness of Weighted Surplus Emission Reductions ($/ton)
($1873/yr)/(0.13 weighted tons/yr) =
$14,408/ton of weighted surplus emissions reduced

The cost-effectiveness for the example is less than $16,000 per ton of pollutants reduced. This project qualifies for up to $17,500 in grant funds requested.

Example 2 – Diesel to Diesel Heavy-Duty Truck Repower
A line haul trucking company proposes to repower a 1994 heavy heavy-duty diesel truck with a model year 2008 certified diesel engine. This vehicle operates 90 percent of the time in California. The applicant is proposing to use fuel use instead of mileage to determine cost-effectiveness.

Baseline Technology Information:
- Baseline technology (application): 1994 diesel heavy heavy-duty engine
- Emission factors (Table B-5):
  17.95 g/mi NOx, 0.40 g/mi ROG, 0.367 g/mi PM10
- Energy consumption factor (Table B-25): 18.5 g/bhp-hr

- Activity (application): 14,330 gal/yr, 60,000 mi/yr
- Percent operated in California (application): 90 percent
- Unit conversion factor: 2.9 bhp-hr/mi (Table B-8)

Reduced Technology Information:

- Reduced technology (application): 2007 diesel heavy heavy-duty engine
- Repower projects are eligible for up to 80 percent of the repower cost.
- Repower cost (quote provided with application): $70,000
- Emission factors (Table B-5):
  6.36 g/mi NOx, 0.23 g/mi ROG, 0.028 g/mi PM10
- Unit conversion factor: 2.9 bhp-hr/mi (Table B-8)

Emission Reduction Calculations:

Formula C-7: Estimated Annual Emissions based on Fuel Usage using Emission Factors

Fuel Based Calculation

1. Annual NOx baseline technology emissions
   [17.95 (g/mi) / 2.9 (bhp-hr/mi)] * (18.5 bhp-hr/gal) * (14,330 gal/yr) * (0.90) * (ton/907,200 g) = 1.63 tons/yr NOx
2. Annual NOx reduced technology emissions
   [6.36 (g/mi) / 2.9 (bhp-hr/mi)] * (18.5 bhp-hr/gal) * (14,330 gal/yr) * (0.90) * (ton/907,200 g) = 0.58 tons/yr NOx
3. Annual ROG baseline technology emissions
   [0.40 (g/mi) / 2.9 (bhp-hr/mi)] * (18.5 bhp-hr/gal) * (14,330 gal/yr) * (0.90) * (ton/907,200 g) = 0.04 tons/yr ROG
4. Annual ROG reduced technology emissions
   [0.23 (g/mi) / 2.9 (bhp-hr/mi)] * (18.5 bhp-hr/gal) * (14,330 gal/yr) * (0.90) * (ton/907,200 g) = 0.02 tons/yr ROG
5. Annual PM10 baseline technology emissions
   [0.367 (g/mi) / 2.9 (bhp-hr/mi)] * (18.5 bhp-hr/gal) * (14,330 gal/yr) * (0.90) * (ton/907,200 g) = 0.03 tons/yr PM10
6. Annual PM10 reduced technology emissions
   [0.028 (g/mi) / 2.9 (bhp-hr/mi)] * (18.5 bhp-hr/gal) * (14,330 gal/yr) * (0.90) * (ton/907,200 g) = 0.003 tons/yr PM10

Mileage based calculation

Formula C-8: Estimated Annual Emissions Based on Mileage using Emission Factors

1. Annual NOx baseline technology emissions
   (17.95 g/mi * 0.90 * 60,000 mi/yr)(ton/907,200 g) = 1.07 tons/yr NOx
2. Annual NOx reduced technology emissions
   (6.36 g/mi * 0.90 * 60,000 mi/yr)(ton/907,200 g) = 0.38 tons/yr NOx
3. Annual ROG baseline technology emissions
   (0.40 g/mi * 0.90 * 60,000 mi/yr)(ton/907,200 g) = 0.02 tons/yr ROG
4. Annual ROG reduced technology emissions
   (0.23 g/mi * 0.90 * 60,000 mi/yr)(ton/907,200 g) = 0.01 tons/yr ROG

5. Annual PM10 baseline technology emissions
   (0.367 g/mi * 0.90 * 60,000 mi/yr)(ton/907,200 g) = 0.022 tons/yr PM10
6. Annual PM10 reduced technology emissions
   (0.028 g/mi * 0.90 * 60,000 mi/yr)(ton/907,200 g) = 0.002 tons/yr PM10

Formula C-10: Annual Surplus Emission Reductions by Pollutant (tons/yr) for Repowers and New Purchases

From fuel based calculation above

- NOx emission benefits = 1.63 tons/yr – 0.58 tons/yr = 1.05 tons/yr NOx
- ROG emission benefits = 0.04 tons/yr – 0.02 tons/yr = 0.02 tons/yr ROG
- PM10 emission benefits= 0.03 tons/yr – 0.003 tons/yr = 0.027 tons/yr PM10

From mileage based calculation above

- NOx emission benefits = 1.07 tons/yr – 0.38 tons/yr = 0.69 tons/yr NOx
- ROG emission benefits = 0.02 tons/yr – 0.01 tons/yr = 0.01 tons/yr ROG
- PM10 emission benefits= 0.022 tons/yr – 0.002 tons/yr = 0.02 tons/yr PM10

Fuel Based Calculation	*Mileage Based Calculation*
Total NOx Emission Benefits	*Total NOx Emission Benefits*
1.05 tons/yr NOx	0.69 tons/yr NOx
Total ROG Emission Benefits	*Total ROG Emission Benefits*
0.02 tons/yr ROG	0.01 tons/yr ROG
Total PM10 Emission Benefits	*Total PM10 Emission Benefits*
0.027 tons/yr PM10	0.020 tons/yr PM10

Formula C-2: Annual Weighted Surplus Emission Reductions

Fuel Based Calculation

1.05 + 0.02 + 20(0.027) = 1.61 weighted tons/yr

Mileage based calculation

0.69 + 0.01 + 20(0.02) = 1.1 weighted tons/yr

Annualized Cost:

Project Life: 7 years

CRF (Table B-1) = 0.167

Formula C-14: Incremental Cost

$70,000 *80 percent = $56,000

Formula C-12: Annualized Cost

$56,000 * 0.167 = $9,352/yr

Cost-Effectiveness:
Formula C-1: Cost-Effectiveness of Weighted Surplus Emission Reductions ($/ton)

Fuel Based Calculation
($9,352/yr)/(1.61 weighted tons/yr) =
$5,809/ton of weighted surplus emissions reduced

Mileage based calculation
($9,352/yr)/(1.1 weighted tons/yr) =
$8,502/ton of weighted surplus emissions reduced

[($5,809-8502)/$8,502] * 100 = 32% more cost-effective.

In this example, fuel usage proved to be greater then 30% more cost-effective. The cost-effectiveness for the example for both fuel- and mileage-based calculations is less than $16,000 per ton of weighted pollutants reduced. This project qualifies for up to $56,000 of grant funds requested and can use a fuel based calculation for cost-effectiveness.

Example 3 – Diesel Heavy-Duty Truck Retrofit
A trucking company proposes to retrofit a 2005 heavy heavy-duty diesel truck with a Level 3 retrofit that is verified for both PM and NOx reductions. This vehicle operates 80 percent of the time in California.

Baseline Technology Information:
- Baseline technology (application): 2005 heavy heavy-duty diesel truck
- Baseline diesel vehicle emission rates (Table B-5):
  11.63 g/mi NOx; 0.252 g/mi of PM10
- Activity (application): 100,000 mi/yr
- Percent operated in California (application): 80 percent

Reduced Technology Information:
- Retrofit verification emission levels (executive order):
  25 percent reduction of NOx and 85 percent reduction of PM10. ROG is not counted since the retrofit device is not verified for ROG.
- Retrofit cost (quote provided with application):
  $18,000 + $600 annual filter maintenance (5 years)
- Retrofits are eligible for 100 percent of the cost unless being installed to meet regulatory requirements
- For retrofit projects that only take credit for NOx reductions from a Level 3 DECS (because the PM reductions are required by regulation) the cost is one-half the project cost.

Emission Reduction Calculations:
Formula C-8: Estimated Annual Emissions Based on Mileage using Emission Factors
1. Annual NOx baseline technology emissions

(11.63 g/mi * 0.80 * 100,000 mi/yr)(ton/907,200 g) = 1.03 tons/yr NOx

2. Annual PM10 baseline technology emissions
   (0.252 g/mi * 0.80 * 100,000 mi/yr)(ton/907,200 g) = 0.022 tons/yr PM10

Formula C-11: Annual Surplus Emission Reductions by Pollutant (tons/yr) for Retrofits

1.03 * 0.25	= 0.26 tons/yr NOx
0.022 * 0.85	= 0.019 tons/yr PM10

Formula C-2: Annual Weighted Surplus Emission Reductions

0.26 + 20(0.019)	=0.64 weighted tons/yr

Annualized Cost:

Project Life: 5 years

CRF (Table B-1): = 0.225

Formula C-14: Incremental Cost

[$18,000 + ($600*5)] * 100 percent = $21,000

Formula C-12: Annualized Cost

0.225 * 21,000 = $4,725/yr

Cost-Effectiveness:

Formula C-1: Cost-Effectiveness of Weighted Surplus Emission Reductions ($/ton)

($4,725/yr)/(0.64 weighted tons/yr) =

$7,383/ton of weighted surplus emissions reduced

The cost-effectiveness for the example is less than $16,000 per ton of pollutants reduced. This project qualifies for up to $21,000 of grant funds requested.

Example 4 - APU Retrofit

An operator of a 2006 line haul truck proposed to install Level 3 diesel particulate filter on a 2006 MY 24 horsepower Tier 2 APU. The cost of the retrofit is $5,000 and is verified for 85 percent reduction of PM10. The APU operates 1500 hours per year, 100 percent of the time in California. This project is eligible for a 5 year project life.

Baseline Technology Information:

- Engine (application): 2006 MY Tier 2
- HP (application): 24
- Annual hours of operation (application): 1500
- Load factor (Table B-9): 0.74
- Emission factors (Table B-10): 0.306 g/bhp-hr PM10

Reduced Technology Information:

- Level 3 verified reductions (executive order): 85 percent PM10
- Cost of retrofit (quote provided with application): $5,000

- Retrofits are eligible for up to 100 percent of the total retrofit costs
- Percent operating in California (application): 100 percent

Emission Reduction Calculations:
Formula C-4: Estimated Annual Emissions based on Hours of Operation (tons/yr)
- Annual PM10 baseline technology emissions
  0.306 g/bhp-hr *24 hp*0.74*1500 hr*(ton/907,200 g) = 0.009 tons/yr PM10

Formula C-11: Annual Surplus Emission Reductions by Pollutant (tons/yr) for retrofits
- 0.009 tons/yr * 0.85 = 0.008 tons/yr PM10

Formula C-2: Annual Weighted Surplus Emission Reductions
20(0.008 tons/yr) = 0.15 weighted tons/yr PM10

Annualized Cost:
Project Life: 5 years
CRF (Table B-1): = 0.225

Formula C-14: Incremental Cost
$5,000 * 100 percent = $5,000

Formula C-12: Annualized Cost
0.225 * $5,000 = $1,125

Cost-Effectiveness:
Formula C-1: Cost-Effectiveness of Weighted Surplus Emission Reductions ($/ton)
($1,125/yr)/(0.15 weighted tons/yr)
= $7,362/tons of weighted surplus emissions reduced

The Cost Effectiveness for this Example is less than $16,000 per ton of pollutants reduced. This project qualifies for up to $5,000 in grant funds requested.

Example 5 - Truck Stop Electrification (TSE) On-board System
An operator plans to idle a heavy-duty diesel truck, that has a standard heating and cooling system, 1500 hours a year at truck stops in California equipped with TSE infrastructure. To meet the regulatory requirements of the ATCM for heavy duty trucks idling in California the operator would be required to install a new 2008 MY Tier 4 Diesel Auxiliary Power Unit (DAPU) on the Truck. The DAPU would also have to be retrofitted with a level 3 Verified Diesel Emission Control System (VDECS). The cost of the APU and VDECS, including installation of the DAPU and VDECS would be $6,500.

The operator proposes to instead install a TSE system on the truck, consisting of an electrical plug, inverter/charger, battery pack and electrical HVAC. There would be no NOx, ROG and PM10 emissions under this zero emission technology option and the

difference in emission from the DAPU with a level 3 VDEC would qualify as reduced surplus emissions for Carl Moyer Program funding purposes. The cost of the TSE system, including installation, would be $8,500.

Baseline Technology Information

- Engine (application): 2008 DAPU engine, retrofitted with verified level 3 (85% PM10 reduction) VDECS
- HP: 24
- Load factor (Application): 0.69
- Hours of operation in California (Application): 1,500 hrs/yr
- Emission factors (Table B-10): 4.33g/bhp-hr NOx, 0.69g/bhp-hr ROG, 0.152 g/bhp-hr PM
- DAPU, retrofitted with verifiable 85% VDECS, PM10 emission factor: 0.152 g/bhp-hr * 15% = 0.023 g/bhp-hr
- Cost (quote provide with application): $6,500
- Project Life (Application): 3 years

Reduced Technology Information

- TSE System (Application)
- Annual hours of operation in California (Application): 1500 hrs/yr
- Emission factors: 0 g/bhp-hr NOx, 0 g/bhp-hr ROG, 0 g.bhp-hr PM
- Cost (quote provided with application): $8,500

Emission Reduction Calculations

Formula C-4: Estimated Annual Emissions Based on Hours of Operation (tons/yr)

1. Annual NOx Baseline Technology Emissions
   4.33g/hp-hr*24hp*0.69*1500hr*(ton/907200g) = 0.12 ton/yr
2. Annual NOx Reduced Technology Emissions = 0.00 ton/yr
3. Annual ROG Baseline Technology Emissions
   0.69g/hp-hr*24hp*0.69*1500hr*(ton/907200g) = 0.02 ton/yr
4. Annual ROG Reduced Technology Emissions = 0.00 ton/yr
5. Annual PM10 Baseline Technology Emissions
   0.023g/hp-hr*24hp*0.69*1500hr*(ton/907200g) = 0.001 ton/yr
6. Annual PM10 Reduced Technology Emissions = 0.000 ton/yr

Formula C-10: Annual Surplus Emissions Reduction by Pollutant (tons/yr).

1. Emission benefits NOx: 0.12 ton/yr – 0.00 ton/yr = 0.12 ton/yr
2. Emission benefits ROG: 0.02 ton/yr – 0.00 ton/yr = 0.02 ton/yr
3. Emission benefits PM10: 0.001 ton/yr – 0.00 ton/yr = 0.001 ton/yr

Formula C-2: Annual Weighted Average Surplus Emission Reductions

0.12 ton/yr + 0.02 ton/yr + 20*0.001 ton/yr = 0.16 ton/yr

Annualized Cost:

Project Life (Application): 3 years
CRF (Table B-1): 0.360

In this case the incremental cost is the difference between the cost of the TSE system and DAPU with retrofit.

Incremental Cost: $8,500 -$6.500 = $2,000

Formula C-12: Annualized Cost
0.360 * $2,000 = $720

Formula C-1: Cost-Effectiveness of Annual Weighted Surplus Emission Reductions ($/ton)
($720/yr)/(0.16 weighted tons/yr) = $4,500/ton of weighted surplus emissions

The Cost Effectiveness for this Example is less than $16,000 per ton of pollutants reduced. This project qualifies for up to $2,000 in grant funds requested.

Example 6 - Transport Refrigeration Unit (TRU) Retrofit
A TRU owner plans to retrofit a 24 horsepower model year 2002 diesel TRU Tier 1 engine with a Verified Level 3 Diesel Particulate Filter (DPF) system. The cost for the DPF system is $2,800, including installation. The TRU is operated 2,000 hours per year, 100 percent of the time in California. The retrofit would be installed and in operation prior by December 31, 2009, therefore the project is eligible for up to a five-year project life. However, the applicant is willing to commit to a three-year project life.

Baseline Technology Information

- Engine (application): MY 2002 TRU engine with a level 2 retrofit (50% PM10 reduction)
- HP (application): 24
- Load factor (Table B-9): 0.64
- Hours of operation in California (application): 2,000 hr/yr
- PM 10 emission factor (Table B-10): 0.306 g/bhp-hr

Reduced Technology Information

- Retrofit (executive order): Level 3 DPF (verified to an 85% reduction in PM10)
- Cost of retrofit (quote provided with application): $2800
- Retrofit is eligible for up to 100 percent of the cost

- Percent operating in California (application): 100 percent

Emissions Reduction Calculation

Formula C-4: Estimated Annual PM10 Emissions Based on Hours of Operation (tons/yr)

Annual PM baseline technology emissions

0.306 g/hp-hr*24hp*0.64*2000 hr/yr*(ton/907200 g) = 0.010 tons/yr

Airborne Toxic Control Measure (ATCM) Early Compliance Credit

Model year 2002 engines must comply with the TRU ATCM's Low Emission TRU In-Use Performance Standard (50 % PM 10 reduction) by December 31, 2009. Model year 2002 TRU engines must also comply with the TRU ATCM's Ultra Low Emission TRU standard (85% PM10 reduction) by the end of 2016. Therefore, the surplus PM10 emissions reduced for each year of the project life (2010-2012) would be 35 percent (85 percent – 50 percent). Because the TRU was not already retrofitted with a level 2 DPF, the project is eligible for up to 50% of the cost of the level 3 DPF.

Formula C-11 Annual Surplus Emission Reductions by Pollutant (tons/yr) for Retrofits (PM only)

(85%-50%)*0.010 tons/yr = 0.004 tons/yr

Formula C-2 Annual Weighted Surplus Emissions Reductions (PM only)

20(0.004tons/yr) = 0.07 tons/yr

Annualized Cost

Project Life: 3 years

CRF: 0.360

Formula C-14: Incremental Cost

$2,800 * 50 percent = $1,400

Formula C-12: Annualized Cost

0.360 * $1,400 =$504

Cost Effectiveness Calculations

Formula C-1: Cost Effectiveness

($504/yr)/(0.07 tons/yr) = $7,200/ton of weighted surplus emissions reduced

The Cost-Effectiveness is less than $16,000 per ton of pollutants reduced. This project qualifies for up to $1,400 in grant funds requested.

II. On-Road Heavy-Duty Fleet Modernization

This section provides examples of calculations for determining the cost-effectiveness of surplus emission reductions for fleet modernization projects.

Example 1 – Used Replacement of a Heavy-Heavy Duty Truck from a Targeted Vocation

A participant wants to scrap an old, heavy heavy-duty truck used to haul lumber from northern California and replace it with a newer, used truck. The participant has provided conclusive documentation that for the last three years the old truck operated 100 percent of the time in and around the Northern California area. The OEM of the replacement truck will already be equipped with a Level 3 diesel emission control system (DECS) and the truck engine has been certified to a NOx FEL level of 1.2 g/bhp-hr. An electronic monitoring unit (EMU) will be installed. The replacement truck is also required to continue operating in the same vocation and location for the life of the project.

Baseline Technology Information

- Baseline technology (application): 1983 heavy heavy-duty diesel truck
- Emission rates (Table B-5): 21.39 g/mi NOx, 1.04 g/mi ROG, 1.249 g/mi PM10
- Activity (application): 42,000 miles/year
- Percent operated in California (application): 100 percent
- Vocation (application): Lumber

Reduced Technology Information

- Reduced technology (application): 2007 MY used, heavy heavy-duty diesel truck
- Emission rates (Table B-5): 6.36 g/mi NOx, 0.23 g/mi ROG, 0.028 g/mi PM10
- Cost (N.A.D.A. used retail value provided with application): $80,000
- Maximum eligible amount for a used replacement truck: 50% of N.A.D.A. value
- EMU cost: $1,150 (Includes installation and monitoring for five years)

Emission Reduction Calculations:

Formula C-8: Estimated Annual Emissions Based on Mileage Using Emission Factors

1. Annual NOx baseline technology emissions
   (21.39 g/mi * 42,000 mi)(ton/ 907,200 g) = 0.990 tons/yr NOx
2. Annual NOx reduced technology emissions
   (6.36 g/mi * 42,000 mi)(ton/ 907,200 g) = 0.294 tons/yr NOx
3. Annual ROG baseline technology emissions
   (1.04 g/mi * 42,000 mi) (ton/ 907,200 g) = 0.048 tons/yr ROG
4. Annual ROG reduced technology emissions

(0.23 g/mi * 42,000 mi)(ton/ 907,200 g) = 0.011 tons/yr ROG

5. Annual PM10 baseline technology emissions
   (1.249 g/mi * 42,000 mi)(ton/ 907,200 g) = 0.058 tons/yr PM10
6. Annual PM10 reduced technology emissions
   (0.028 g/mi * 42,000 mi)(ton/ 907,200 g) = 0.001 tons/yr PM10

Formula C-10: Annual Surplus Emission Reductions by Pollutant (tons/yr) for Repowers and New Purchases:

- NOx Emission Benefits = 0.990 tons/yr - 0.294 tons/yr = 0.696 tons/yr NOx
- ROG Emission Benefits = 0.048 tons/yr - 0.011 tons/yr = 0.038 tons/yr ROG
- PM10 Emission Benefits = 0.058 tons/yr - 0.001 tons/yr = 0.057 tons/yr PM10

Formula C-2: Annual Weighted Surplus Emission Reductions

0.696 tons/yr + 0.038 tons/yr + 20(0.057 tons/yr) = 1.864 weighted tons/yr

Annualized Cost

Project Life = 5 Years

CRF (Table B-1) = 0.225

Formula C-15: Incremental Cost

Maximum Percent Funding for Used Replacement Vehicle:

0.50 * $80,000 = $40,000

Replacement Truck + EMU:

$40,000 + $1,150 = $41,150

Formula C-12: Annualized Cost

$41,150 * 0.225 = $9,259/yr

Cost-Effectiveness

Formula C-1: Cost-Effectiveness of Weighted Surplus Emission Reductions

= ($9,259/yr) / (1.864 weighted tons/yr)

= $4,959 weighted tons/yr

In this example, the cost-effectiveness is less than threshold of $16,000 per weighted ton of pollutants reduced. This project qualifies for up to $41,150 in grant funds requested (50% of the N.A.D.A. value + EMU cost).

Example 2 – New Replacement of a Heavy-Heavy Duty Truck from a Targeted Vocation

A participant wants to scrap an old, heavy heavy-duty truck used to haul lumber from northern California and replace it with a new truck. The participant has provided conclusive documentation that for the last three years the old truck operated 100 percent of the time in and around the Northern California area. The OEM of the replacement truck will already be equipped with a Level 3 diesel emission control system (DECS) and the truck engine has been certified to a NOx FEL level of 1.2 g/bhp-

hr. An electronic monitoring unit (EMU) will be installed. The replacement truck is also required to continue operating in the same vocation and location for the life of the project.

Baseline Technology Information

- Baseline technology (application): 1983 heavy heavy-duty diesel truck
- Emission rates (Table B-5): 21.39 g/mi NOx, 1.04 g/mi ROG, 1.249 g/mi PM10
- Activity (application): 42,000 miles/year
- Percent operated in California (application): 100 percent
- Vocation (application): Lumber

Reduced Technology Information

- Reduced technology (application): 2008 new heavy heavy-duty diesel truck
- Emission rates (Table B-5): 6.36 g/mi NOx, 0.23 g/mi ROG, 0.028 g/mi PM10
- Cost (quote provided with application): $120,000
- Maximum eligible amount for a new replacement truck: 50% of invoiced price
- EMU cost: $1,150 (Includes installation and monitoring for five years)

Emission Reduction Calculations:
Formula C-8: Estimated Annual Emissions Based on Mileage Using Emission Factors

1. Annual NOx baseline technology emissions
   (21.39 g/mi * 42,000 mi)(ton/ 907,200 g) = 0.990 tons/yr NOx
2. Annual NOx reduced technology emissions
   (6.36 g/mi * 42,000 mi)(ton/ 907,200 g) = 0.294 tons/yr NOx
3. Annual ROG baseline technology emissions
   (1.04 g/mi * 42,000 mi) (ton/ 907,200 g) = 0.048 tons/yr ROG
4. Annual ROG reduced technology emissions
   (0.23 g/mi * 42,000 mi)(ton/ 907,200 g) = 0.011 tons/yr ROG
5. Annual PM10 baseline technology emissions
   (1.249 g/mi * 42,000 mi)(ton/ 907,200 g) = 0.058 tons/yr PM10
6. Annual PM10 reduced technology emissions
   (0.028 g/mi * 42,000 mi)(ton/ 907,200 g) = 0.001 tons/yr PM10

Formula C-10: Annual Surplus Emission Reductions by Pollutant (tons/yr) for Repowers and New Purchases:

- NOx Emission Benefits = 0.990 tons/yr - 0.294 tons/yr = 0.696 tons/yr NOx
- ROG Emission Benefits = 0.048 tons/yr - 0.011 tons/yr = 0.038 tons/yr ROG
- PM10 Emission Benefits = 0.058 tons/yr - 0.001 tons/yr = 0.057 tons/yr PM10

Formula C-2: Annual Weighted Surplus Emission Reductions

0.696 tons/yr + 0.038 tons/yr + 20(0.057 tons/yr) = 1.864 weighted tons/yr

Annualized Cost

Project Life = 5 Years

CRF (Table B-1) = 0.225

Formula C-15: Incremental Cost

Maximum Percent Funding for New Replacement Vehicle:

0.50 * $120,000 = $60,000

New Replacement Truck + EMU:

$60,000 + $1,150 = $61,150

Formula C-12: Annualized Cost

$61,150 * 0.225 = $13,759/yr

Cost-Effectiveness

Formula C-1: Cost-Effectiveness of Weighted Surplus Emission Reductions

= ($13,759/yr) / (1.864 weighted tons/yr)

= $7,370 weighted tons/yr

In this example, the cost-effectiveness is less than threshold of $16,000 per weighted ton of pollutants reduced. This project qualifies for up to $61,150 in grant funds requested (50% of the invoice price + EMU cost).

III. Off-Road Compression-Ignition Engines

This section provides examples of calculations for determining the cost-effectiveness of surplus emission reductions for off-road compression-ignition projects.

Example 1 – Repower with a Tier 3 Engine and Retrofit with a Level 3 DECS
A construction company meeting the definition of a medium fleet in the Off-Road Regulation wants to repower a scraper with a Tier 3 engine. The baseline technology is a model year 1987 300 hp uncontrolled engine that operates for 1,500 hours per year. The applicant is proposing to install a 300 hp Tier 3 engine that costs $80,000. This equipment operates 100 percent of the time in California. A Level 3 diesel particulate filter has been verified for use on the engine and has a cost of $25,000. This project will be installed and in operation prior to March 1, 2009 and thus is surplus to the Off-Road Regulation and can be given a project life of 4 years.

Baseline Technology Information:
- Engine (application): 1987 Model Year
- HP (application): 300
- Annual Hours of operation (application): 1,500
- Load factor (Table B-11): 0.72
- Emission factors (Table B-12): 10.23 g/bhp-hr NOx; 1.06 g/bhp-hr ROG; 0.396 g/bhp-hr PM10

Reduced Technology Information:
- Engine: Tier 3 (ARB executive order)
- HP (application): 300
- Hours of operation (application): 1,500
- Cost of new engine (quote provided with application): $80,000
- Tier 3 repowers are eligible for up to 85% of the cost of the repower
- Load factor (Table B-11): 0.72
- Emission factors (Table B-13): 2.32 g/bhp-hr NOx; 0.12 g/bhp-hr ROG; 0.112 g/bhp-hr PM10
- Percent operating in California (application): 100 percent
- Retrofit: Level 3 verified reductions: 85 percent PM10
- Cost of retrofit (quote provided with application): $25,000
- Retrofits are eligible for up to 100% of total retrofit costs

Emission Reduction Calculations:
Formula C-4: Estimated Annual Emissions based on Hours of Operation (tons/yr)
1. Annual NOx baseline technology emissions
   10.23 g/bhp-hr *300 hp*0.72*1500 hr*(ton/907,200 g) = 3.65 tons/yr NOx
2. Annual NOx reduced technology emissions
   2.32 g/bhp-hr *300 hp*0.72*1500 hr*(ton/907,200 g) = 0.83 tons/yr NOx
3. Annual ROG baseline technology emissions
   1.06 g/bhp-hr *300 hp* 0.72*1500 hr*(ton/907,200 g) = 0.38 tons/yr ROG
4. Annual ROG reduced technology emissions

0.12 g/bhp-hr *300 hp*0.72*1500 hr*(ton/907,200 g) = 0.04 tons/yr ROG

5. Annual PM10 baseline technology emissions
   0.396 g/bhp-hr *300 hp*0.72*1500 hr*(ton/907,200 g) = 0.141 tons/yr PM10
6. Annual PM10 reduced technology emissions
   0.112 g/bhp-hr *300 hp*0.72*1500 hr*(ton/907,200 g) = 0.040 tons/yr PM10

Formula C-10: Annual Surplus Emission Reductions by Pollutant (tons/yr) for Repowers and New Purchases

- Emission benefits NOx = 3.65 tons/yr - 0.83 tons/yr = 2.82 tons/yr NOx
- Emission benefits ROG = 0.38 tons/yr - 0.04 tons/yr = 0.34 tons/yr ROG
- Emission benefits PM10 = 0.141 tons/yr - 0.040 tons/yr = 0.101 tons/yr PM10

Formula C-11: Annual Surplus Emission Reductions by Pollutant (tons/yr) for Retrofits

0.040 tons/yr PM10 * 0.85 = 0.034 tons/yr PM10

Total PM10 Emission Benefits

0.101 tons/yr + 0.034 tons/yr = 0.135 tons/yr PM10

Formula C-2: Annual Weighted Surplus Emission Reductions

2.82 tons/yr + 0.34 tons/yr + 20(0.135 tons/yr) = 5.86 weighted tons/yr

Annualized Cost:

Project Life: 4 years

CRF (Table B-1): = 0.275

Formula C-14: Incremental Cost

($80,000 * 85 percent) + ($25,000 * 100 percent) = $93,000

Formula C-12: Annualized Cost

0.275 * $93,000 = $25,575

Cost-Effectiveness:

Formula C-1: Cost-Effectiveness of Weighted Surplus Emission Reductions ($/ton)

($25,575/yr)/(5.86 weighted tons/yr)

= $4,364/tons of weighted surplus emissions reduced

The cost-effectiveness for the example is less than $16,000 per ton of pollutants reduced. This project qualifies for up to $93,000 in grant funds requested.

Example 2 – Retrofit of a Tier 1 Engine with a Level 3 DECS

A local municipality proposed to install Level 3 diesel particulate filter on a rubber tired loader with a Tier 1 160 hp engine. The cost of the retrofit is $20,000 and is verified for 85 percent reductions of PM10. The loader operates 500 hours per year, 100 percent of the time in California. The local municipality meets the definition of a small fleet

under the Off-Road Regulation. This project will be installed and in operation prior to March 1, 2009 and thus is eligible for a 5 year project life.

Baseline Technology Information:

- Engine (application): Tier 1
- HP (application): 160
- Annual hours of operation (application): 500
- Load factor (Table B-11): 0.54
- Emission factors (Table B-13): 0.274 g/bhp-hr PM10

Reduced Technology Information:

- Level 3 verified reductions: 85 percent PM10
- Cost of retrofit (quote provided with application): $20,000
- Percent operating in California (application): 100 percent

Emission Reduction Calculations:

Formula C-4: Estimated Annual Emissions based on Hours of Operation (tons/yr)

- Annual PM10 baseline technology emissions
  0.274 g/bhp-hr *160 hp*0.54*500 hr*(ton/907,200 g) = 0.013 tons/yr PM10

Formula C-11: Annual Surplus Emission Reductions by Pollutant (tons/yr) for retrofits

- 0.013 tons/yr * 0.85 = 0.011 tons/yr PM10

Formula C-2: Annual Weighted Surplus Emission Reductions

20(0.011 tons/yr) = 0.22 weighted tons/yr PM10

Annualized Cost:

Project Life: 5 years

CRF (Table B-1): = 0.225

Formula C-14: Incremental Cost

$20,000 * 100 percent = $20,000

Formula C-12: Annualized Cost

0.225 * $20,000 = $4,500

Cost-Effectiveness:

Formula C-1: Cost-Effectiveness of Weighted Surplus Emission Reductions ($/ton)

($4,500/yr)/(0.22 weighted tons/yr)

= $20,454/tons of weighted surplus emissions reduced

The cost-effectiveness for this example is greater than the $16,000 per ton weighted cost-effectiveness requirement. In order to meet the $16,000 per ton weighted cost-effectiveness requirement, this project would only qualify for a fraction of the incremental cost – $15,644. This amount is determined by multiplying the maximum allowed cost-effectiveness by the estimated annual emission reductions and dividing by the capital recovery factor:

($16,000 * 0.22)/0.225 = $15,644

IV. Large Spark-Ignition Off-Road Equipment

This section provides examples of calculations for determining the cost-effectiveness of surplus emission reductions for large spark-ignition engine projects.

Example 1 – New Electric Purchase
A lumber company applied for a Carl Moyer grant to purchase a new counter balanced sit down rider electric forklift (Class I, lift code 6) costing $30,000 (including one battery pack). The owner has decided to purchase new electric forklift instead of purchasing a 55 horsepower 2008 model year propane fueled forklift certified to the 2.0 g/bhp-hr NOx + HC. The company is a small fleet and thus exempt for the off-road LSI in-use fleet regulations. The equipment will operate 1900 hours annually and 100 percent of the time in California. This equipment is eligible for a project life of 10 years.

Baseline Technology Information:
- Engine (application): 2008 model year
- HP (application): 55
- Load factor (Table B14): 0.3
- Activity (from application): 1900 hours/year
- Emission factors (Table B-15): 1.05 g/bhp-hr NOx; 0.07 g/bhp-hr ROG; 0.06 g/bhp-hr PM10

Reduced Technology Information:
- Technology (application): Electric forklift
- Forklift cost: $30,000
- Electric equipment is eligible for up to 30% of the total cost
- Percent operated in California (application): 100 percent
- Emission factors: Electric equipment are zero emission (0 g/bhp-hr NOx; 0 g/bhp-hr ROG; 0 g/bhp-hr PM10)

Emission Reduction Calculations:
Formula C-4: Estimated Annual Emissions based on Hours using Off-Road LSI Emission Factors
1. Annual NOx baseline technology emissions
   (1.05 g/bhp-hr * 55 HP * 0.30 * 1900 hr/yr)/907,200 g/ton = 0.04 ton/yr NOx
2. Annual NOx reduced technology emissions = 0 ton/yr
3. Annual ROG baseline technology emissions
   (0.07 g/bhp-hr * 55 HP * 0.3 * 1900 hr/yr)/907,200 g/ton = 0.00 ton/yr
4. Annual ROG reduced technology emissions = 0 ton/yr
5. Annual PM10 baseline technology emissions
   (0.06 g/bhp-hr * 55 HP * 0.3 * 1900 hr/yr)/907,200 g/ton = 0.002 ton/yr
6. Annual PM10 reduced technology emissions = 0 ton/yr

Formula C-10: Annual Surplus Emission Reductions by Pollutant (tons/yr) for new purchases and repowers

- NOx emission benefits = 0.04 tons/yr - 0 tons/yr = 0.04 tons/yr NOx
- ROG emission benefits = 0.00 tons/yr - 0 tons/yr = 0.00 tons/yr ROG
- PM10 emission benefits = 0.002 tons/yr - 0 tons/yr = 0.002 tons/yr PM10

Formula C-2: Annual Weighted Surplus Emission Reductions
0.04 tons/yr + 0.00 tons/yr + 20(0.002 tons/yr) = 0.08 weighted tons/yr

Annualized Cost:
Project Life: 10 years (from application)
CRF (Table B-1): = 0.123

Formula C-14: Incremental Cost
$30,000 * 0.30 = $9,000

Formula C-12: Annualized Cost
0.123 * $9,000 = $1,107yr

Cost-Effectiveness:
Formula C-1: Cost-Effectiveness of Weighted Surplus Emission Reductions ($/ton)
($1,107/yr / (0.08 weighted tons/yr) =
$13,837/ton of weighted surplus emissions

The cost-effectiveness for the example is less than $16,000 per ton of pollutants reduced. This project qualifies for up to $9000 in grants requested.

Example 2 – LSI Engine Retrofit

A forklift owner proposes to retrofit an existing forklift. The existing forklift is an uncontrolled 55 horsepower propane fueled Toyota MY 1998. A level 3a retrofit has been verified for use on this engine. The cost of the retrofit is $3,300. The company is a small fleet and thus exempt for the off-road LSI in-use fleet regulations. The applicant operates equipment 600 hours per year and will operate 100 percent of the time in California. This equipment is eligible for a project life of 3 years.

Baseline Technology Information:

- Engine (application): MY 1998
- HP (application): 55
- Load factor (Table B-14): 0.3
- Annual hours (application): 600 hours
- Emission factors (Table B-15): 10.51 g/bhp-hr NOx; 1.02 g/bhp-hr ROG; 0.06 g/bhp-hr PM10

Reduced Technology Information:

- Technology (application): Level 3a LSI retrofit verified to an absolute emission value of 1.0 g/bhp-hr

- HP (application): 55
- Load factor (Table B-15): 0.3
- Annual hours (application): 600 hours
- Cost of retrofit: ($3,300 – quote from applicant):
- Retrofit emission factors from (Table B16): 0.53 g/bhp-hr NOx; 0.03 g/bhp-hr ROG

Emission Reduction Calculations:

Formula number C-4: Estimated Annual Emissions based on Hours using Emission Factors

1. Annual NOx baseline technology emissions
   (10.51 g/bhp-hr * 55 HP * 0.3 * 600 hr/yr)/907,200 g/ton = 0.12 ton/yr NOx
2. Annual NOx reduced technology emissions
   (0.53 g/bhp-hr * 55 HP * 0.30 * 600 hr/yr)/907,200 g/ton = 0.01 ton/yr NOx
3. Annual ROG baseline technology emissions
   (1.02 g/bhp-hr * 55 HP * 0.3 * 600 hr/yr)/907,200 g/ton = 0.01 ton/yr ROG
4. Annual ROG reduced technology emissions
   (0.03 g/bhp-hr * 55 HP * 0.3 * 600 hr/yr)/907,200 g/ton = 0.000 ton/yr ROG
5. Annual PM10 baseline technology emissions
   (0.06 g/bhp-hr * 55 HP * 0.3 * 600 hr/yr)/907,200 g/ton = 0.001 ton/yr PM10
6. Annual PM10 reduced technology emissions
   (0.06 g/bhp-hr * 55 HP * 0.3 * 600 hr/yr)/907,200 g/ton = 0.001 ton/yr PM10

Formula C-10: Annual Surplus Emission Reductions by Pollutant (tons/yr)

- Emission benefits NOx = 0.12 tons/yr - 0.01 tons/yr = 0.11 tons/yr NOx
- Emission benefits ROG = 0.01 tons/yr - 0.000 tons/yr = 0.01 tons/yr ROG
- Emission benefits PM10 = 0.001 tons/yr - 0.001 tons/yr = 0.00 tons/yr PM10

Formula C-2: Annual Weighted Surplus Emission Reductions

0.11 tons/yr + 0.01 tons/yr + 20(0.00 tons/yr) = 0.12 weighted tons/yr

Annualized Cost:

Project Life: 3 years
CRF (Table B-1): = 0.360

Formula C-14: Maximum Eligible Funding

= $3,300

Formula C-12: Annualized Cost

0.360 * $3,300 = $1,188/yr

Cost-Effectiveness:

Formula C-1: Cost-Effectiveness of Weighted Surplus Emission Reductions ($/ton)

($1,188/yr) / (0.12 tons/yr) =
$9,900/ton of surplus emissions reduced

The cost-effectiveness for the example is less than $16,000 per ton of pollutants reduced. This project qualifies for up to $3,300 in grants requested.

V. Off-Road Equipment Replacement

This section provides examples of calculations for determining the cost-effectiveness of surplus emission reductions for off-road equipment replacement projects.

Example 1 – Replacement of a 1985 agricultural tractor
A farmer proposes to replace an uncontrolled 1985 175 hp agricultural tractor with a new 175 hp Tier 3 agricultural tractor. The new equipment will cost $100,000. This equipment operates 1000 hours per year, 100 percent of the time in California. A Level 3 diesel particulate filter has been verified for use on the engine and has a cost of $25,000. There is no available Tier 3 repower for this specific equipment, so the applicant is eligible for up to 80 percent of the new equipment cost. This equipment is eligible for a project life of 5 years.

Baseline Technology Information:
- Engine (application): 1985 Model Year
- HP (application): 175
- Hours of operation (application): 1000
- Load factor (Table B-11): 0.70
- Emission factors (Table B-12): 10.23 g/bhp-hr NOx; 1.06 g/bhp-hr ROG; 0.396 g/bhp-hr PM10

Reduced Technology Information:
- Engine: Tier 3 (ARB executive order)
- HP (application): 175
- Hours of operation (application): 1000
- Equipment replacement is eligible for up to 80 percent of the new equipment cost.
- Cost of new equipment (quote provided with application): $100,000
- Load factor (Table B-11): 0.70
- Emission factors (Table B-13): 2.32 g/bhp-hr NOx; 0.12 g/bhp-hr ROG; 0.112 g/bhp-hr PM10
- Percent operating in California (application): 100 percent
- Retrofit: Level 3 verified reductions- 85 percent PM10
- Retrofits are eligible for up to 100% of total cost.
- Cost of retrofit (quote provided with application): $25,000

Emission Reduction Calculations:
Formula C-4: Estimated Annual Emissions based on Hours of Operation (tons/yr)
7. Annual NOx baseline technology emissions
   10.23 g/bhp-hr *175 hp*0.70*1000 hr*(ton/907,200 g) = 1.38 tons/yr NOx
8. Annual NOx reduced technology emissions
   2.32 g/bhp-hr *175 hp*0.70*1000 hr*(ton/907,200 g) = 0.31 tons/yr NOx
9. Annual ROG baseline technology emissions
   1.06 g/bhp-hr *175 hp*0.70*1000 hr*(ton/907,200 g) = 0.14 tons/yr ROG
10. Annual ROG reduced technology emissions
    0.12 g/bhp-hr *175 hp*0.70*1000 hr*(ton/907,200 g) = 0.02 tons/yr ROG
11. Annual PM10 baseline technology emissions

0.396 g/bhp-hr *175 hp*0.70*1000 hr*(ton/907,200 g) = 0.053 tons/yr PM10

12. Annual PM10 reduced technology emissions
0.112 g/bhp-hr *175 hp*0.70*1000 hr*(ton/907,200 g) = 0.015 tons/yr PM10

Formula C-10: Annual Surplus Emission Reductions by Pollutant (tons/yr) for Repowers and New Purchases

- Emission benefits NOx = 1.38 tons/yr - 0.31 tons/yr = 1.07 tons/yr NOx
- Emission benefits ROG = 0.14 tons/yr - 0.02 tons/yr = 0.12 tons/yr ROG
- Emission benefits PM10 = 0.053 tons/yr - 0.015 tons/yr = 0.038 tons/yr PM10

Formula C-11: Annual Surplus Emission Reductions by Pollutant (tons/yr) for Retrofits
0.015 tons/yr PM10 * 0.85 = 0.013 tons/yr PM10

Total PM10 Emission Benefits
0.038 tons/yr + 0.013 tons/yr = 0.051 tons/yr PM10

Formula C-2: Annual Weighted Surplus Emission Reductions
1.07 tons/yr + 0.12 tons/yr + 20(0.051 tons/yr) = 2.21 weighted tons/yr

Annualized Cost:
Project Life: 5 years
CRF (Table B-1): = 0.225

Formula C-14: Incremental Cost
($100,000 * 80 percent) + ($25,000 * 100 percent) = $105,000

Formula C-12: Annualized Cost
0.225 * $105,000 = $23,625

Cost-Effectiveness:
Formula C-1: Cost-Effectiveness of Weighted Surplus Emission Reductions ($/ton)
($23,625/yr)/(2.21 weighted tons/yr)
= $10,690/tons of weighted surplus emissions reduced

The cost-effectiveness for the example is less than $16,000 per ton of pollutants reduced. This project qualifies for up to $105,000 in grant funds requested.

Example 2 – Replacement of two rubber tired loaders

A construction company meeting the definition of a medium fleet in the Off-Road Regulation wants to replace two uncontrolled rubber tired loaders with one Tier 3 rubber tired loader. The baseline technologies are: 1) a model year 1987 210 hp uncontrolled engine that operates for 750 hours per year and 2) a model year 1978 180 hp uncontrolled engine that operates for 350 hours per year. The applicant is proposing to purchase a 210 hp Tier 3 rubber tired loader that costs $275,000. This equipment operates 100 percent of the time in California. A Level 3 diesel particulate filter has been verified for use on the engine and has a cost of $25,000. There are no available Tier 3 repowers for this specific equipment, so the applicant is eligible for up to 80 percent of the new equipment cost. This project will be in operation prior to March 1,

2009 and thus be surplus to the Off-Road Regulation and can be given a maximum project life of 4 years.

Baseline Technology Information, Equipment 1:

- Engine (application): 1987 Model Year
- HP (application): 210
- Annual Hours of operation (application): 750
- Load factor (Table B-11): 0.54
- Emission factors (Table B-12): 10.23 g/bhp-hr NOx; 1.06 g/bhp-hr ROG; 0.396 g/bhp-hr PM10

Baseline Technology Information, Equipment 2:

- Engine (application): 1978 Model Year
- HP (application): 180
- Annual Hours of operation (application): 350
- Load factor (Table B-11): 0.54
- Emission factors (Table B-12): 11.16 g/bhp-hr NOx; 1.20 g/bhp-hr ROG; 0.396 g/bhp-hr PM10

Reduced Technology Information:

- Engine: Tier 3 (ARB executive order)
- HP (application): 210
- Hours of operation (application): 1,100
- Cost of new equipment (quote provided with application): $275,000
- Equipment replacement is eligible for up to 80 percent of the new equipment cost.
- Load factor (Table B-11): 0.54
- Emission factors (Table B-13): 2.32 g/bhp-hr NOx; 0.12 g/bhp-hr ROG; 0.112 g/bhp-hr PM10
- Percent operating in California (application): 100 percent
- Retrofit: Level 3 verified reductions- 85 percent PM10
- Cost of retrofit (quote provided with application): $25,000
- Retrofits are eligible for up to 100% of total retrofit costs

Emission Reduction Calculations:

Formula C-4: Estimated Annual Emissions based on Hours of Operation (tons/yr)

1. Annual NOx baseline technology emissions, equipment 1
   10.23 g/bhp-hr *210 hp*0.54*750 hr*(ton/907,200 g) = 0.96 tons/yr NOx
2. Annual NOx baseline technology emissions, equipment 2
   11.16 g/bhp-hr *180 hp*0.54*350 hr*(ton/907,200 g) = 0.42 tons/yr NOx
3. Annual NOx reduced technology emissions
   2.32 g/bhp-hr *210 hp*0.54*1100 hr*(ton/907,200 g) = 0.32 tons/yr NOx
4. Annual ROG baseline technology emissions, equipment 1
   1.06 g/bhp-hr *210 hp*0.54*750 hr *(ton/907,200 g) = 0.10 tons/yr ROG
5. Annual ROG baseline technology emissions, equipment 2
   1.20 g/bhp-hr *180 hp*0.54*350 hr*(ton/907,200 g) = 0.05 tons/yr ROG
6. Annual ROG reduced technology emissions
   0.12 g/bhp-hr *210 hp*0.54*1100 hr*(ton/907,200 g) = 0.02 tons/yr ROG

7. Annual PM10 baseline technology emissions, equipment 1
   0.396 g/bhp-hr *210 hp*0.54*750 hr*(ton/907,200 g) = 0.037 tons/yr PM10
8. Annual PM10 baseline technology emissions, equipment 2
   0.396 g/bhp-hr *180 hp*0.54*350 hr*(ton/907,200 g) = 0.015 tons/yr PM10
9. Annual PM10 reduced technology emissions
   0.112 g/bhp-hr *210 hp*0.54*1100 hr*(ton/907,200 g) = 0.015 tons/yr PM10

Formula C-10: Annual Surplus Emission Reductions by Pollutant (tons/yr) for Repowers and New Purchases

- Emission benefits NOx = (0.96+0.42 tons/yr) - 0.32 tons/yr = 1.06 tons/yr NOx
- Emission benefits ROG = (0.10+0.05 tons/yr) - 0.02 tons/yr = 0.13 tons/yr ROG
- Emission benefits PM10 = (0.037+0.015 tons/yr) - 0.015 tons/yr = 0.037 tons/yr PM10

Formula C-11: Annual Surplus Emission Reductions by Pollutant (tons/yr) for Retrofits

0.015 tons/yr PM10 * 0.85 = 0.013 tons/yr PM10

Total PM10 Emission Benefits

0.037 tons/yr + 0.013 tons/yr = 0.050 tons/yr PM10

Formula C-2: Annual Weighted Surplus Emission Reductions

1.06 tons/yr + 0.13 tons/yr + 20(0.050 tons/yr) = 2.19 weighted tons/yr

Annualized Cost:

Project Life: 4 years

CRF (Table B-1): = 0.275

Formula C-14: Incremental Cost

($275,000 * 85 percent) + ($25,000 * 100 percent) = $245,000

Formula C-12: Annualized Cost

0.275 * $245,000 = $67,375

Cost-Effectiveness:

Formula C-1: Cost-Effectiveness of Weighted Surplus Emission Reductions ($/ton)

($67,375/yr)/(2.19 weighted tons/yr)

= $30,764/tons of weighted surplus emissions reduced

The cost-effectiveness for this example is greater than the $16,000 per ton weighted cost-effectiveness requirement. In order to meet the $16,000 per ton weighted cost-effectiveness requirement, this project would only qualify for a fraction of the incremental cost – $127,418 (or 52% of the incremental cost). This amount is determined by multiplying the maximum allowed cost-effectiveness by the estimated annual emission reductions and dividing by the capital recovery factor:

($16,000 * 2.19)/0.275 = $127,418

Example 3 – Replacement of a 1993 LSI forklift with a new LSI forklift
An applicant proposes to replace a 1993 60 hp LPG forklift with a new 2008 Model Year 70 hp LPG forklift. The new equipment will cost $22,000. This equipment operates 750 hours per year, 100 percent of the time in California. This equipment belongs to a small fleet and is eligible for a project life of 3 years.

Baseline Technology Information:
- Engine (application): Model Year 1993
- HP (application): 60
- Hours of operation (application): 750
- Load factor (Table B-14): 0.30
- Emission factors (Table B-15): 10.51 g/bhp-hr NOx; 1.02 g/bhp-hr ROG; 0.060 g/bhp-hr PM10

Reduced Technology Information:
- Engine: Model Year 2007
- HP (application): 70
- Hours of operation (application): 750
- Cost of new equipment (quote provided with application): $22,000
- Equipment replacement is eligible for up to 80 percent of the new equipment cost.
- Load factor (Table B-14): 0.30
- Emission factors (Table B-15): 1.05 g/bhp-hr NOx; 0.07g/bhp-hr ROG; 0.060 g/bhp-hr PM10
- Percent operating in California (application): 100 percent

Emission Reduction Calculations:
Formula C-4: Estimated Annual Emissions based on Hours of Operation (tons/yr)
1. Annual NOx baseline technology emissions
   10.51 g/bhp-hr *60 hp*0.30*750 hr*(ton/907,200 g) = 0.16 tons/yr NOx
2. Annual NOx reduced technology emissions
   1.05 g/bhp-hr *70 hp*0.30*750 hr*(ton/907,200 g) = 0.02 tons/yr NOx
3. Annual ROG baseline technology emissions
   1.02 g/bhp-hr *60 hp*0.30*750 hr*(ton/907,200 g) = 0.051 tons/yr ROG
4. Annual ROG reduced technology emissions
   0.07 g/bhp-hr *70 hp*0.30*750hr*(ton/907,200 g) = 0.001 tons/yr ROG
5. Annual PM10 baseline technology emissions
   0.060 g/bhp-hr *60 hp*0.30*750 hr*(ton/907,200 g) = 0.001 tons/yr PM10
6. Annual PM10 reduced technology emissions
   0.060 g/bhp-hr *70 hp*0.30*750 hr*(ton/907,200 g) = 0.001 tons/yr PM10

Formula C-10: Annual Surplus Emission Reductions by Pollutant (tons/yr) for Repowers and New Purchases
- Emission benefits NOx = 0.16 tons/yr - 0.02 tons/yr = 0.14 tons/yr NOx
- Emission benefits ROG = 0.051 tons/yr - 0.001 tons/yr = 0.050 tons/yr ROG
- Emission benefits PM10 = 0.001 tons/yr - 0.001 tons/yr = 0.0 tons/yr PM10

Formula C-2: Annual Weighted Surplus Emission Reductions
0.14 tons/yr + 0.050 tons/yr + 20(0.0 tons/yr) = 0.19 weighted tons/yr

Annualized Cost:
Project Life: 3 years
CRF (Table B-1): = 0.360

Formula C-14: Incremental Cost
($22,000 * 80 percent) = $17,600

Formula C-12: Annualized Cost
0.360 * $17,600 = $6,336

Cost-Effectiveness:
Formula C-1: Cost-Effectiveness of Weighted Surplus Emission Reductions ($/ton)
($6,336/yr)/(0.19 weighted tons/yr)
= $33,347/tons of weighted surplus emissions reduced

The cost-effectiveness for this example is greater than the $16,000 per ton weighted cost-effectiveness requirement. In order to meet the $16,000 per ton weighted cost-effectiveness requirement, this project would only qualify for a fraction of the incremental cost – $8,444 (or 48% of the incremental cost). This amount is determined by multiplying the maximum allowed cost-effectiveness by the estimated annual emission reductions and dividing by the capital recovery factor:

($16,000 * 0.19)/0.360 = $8,444

Example 4 – Replacement of a 1993 LSI forklift with a new electric forklift
An applicant proposes to replace a 1993 60 hp LPG forklift with a new electric 70 hp (52 KW) forklift in 2008. The new equipment will cost $34,000. This equipment operates 750 hours per year, 100 percent of the time in California.

When calculating emission benefits for replacement with electric equipment, SB 467 requires that calculations are done from two transactions:
- Transaction 1: Existing equipment to be scrapped to zero emission (maximum of 3 year project life attributed to this transaction)
- Transaction 2: New piece of equipment that would be purchased in 3 years, or the time of normal attrition, to zero emission (maximum of 7 year project life attributed to this transaction)

This equipment belongs to a small fleet and is eligible for a maximum total project life of 10 years.

Baseline Technology Information-Transaction 1:
- Engine (application): Model Year 1993
- HP (application): 60
- Hours of operation (application): 750
- Load factor (Table B-14): 0.30
- Emission factors (Table B-15): 10.51 g/bhp-hr NOx; 1.02 g/bhp-hr ROG; 0.060 g/bhp-hr PM10

Baseline Technology Information-Transaction 2:

- Engine (application): Model Year 2011
- HP (application): 60
- Hours of operation (application): 750
- Load factor (Table B-14): 0.30
- Emission factors (Table B-15): 0.32 g/bhp-hr NOx; 0.02 g/bhp-hr ROG; 0.060 g/bhp-hr PM10

Reduced Technology Information:

- Engine: electric
- HP (application): 70
- Hours of operation (application): 750
- Cost of new equipment (quote provided with application): $34,000
- Equipment replacement is eligible for up to 80 percent of the new equipment cost.
- Load factor (Table B-14): 0.30
- Emission factors (Table B-15): 0 g/bhp-hr NOx; 0 g/bhp-hr ROG; 0 g/bhp-hr PM10
- Percent operating in California (application): 100 percent

Emission Reduction Calculations:

Formula C-4: Estimated Annual Emissions based on Hours of Operation (tons/yr)

1. Annual NOx baseline technology emissions- Transaction 1
   10.51 g/bhp-hr *60 hp*0.30*750 hr*(ton/907,200 g) = 0.16 tons/yr NOx
2. Annual NOx baseline technology emissions- Transaction 2
   0.32 g/bhp-hr *60 hp*0.30*750 hr*(ton/907,200 g) = 0.005 tons/yr NOx
3. Annual NOx reduced technology emissions
   0 g/bhp-hr *70 hp*0.30*750 hr*(ton/907,200 g) = 0.0 tons/yr NOx
4. Annual ROG baseline technology emissions- Transaction 1
   1.02 g/bhp-hr *60 hp*0.30*750 hr*(ton/907,200 g) = 0.051 tons/yr ROG
5. Annual ROG baseline technology emissions- Transaction 2
   0.02 g/bhp-hr *60 hp*0.30*750 hr*(ton/907,200 g) = 0.0003 tons/yr ROG
6. Annual ROG reduced technology emissions
   0.0 g/bhp-hr *70 hp*0.30*750hr*(ton/907,200 g) = 0.0 tons/yr ROG
7. Annual PM10 baseline technology emissions- Transaction 1
   0.060 g/bhp-hr *60 hp*0.30*750 hr*(ton/907,200 g) = 0.001 tons/yr PM10
8. Annual PM10 baseline technology emissions- Transaction 2
   0.060 g/bhp-hr *60 hp*0.30*750 hr*(ton/907,200 g) = 0.001 tons/yr PM10
9. Annual PM10 reduced technology emissions
   0.0 g/bhp-hr *70 hp*0.30*750 hr*(ton/907,200 g) = 0.0 tons/yr PM10

Formula C-10: Annual Surplus Emission Reductions by Pollutant (tons/yr) for Repowers and New Purchases

Transaction 1

- Emission benefits NOx = 0.16 tons/yr - 0.0 tons/yr = 0.16 tons/yr NOx
- Emission benefits ROG = 0.051 tons/yr - 0.0 tons/yr = 0.051 tons/yr ROG
- Emission benefits PM10 = 0.001 tons/yr - 0.0 tons/yr = 0.001 tons/yr PM10

Transaction 2

- Emission benefits NOx = 0.005 tons/yr - 0.0 tons/yr = 0.005 tons/yr NOx
- Emission benefits ROG = 0.0003 tons/yr - 0.0 tons/yr = 0.0003 tons/yr ROG
- Emission benefits PM10 = 0.001 tons/yr - 0.0 tons/yr = 0.001 tons/yr PM10

Formula C-2: Annual Weighted Surplus Emission Reductions
Transaction 1

0.16 tons/yr + 0.051 tons/yr + 20(0.001 tons/yr) = 0.213 weighted tons/yr

Transaction 2

0.005 tons/yr + 0.0003 tons/yr + 20(0.001 tons/yr) = 0.025 weighted tons/yr

Only a fraction of each of the annual weighted surplus emission reductions from the two transactions is used to determine the total annual weighted surplus emission reductions for cost effectiveness. This fraction is the project life associated with each transaction over the total project life.

(3/10 * 0.213) + (7/10 * 0.025) = 0.081

Annualized Cost:
Project Life: 10 years

CRF (Table B-1): = 0.123

Formula C-14: Incremental Cost

($34,000 * 80 percent) = $27,200

Formula C-12: Annualized Cost

0.123 * $27,200 = $3,346

Cost-Effectiveness:
Formula C-1: Cost-Effectiveness of Weighted Surplus Emission Reductions ($/ton)

($3,346/yr)/(0.081 weighted tons/yr)
= $41,309/tons of weighted surplus emissions reduced

The cost-effectiveness for this example is greater than the $16,000 per ton weighted cost-effectiveness requirement. In order to meet the $16,000 per ton weighted cost-effectiveness requirement, this project would only qualify for a fraction of the incremental cost – $10,537 (or 39% of the incremental cost). This amount is determined by multiplying the maximum allowed cost-effectiveness by the estimated annual emission reductions and dividing by the capital recovery factor:

($16,000 * 0.081)/0.123 = $10,537

VI. Locomotives

This section provides examples of calculations for determining cost-effectiveness of surplus emission reductions for locomotive projects.

Example 1 – Switch Locomotive Engine Remanufacture Kit (Class 3 Railroad)
A Class 3 railroad operator opts to remanufacture an existing 1971 model year switch locomotive engine with a U.S. EPA-certified Tier 0 Engine Remanufacture Kit. The existing locomotive consumes 40,000 gallons of fuel per year, with 100 percent operation in California. The cost of the remanufacture kit plus installation of the kit costs $400,000. The cost to purchase and install an automatic engine start-stop ILD is $11,000. The railroad company will commit to a 10 year project life. Emission reductions are calculated as follows:

Baseline Technology Information:

- Locomotive model year (application): 1971
- Locomotive emission rate (Table B-18): 16.36 g/bhp-hr NOx, 1.06 g/bhp-hr ROG, 0.378 g/bhp-hr PM10
- Activity (application): 40,000 gal/year
- Energy consumption factor = 20.8 bhp-hr/gal (Table B-25)

Reduced Technology Information:

- Emission Factors (Table B-18): 11.84 g/bhp-hr NOx, 1.06 g/bhp-hr ROG, 0.378 g/bhp-hr PM10[1]
- Activity (application): 40,000 gal/year
- Energy consumption factor = 20.8 bhp-hr/gal (Table B-25)
- ILD emission reduction factor (Table B-19): 0.90
- Locomotive project criteria allow for the Carl Moyer Program to pay for up to 85 percent of the remanufacture kit cost and 50 percent of ILD cost

Emission Reduction Calculations:
Formula C-6: Estimated Annual Emissions based on Fuel Consumed using Emission Factors or Converted Emission Standard (tons/yr):

1. Annual NOx baseline technology emissions
(16.36 g/bhp-hr*40,000 gal/yr*20.8 bhp-hr/gal)*(ton/907,200g) = 15.00 ton/yr NOx
2. Annual NOx reduced technology emissions
(11.84 g/bhp-hr*40,000 gal/yr*20.8 bhp-hr/gal*0.90)*(ton/907,200g)=9.77 ton/yr NOx
3. Annual ROG baseline technology emissions
(1.06 g/bhp-hr *40,000 gal/yr*20.8 bhp-hr/gal)*(ton/907,200g) = 0.97 ton/yr ROG
4. Annual ROG reduced technology emissions
(1.06 g/bhp-hr*40,000 gal/yr*20.8 bhp-hr/gal *0.90)*(ton/907,200g)=0.87 ton/yr ROG
5. Annual combustion PM10 baseline technology
(0.378 g/bhp-hr*40,000 gal/yr*20.8 bhp-hr/gal)*(ton/907,200g) = 0.347 ton/yr PM10
6. Annual combustion PM10 reduced technology emissions
(0.378 g/bhp-hr*40,000 gal/yr*20.8 bhp-hr/gal *0.90)*(ton/907,200g)
= 0.312 ton/yr PM10

[1] For information regarding how to calculate reduced engine emission factors, refer to the Supplemental Documents webpage at: www.arb.ca.gov/msprog/moyer/guidelines/supplemental-docs.htm

Formula C-10: Annual Surplus Emission Reductions by Pollutant (tons/yr) for Repowers and New Purchases

- NOx emission benefits = 15.00 tons/yr – 9.77 tons/yr = 5.23 tons/yr NOx
- ROG emission benefits = 0.97 tons/yr - 0.87 tons/yr = 0.10 tons/yr ROG
- PM10 emission benefits= 0.347 tons/yr - 0.312 tons/yr = 0.035 tons/yr PM10

Formula C-2: Annual Weighted Surplus Emission Reductions

5.23 tons/yr + 0.10 tons/yr + 20(0.035 tons/yr) = 6.02 weighted tons/yr

Annualized Cost:

Project Life: 10 years

CRF (Table B-1): = 0.123

Formula C-14: Incremental Cost

($400,000 * 85 percent) + ($11,000 * 50 percent) = 345,500

Formula C-12: Annualized Cost

0.123 * $345,500 = $42,497/yr

Cost-Effectiveness:

Formula C-1: Cost-Effectiveness of Weighted Surplus Emission Reductions ($/ton)

($42,497/yr)/(6.02 weighted tons/yr)

= $7,057/tons of weighted surplus emissions reduced

The project cost-effectiveness is below $16,000 per weighted ton of emissions reduced. Therefore, the project qualifies for $305,500 in Carl Moyer Program funding.

Example 2 – Multiple Engine Switcher Purchase (Class 1 Railroad)

A Class 1 railroad operator has the opportunity to purchase an alternative technology switch locomotive. Because this is a multiple engine switcher (Engine Family Number 7NREG0060LOC) with new electronics, a new battery, and other components, the project is evaluated as a new locomotive purchase. Fuel receipts indicate other switch locomotives with the same activity in the rail yard consume 45,000 gallons of fuel per year. The cost of the new alternative technology switcher is $1.2 million. The project life is 10 years. Emission reductions are calculated as follows:

Baseline Technology Information:

- Locomotive model year: none
- Locomotive emission factor (Tier 1, Table B-18)[2]: 11.84 g/bhp-hr NOx, 1.06 g/bhp-hr ROG, 0.378 g/bhp-hr PM10
- Activity (application): 45,000 gal/year
- Energy consumption factor = 20.8 bhp-hr/gal (Table B-25)

Reduced Technology Information:

- Engine model year: 2007
- Emission factors (Engine Family 7NREG0060LOC)[1]: 2.54 g/bhp-hr NOx, 0.105 g/bhp-hr ROG, 0.060 g/bhp-hr PM10
- Activity (application): 45,000 gal/year

[2] For information regarding how to determine reduced engine emission factors, refer to the Supplemental Documents webpage at: www.arb.ca.gov/msprog/moyer/guidelines/supplemental-docs.htm

- Energy consumption factor = 18.5 bhp-hr/gal (Table B-25)
- Locomotive project criteria allow for the Carl Moyer Program to pay for up to 50 percent of Class 1 railroad alternative switcher locomotive purchase cost

Emission Reduction Calculations:

Formula C-6: Estimated Annual Emissions based on Fuel Consumed using Emission Factors or Converted Emission Standard (tons/yr):

1. Annual NOx baseline technology emissions
   (11.84 g/bhp-hr * 45,000 gal/yr * 20.8 bhp-hr/gal) *(ton/907,200g) = 12.21 ton/yr NOx
2. Annual NOx reduced technology emissions
   (2.54 g/bhp-hr * 45,000 gal/yr * 18.5 bhp-hr/gal) *(ton/907,200g) = 2.33 ton/yr NOx
3. Annual ROG baseline technology emissions
   (1.06 g/bhp-hr * 45,000 gal/yr * 20.8 bhp-hr/gal) *(ton/907,200g) = 1.09 ton/yr ROG
4. Annual ROG reduced technology emissions
   (0.105 g/bhp-hr * 45,000 gal/yr * 18.5 bhp-hr/gal) *(ton/907,200g) = 0.10 ton/yr ROG
5. Annual combustion PM10 baseline technology
   (0.378 g/bhp-hr * 45,000 gal/yr * 20.8 bhp-hr/gal) *(ton/907,200g)=0.390 ton/yr PM10
6. Annual combustion PM10 reduced technology emissions
   (0.060 g/bhp-hr * 45,000 gal/yr * 18.5 bhp-hr/gal) *(ton/907,200g)=0.055 ton/yr PM10

Formula C-10: Annual Surplus Emission Reductions by Pollutant (tons/yr) for Repowers and New Purchases

- Emission benefits NOx = 12.21 tons/yr – 2.33 tons/yr = 9.88 tons/yr NOx
- Emission benefits ROG = 1.09 tons/yr – 0.10 tons/yr = 1.00 tons/yr ROG
- Emission benefits PM10 = 0.390 tons/yr – 0.055 tons/yr = 0.335 tons/yr PM10

Formula C-2: Annual Weighted Surplus Emission Reductions

9.88 tons/yr +1.00 tons/yr + 20(0.335 tons/yr) = 17.59 weighted tons/yr

Annualized Cost:

Project Life: 10 years

CRF (Table B-1): = 0.123

Formula C-14: Incremental Cost

$1,200,000 * 0.50 = $600,000

Formula C-12: Annualized Cost

0.123 * $600,000 = $73,800/yr

Cost-Effectiveness:

Formula C-1: Cost-Effectiveness of Weighted Surplus Emission Reductions ($/ton)

($73,800/yr)/(17.59 weighted tons/yr)

= $4,197/tons of weighted surplus emissions reduced

The project cost-effectiveness is below $16,000 per weighted ton of emissions reduced. Therefore, the project qualifies for $600,000 in Carl Moyer Program funding.

Example 3 – Idle-Limiting Device Installation (Class 3 Railroad)

A Class 3 railroad wants to purchase and install an AESS ILD on one of its 1970 uncontrolled switch locomotives. Fuel receipts indicate other switch locomotives with the same activity in the rail yard consume 25,000 gallons of fuel per year. The cost to purchase and install the AESS is $14,000. The project life is 3 years. Emission reductions are calculated as follows:

Baseline Technology Information:

- Locomotive model year: 1970
- Locomotive emission rate (uncontrolled, Table B-18): 16.36 g/bhp-hr NOx, 1.06 g/bhp-hr ROG, 0.378 g/bhp-hr PM10
- Activity (application): 25,000 gal/year
- Energy consumption factor = 20.8 bhp-hr/gal (Table B-25)
- ILD emission reduction factor (Table B-19): 0.90
- Locomotive project criteria allow for the Carl Moyer Program to pay for up to 50 percent of ILD cost

Emission Reduction Calculations:

Formula C-6: Estimated Annual Emissions based on Fuel Consumed using Emission Factors or Converted Emission Standard (tons/yr):

1) Annual NOx emission reductions
   (16.36 g/bhp-hr * 25,000 gal/yr * 20.8 bhp-hr/gal) *(ton/907,200g) = 9.38 ton/yr NOx
2) Annual NOx reduced technology emissions
   (16.36 g/bhp-hr*25,000 gal/yr*20.8 bhp-hr/gal*0.90)*(ton/907,200g)=8.44 ton/yr NOx
3) Annual ROG baseline technology emissions
   (1.06 g/bhp-hr * 25,000 gal/yr * 20.8 bhp-hr/gal) *(ton/907,200g) = 0.61 ton/yr ROG
4) Annual ROG reduced technology emissions
   (1.06 g/bhp-hr*25,000 gal/yr*20.8 bhp-hr/gal*0.90)*(ton/907,200g) =0.55 ton/yr ROG
5) Annual combustion PM10 baseline technology
   (0.378 g/bhp-hr * 25,000 gal/yr * 20.8 bhp-hr/gal)*(ton/907,200g) =0.217 ton/yr PM10
6) Annual combustion PM10 reduced technology emissions
   (0.378 g/bhp-hr*25,000 gal/yr*20.8 bhp-hr/gal*0.90)*(ton/907,200g)=0.195ton/yr PM10

Formula C-10: Annual Surplus Emission Reductions by Pollutant (tons/yr) for Repowers and New Purchases

- Emission benefits NOx = 9.38 tons/yr – 8.44 tons/yr = 0.94 tons/yr NOx
- Emission benefits ROG = 0.61 tons/yr – 0.55 tons/yr = 0.06 tons/yr ROG
- Emission benefits PM10 = 0.217 tons/yr – 0.195 tons/yr = 0.022 tons/yr PM10

Formula C-2: Annual Weighted Surplus Emission Reductions

0.94 tons/yr +0.06 tons/yr + 20(0.022 tons/yr) = 1.43 weighted tons/yr

Annualized Cost:

Project Life: 3 years

CRF (Table B-1): = 0.360

Formula C-14: Incremental Cost

$14,000 * 0.50 = $7,000

Formula C-12: Annualized Cost

0.360 * $7,000 = $2,520/yr

Cost-Effectiveness:

Formula C-1: Cost-Effectiveness of Weighted Surplus Emission Reductions ($/ton)

($2,520/yr)/(1.43 weighted tons/yr)

= $1,760/tons of weighted surplus emissions reduced

The project cost-effectiveness is below $16,000 per weighted ton of emissions reduced. Therefore, the project qualifies for $7,000 in Carl Moyer Program funding.

VII. Marine Vessels

This section provides examples of calculations for determining the cost-effectiveness of surplus emission reductions for marine vessel projects.

Example 1 – Tow Boat Auxiliary Engine Repower
A tow boat owner in San Diego wishes to repower a 125 horsepower 1987 auxiliary engine with a new Tier 2 200 horsepower marine engine. The vessel owner has documented that the vessel auxiliary engine operates for 900 hours annually in California waters. The cost to repower the existing engine is $50,000. Since the vessel is subject to ARB's Harbor Craft Diesel Engine Regulation, the repower must be complete by December 31, 2011, and the project life may not extend beyond December 31, 2014 (See Table 1 in the marine vessel chapter for details). Since the repower shall be complete by December 31, 2009, the operator opts to commit to the maximum five year project life (i.e. the time between project completion and the rule implementation deadline). Emission reductions are calculated as follows:

Baseline Technology Information:
- Baseline technology (application): 1987
- Engine horsepower (application): 125 hp
- Engine emission rate (Table B-21): 10.23 g/bhp-hr NOx, 0.82 g/bhp-hr ROG, 0.333 g/bhp-hr PM10
- Activity (application): 900 hr/yr
- Engine load factor (Table B-22): 0.43

Reduced Technology Information:
- Reduced technology (application): Tier 2 marine engine
- Engine horsepower (application) = 200 hp
- Emission rate (Table B-21): 4.84 g/bhp-hr NOx, 0.58 g/bhp-hr ROG, 0.120 g/bhp-hr PM10
- Activity (application): 900 hr/yr
- Load factor adjustment (*Formula C-5: Replacement Load Factor*):
  = 0.43*(125 hp/200 hp) = 0.27
- Marine vessel project criteria allow for the Carl Moyer Program to pay for up to 50 percent of the repower cost for this type of vessel

Emission Reduction Calculations:
Formula C-4: Estimated Annual Emissions based on Hours of Operation (tons/yr)
1. Annual NOx baseline technology emissions
   (10.23 g/bhp-hr * 900 hr/yr * 125 hp * 0.43)(ton/907,200 g)
   = 0.55 ton/yr NOx
2. Annual NOx reduced technology emissions
   (4.84 g/bhp-hr * 900 hr/yr * 200 hp * 0.27)(ton/907,200 g)
   = 0.26 ton/yr NOx
3. Annual ROG baseline technology emissions
   (0.81 g/bhp-hr * 900 hr/yr * 125 hp * 0.43)(ton/907,200 g)

= 0.04 ton/yr ROG

4. Annual ROG reduced technology emissions
   (0.58 g/bhp-hr * 900 hr/yr * 200 hp * 0.27)(ton/907,200 g)
   = 0.03 ton/yr ROG
5. Annual PM10 baseline technology emissions
   (0.333 g/bhp-hr * 900 hr/yr * 125 hp * 0.43)(ton/907,200 g
   = 0.018 ton/yr PM10
6. Annual PM10 reduced technology emissions
   (0.120 g/bhp-hr * 900 hrs/year * 200 hp * 0.27)(ton/907,200 g)
   = 0.006 ton/yr PM10

Formula C-10: Annual Surplus Emission Reductions by Pollutant (tons/yr) for Repowers and New Purchases

- NOx emission reductions = 0.55 tons/yr – 0.26 tons/yr = 0.29 tons/yr NOx
- ROG emission reductions = 0.04 tons/yr – 0.03 tons/yr = 0.01 tons/yr ROG
- PM10 emission reductions = 0.018 tons/yr – 0.006 tons/yr= 0.011 tons/yr PM10

Formula C-2: Annual Weighted Surplus Emission Reductions

0.28 tons/yr + 0.01 tons/yr + 20(0.011 tons/yr) = 0.53 weighted tons/yr

Annualized Cost:

Project life = 5 years

CRF (Table B-1) = 0.225

Formula C-14: Incremental Cost

$50,000 * 50 percent = $25,000

Formula C-12: Annualized Cost

($25,000 * .225) = $5,625/yr

Cost-Effectiveness:

Formula C-1: Cost-Effectiveness of Weighted Surplus Emission Reductions ($/ton)

($5,625/year)/ (0.53 weighted tons/yr)

= $10,666/ton of weighted surplus emissions reduced

The project cost-effectiveness is below $16,000 per weighted ton of emissions reduced. Therefore, the project qualifies for $25,000 in Carl Moyer Program funding.

Example 2 – Fishing Vessel Propulsion Engine Repower (Wet Exhaust System)

A commercial fishing vessel owner wishes to repower a 1973 250 horsepower propulsion engine with a new Tier 2 250 horsepower marine engine. The vessel has a wet exhaust system. The vessel owner has documented that the vessel propulsion engine operates 1,200 hours per year in California waters. The cost to purchase and install a new engine is $51,300. The applicant will commit to a 5 year project life. Emission reductions are calculated as follows:

Baseline Technology Information:

- Baseline technology (application): 1973
- Engine horsepower (application): 250 hp
- Engine emission rate (Table B-20): 14.27 g/bhp-hr NOx, 0.79 g/bhp-hr ROG, 0.451 g/bhp-hr PM10
- Activity (application): 1,200 hr/yr
- Engine load factor (Table B-22): 0.27
- Wet exhaust emission factor (from marine repower project criteria): 0.80

Reduced-Emission Technology Information:

- Reduced technology (application): Tier 2 marine engine
- Engine horsepower (application): 250 hp
- Emission rate (Table B-20): 4.84 g/bhp-hr NOx, 0.49 g/bhp-hr ROG, 0.120 g/bhp-hr PM10
- Activity (application): 1,200 hr/yr
- Engine load factor (Table B-22): 0.27
- Wet exhaust emission factor (from marine repower project criteria): 0.80
- Marine vessel project criteria allow for the Carl Moyer Program to pay for up to 50 percent of the repower cost for this type of vessel

Emission Reduction Calculations:

Formula C-6: Estimated Annual Emissions based on Fuel Consumed using Emission Factors or Converted Emission Standard (tons/yr)

1. Annual NOx baseline technology emissions
   (14.27 g/bhp-hr * 1,200 hr/yr * 250 hp * 0.27 * 0.80)(ton/907,200 g)
   = 1.02 ton/yr NOx
2. Annual NOx reduced technology emissions
   (4.84 g/bhp-hr * 1,200 hr/yr * 250 hp * 0.27 * 0.80)(ton/907,200 g)
   = 0.35 ton/yr NOx
3. Annual ROG baseline technology emissions
   (0.79 g/bhp-hr * 1,200 hr/yr * 250 hp * 0.27 * 0.80)(ton/907,200 g)
   = 0.06 ton/yr ROG
4. Annual ROG reduced technology emissions
   (0.49 g.bhp-hr * 1,200 hr/yr * 250 hp * 0.27 * 0.80)(ton/907,200 g)
   = 0.04 ton/yr ROG
5. Annual PM10 baseline technology emissions
   (0.451 g/bhp-hr * 1,200 hr/yr * 250 hp * 0.27 * 0.80)(ton/907,200 g)

= 0.032 ton/yr PM10

6. Annual PM10 reduced technology emissions
   (0.120 g/bhp-hr * 1,200 hr/yr * 250 hp * 0.27 * 0.80)(ton/907,200 g)
   = 0.009 ton/yr PM10

Formula C-10: Annual Surplus Emission Reductions by Pollutant for Repowers and New Purchases

- NOx Emission Reductions = 1.02 tons/yr – 0.35 tons/yr = 0.67 tons/yr NOx
- ROG Emission Reductions = 0.06 tons/yr – 0.04 tons/yr = 0.02 tons/yr ROG
- PM10 Emission Reductions = 0.032 tons/yr – 0.009 tons/yr
  = 0.024 tons/yr PM10

Formula C-2: Annual Weighted Surplus Emission Reductions
0.67 + 0.02 +20(0.024) = 1.17 weighted tons/yr

Annualized Cost:
Project life = 5 years
CRF (Table B-1) = 0.225

Formula C-14: Incremental Cost
$51,300 * 50 percent = $25,650

Formula C-12: Annualized Cost
$25,650 * 0.225 = $5,771/yr

Cost Effectiveness:
Formula C-1: Cost-Effectiveness of Surplus Emission Reductions
($5,771/year)/(1.17 weighted tons/yr) =
$4,942 ton of weighted surplus emissions reduced

The project cost-effectiveness is below $16,000 per weighted ton of emissions reduced. Therefore, the project qualifies for $25,650 in Carl Moyer Program funding.

Example 3 – Passenger Terminal Shore Power
The Port of Los Angeles wants to install shore power at one of its terminals. The shore-side transformer for the project costs $2 million, and will be installed by December 31, 2009. The port will begin complying with ARB's Shore Power Regulation in 2014 by ensuring at least 50 percent of vessels use shore power when at berth. The port has contracts with three cruise ships committing them to use the shore power at the terminal for ten visits each per year, and for eight hours per visit. The vessels typically use marine gas oil with a sulfur content of less that 0.10 percent. Emission reductions are calculated as follows:

Project Information:

- Type of Shore Power Berth: Passenger vessel
- Vessel emission rate (Table B-23): 13.9 g/bhp-hr NOx, 0.49 g/bhp-hr ROG, 0.25 g/bhp-hr PM10
- Average Berthing Time: 8 hours per visit
- Number of Visits: 3 ships x 10 visits = 30 visits per year
- Ship Power Requirement: 7,200 kW (weighted average for vessels as provided by applicant)
- Control Factor: 0.10 (Chapter 9, Section IV(c)(12))

Emission Reduction Calculations:

7. Annual NOx emission reductions
   (13.9 g/bhp-hr *8 hr/visit *30 visits/yr * 7,200 kW *0.9)/(ton/907,200 g))*(hp/1.34 kW)
   = 17.78 ton/yr NOx

8. Annual ROG emission reductions
   (0.49 g/bhp-hr * 8 hr/visit * 30 visits/yr * 7,200 kW *0.9)/(ton/907,200 g)*(hp/1.34 kW)
   = 0.63 ton/yr ROG

9. Annual PM10 emission reductions
   (0.25 g/bhp-hr *8 hr/visit * 30 visits/yr * 7,200 kW *0.9)(ton/907,200 g))*(hp/1.34 kW)
   = 0.320 ton/yr PM10

Formula C-2: Annual Weighted Surplus Emission Reductions

17.78 + 0.63 +20(0.320) = 24.81 weighted tons/yr

Annualized Cost:

Project life = 4 years

CRF (Table B-1) = 0.275

Formula C-14: Incremental Cost

$2 million * 50 percent = $1 million

Formula C-12: Annualized Cost

$1million * 0.275 = $275,000/yr

Cost Effectiveness:

Formula C-1: Cost-Effectiveness of Surplus Emission Reductions

($275,000/year)/(24.81 weighted tons/yr) =
$11,086/ ton of weighted surplus emissions reduced

The project cost-effectiveness is below $16,000 per weighted ton of emissions reduced. Therefore, the project qualifies for $1 million in Carl Moyer Program funding.

VIII. Agricultural Sources

This section provides examples of calculations for determining the cost-effectiveness of surplus emission reductions for agricultural source projects.

Example 1 - Repower (diesel to diesel)
An applicant wants to replace an existing 1977 182 hp diesel stationary irrigation pump engine with a new 180 hp diesel stationary engine. The existing engine is subject to the Stationary Diesel In-Use Agricultural Engines Air Toxics Control Measure, and must be replaced with an engine meeting Tier 3 emission standards by 12/31/10. The project must use a 2 year project life to ensure emission reductions surplus to the compliance date.

Baseline Technology Information:
- Baseline technology (application): 1977 MY (uncontrolled)
- Engine horsepower (application): 182 hp
- Activity (application): 3,000 hours per year
- Load factor (Table B-11): 0.65
- Emission factors (Table B-12): 11.16 g/bhp-hr NOx; 1.20 g/bhp-hr ROG; 0.396 g/bhp-hr PM10

Reduced Technology Information:
- Reduced technology (application): 2008 MY (Tier 3)
- Engine horsepower (application): 180 hp
- Activity (application): 3,000 hr/yr
- Load factor (Table B-11): 0.65
- Emission factors (Table B-13): 2.32 g/bhp-hr NOx; 0.12 g/bhp-hr ROG; 0.112 g/bhp-hr PM10
- New engine cost (quote provided with application): $20,320 (includes hour meter)
- Tier 3 engine repowers are eligible for up to 85% of repower cost.

Emission Reduction Calculations:
Formula C-4: Estimated Annual Emissions Based on Hours of Operation (tons/yr)
1. Annual NOx baseline technology emissions
   (11.16 g/bhp-hr * 182 hp * 0.65 * 3,000 hrs)(ton/907,200 g) = 4.37 tons/yr NOx
2. Annual NOx reduced technology emissions
   (2.32g/bhp-hr * 184 hp * 0.65 * 3,000 hrs)(ton/907,200 g) = 0.92 tons/yr NOx
3. Annual ROG baseline technology emissions
   (1.20 g/bhp-hr * 182 hp * 0.65 * 3,000 hrs)(ton/907,200 g) = 0.47 tons/yr ROG
4. Annual ROG reduced technology emissions
   (0.12 g/bhp-hr * 184 hp * 0.65 * 3,000 hrs)(ton/907,200 g) = 0.05 tons/yr ROG
5. Annual PM10 baseline technology emissions
   (0.396 g/bhp-hr * 182 hp * 0.65 * 3,000 hrs)(ton/907,200 g) = 0.155 tons/yr PM10
6. Annual PM10 reduced technology emissions
   (0.112 g/bhp-hr * 184 hp * 0.65 * 3,000 hrs)(ton/907,200 g) = 0.044 tons/yr PM10

Formula C-10: Annual Surplus Emission Reductions by Pollutant (tons/yr) for Repowers and New Purchases

- NOx emission benefits = 4.37 tons/yr – 0.92 tons/yr = 3.45 tons/yr NOx
- ROG emission benefits = 0.47 tons/yr – 0.05 tons/yr = 0.42 tons/yr ROG
- PM10 emission benefits = 0.155 tons/yr – 0.044 tons/yr = 0.101 tons/yr PM10

Formula C-2: Annual Weighted Surplus Emission Reductions

4.45 tons/yr + 0.42 tons/yr + 20(0.101 tons/yr) = 6.89 weighted tons/yr

Annualized Cost:

Project life: 2 years

CRF (Table B-1): =0.530

Formula C-14: Incremental Cost

$20,320 * 0.85 = $17,272

Formula C-12: Annualized Cost

0.530 * $17,272 = $9,154/yr

Cost-Effectiveness:

Formula C-1: Cost-Effectiveness of Weighted Surplus Emission Reductions

($9,154/yr)/(6.89 weighted tons/yr)

= $1,329/tons of weighted surplus emissions reduced

The cost-effectiveness for this project is less than $16,000 per weighted ton of emissions reduced. This project qualifies for up to $17,272 of grant funds requested.

Example 2 – Repower (diesel engine to electric motor)

An applicant wants to replace an existing 1991 120 hp diesel stationary irrigation pump engine with a new 100 hp (75 kW) electric motor. The existing engine is subject to the Stationary Diesel In-Use Agricultural Engines Air Toxics Control Measure, and must be replaced with an engine meeting Tier 3 emission standards by 12/31/10. The project may use up to a 10 year project life for this project; the applicant and district choose to use a 5 year project life. The emission reductions provided by this project are calculated in two transactions following the "Stationary Diesel In-Use Agricultural Engine Air Toxic Control Measure Carl Moyer Program Implementation Chart" (http://www.arb.ca.gov/msprog/moyer/guidelines/supplemental-docs.htm):

- Transaction 1: two years of emission reductions are calculated for the existing engine being replaced with the electric motor.
- Transaction 2: three years of emission reductions are calculated for a Tier 3 diesel engine being replaced with the electric motor.

Baseline Technology Information- Transaction 1:

- Engine (application): 1991 MY (uncontrolled)
- Engine horsepower (application): 120 hp

- Load factor (Table B-11): 0.65
- Activity (application): 2,000 hours per year
- Emission factors (Tables B-12): 7.60 g/bhp-hr NOx; 0.82 g/bhp-hr ROG; 0.274 g/bhp-hr PM10

Baseline Technology Information- Transaction 2:

- Engine (application): 2008 MY (Tier 3)
- Engine horsepower (application): 120 hp
- Load factor (Table B-11): 0.65
- Activity (application): 2,000 hours per year
- Emission factors (Tables B-13): 2.74 g/bhp-hr NOx; 0.12 g/bhp-hr ROG; 0.160 g/bhp-hr PM10

Reduced Technology Information:

- Motor (application): 2008 electric motor
- Motor horsepower (application): 100 hp (75 kW)
- Activity (application): 2,000 hours per year
- Cost of new motor and necessary peripheral equipment (itemized quote provided with application): $18,000
- Project eligible for up to 85% of cost
- Emissions: 0 g/bhp-hr NOx; 0 g/bhp-hr ROG; 0 g/bhp-hr PM10

Emission Reduction Calculations:

Formula C-4: Estimated Annual Emissions Based on Hours of Operation

1. Annual NOx baseline technology emissions- Transaction 1
   (7.60 g/hp-hr *120 hp * 0.65 * 2,000 hrs)/(907,200 g/ton) = 1.31 tons/yr NOx
2. Annual NOx baseline technology emissions- Transaction 2
   (2.74 g/hp-hr *120 hp * 0.65 * 2,000 hrs)/(907,200 g/ton) = 0.47 tons/yr NOx
3. Annual NOx reduced technology emissions = 0 tons/yr NOx
4. Annual ROG baseline technology emissions- Transaction 1
   (0.82 g/hp-hr *120 hp * 0.65 * 2,000 hrs)/(907,200 g/ton) = 0.14 tons/yr ROG
5. Annual ROG baseline technology emissions- Transaction 2
   (0.12 g/hp-hr *120 hp * 0.65 * 2,000 hrs)/(907,200 g/ton) = 0.02 tons/yr ROG
6. Annual ROG reduced technology emissions = 0 tons/yr ROG
7. Annual PM10 baseline technology emissions- Transaction 1
   (0.274 g/hp-hr *120 hp *0.65 * 2,000 hrs)/(907,200 g/ton) = 0.047 tons/yr PM
8. Annual PM10 baseline technology emissions- Transaction 2
   (0.160 g/hp-hr *120 hp *0.65 * 2,000 hrs)/(907,200 g/ton) = 0.028 tons/yr PM
9. Annual PM10 reduced technology emissions = 0 tons/yr PM

Formula C-10: Annual Surplus Emission Reductions by Pollutant (tons/yr) for Repowers and New Purchases

Transaction 1

- Emission benefits NOx = 1.31 tons/yr - 0 tons/yr = 1.31 tons/yr NOx
- Emission benefits ROG = 0.14 tons/yr - 0 tons/yr = 0.14 tons/yr ROG

- Emission benefits PM10 = 0.047 tons/yr - 0 tons/yr = 0.047 tons/yr PM10

Transaction 2
- Emission benefits NOx = 0.47 tons/yr - 0 tons/yr = 0.47 tons/yr NOx
- Emission benefits ROG = 0.02 tons/yr - 0 tons/yr = 0.02 tons/yr ROG
- Emission benefits PM10 = 0.028 tons/yr - 0 tons/yr = 0.028 tons/yr PM10

Formula C-2: Annual Weighted Surplus Emission Reductions
Transaction 1

1.31 tons/yr + 0.14 tons/yr + 20(0.047) tons/yr = 2.39 weighted tons/yr

Transaction 2

0.47 tons/yr + 0.02 tons/yr + 20(0.028) tons/yr = 1.05 weighted tons/yr

Only a fraction of each of the annual weighted surplus emission reductions from the two transactions is used to determine the total annual weighted surplus emission reductions for project cost effectiveness. This fraction is the project life associated with each transaction over the total project life.

(2/5 * 2.39 tons/yr) + (3/5 * 1.05 tons/yr) = 1.59 tons/yr

Annualized Cost:
Project Life: 5 years

CRF (Table B-1) = 0.225

Formula C-14: Incremental Cost

$18,000 * 0.85 = $15,300

Formula C-12: Annualized Cost

$15,300 * 0.225 = $3,443/yr

Cost-Effectiveness:
Formula C-1: Cost-Effectiveness of Weighted Surplus Emission Reductions ($/weighted ton)

($3,433/yr)/(1.59 weighted ton/yr)

= $2,165/weighted ton of surplus emissions reduced

The cost-effectiveness for the example is less than $16,000 per weighted ton of pollutants reduced. This project qualifies for up to $15,300 of grant funds requested.

IX. Light-Duty Vehicles

This section provides examples of calculations for determining the cost-effectiveness of surplus emission reductions for light-duty vehicle projects.

Example 1 - Conventional VAVR Project

A district pays $750 to an enterprise operator to retire a 1980 light-duty vehicle in 2008. Added district costs including vehicle identification and testing are $125 for a total cost of $875.

Emissions Reduction: Table D-1 lists the default emission reductions over the 3 year project life in pounds for 2008.

- ROG_{Total} = 149.8 pounds over 3 years
  = (149.8 lb)/[(3 yrs)*(2000 lb/ton)]
  = 0.02497 tons/yr ROG
- NOx = 99.8 pounds over 3 years
  = (99.8 lb)/[(3 yrs)*(2000 lb/ton)]
  = 0.01663 tons/yr NOx
- PM10 = 1.16 pounds over 3 years
  = (1.16 lb)/[(3 yrs)*(2000 lb/ton)]
  = 0.000193 tons/yr PM10

Annual Weighted Surplus Emission Reductions: 0.02497 + 0.01663 + 20*(0.000193)
= 0.04546 weighted tons/yr

Project Life: 3 years CRF: 0.360 **based on 4% interest** Total Cost: $875

Annualized Cost: 0.360 * $875 = $315/yr

Cost-Effectiveness: ($315/yr)/(0.04546 weighted tons/yr) = **$6,929**/weighted ton

Example 2 – High Emitter VAVR Project, Unknown Replacement Vehicle

ASM test results completed in 2008 on a 1986 high emitting passenger vehicle weighing 3,400 lbs are listed below. Total district costs for vehicle retiring was $1,500 including costs for identifying the vehicle and stranded costs. The replacement vehicle model year was unknown. The district program did not include PM measuring protocols but included a BAR-approved protocol for measuring evaporative emissions. Default PM emission reductions were obtained from Table D-1. Evaporative emission reductions include both the default emission reductions from Table D-1 and extra emission reductions as the vehicle failed the evaporative emissions test. The vehicle miles traveled were taken from Table D-9 and listed as 8,552 mi/yr.

Pollutant	HC_{Exh}	NOx	CO
ASM5015	1750	771	0.200
ASM2525	1600	660	0.100

Using Table D-5 conversion equations, the retired vehicle's year 1 emission rates were:

HC_{Exh}	6.1023 g/mi
NOx	2.1303 g/mi

The emission rates for the 1986 retired vehicle in years 2&3 were derived from the ASM cut points found in Table D-7 and determined as follows.

	5015			2525		
	HC_{Exh}	CO	NOx	HC_{Exh}	CO	NOx
A	67.0	0.52	850	42.1	0.32	680.0
B	212963.0	979.63	894444.5	212963.0	979.63	894444.5

Using the equation: Std. = A + B/(weight), the ASM cut points for a 3,400 lb vehicle were:

5015			2525		
HC_{Exh}	CO	NOx	HC_{Exh}	CO	NOx
129.64	0.8081	1113.07	104.74	0.6081	943.07

Using Table D-5 conversion equations, the retired vehicle's years 2&3 emission rates were:

HC_{Exh}	2.0899 g/mi
NOx	2.0633 g/mi

The fleet average emission rates for an unknown replacement vehicle in 2008 were taken from Table D-11 and are:

HC_{Exh}	0.1417 g/mi
NOx	0.3430 g/mi

Emission Reductions: (Yr 1)	HC_{Exh}	=	(6.1023 – 0.1417) x 8,552)/454 = 112.28 lb/yr	
	NOx	=	(2.1303 – 0.3430) x 8,552)/454 = 33.67 lb/yr	
Emission Reductions: (Yr 2 & 3)	HC_{Exh}	=	(2.0899 – 0.1417) x 8,552)/454 = 36.70 lb/yr	
	NOx	=	(2.0633 – 0.3430) x 8,552)/454 = 32.41 lb/yr	
Emission Reductions: (Yr 1, 2, & 3)	HC_{Evap}	=	44.7lb/3 yr + 3*14.5/yr	= 88.2 lb/3 yr
	PM	=	1.33 lb/3 Yr	
Total Reductions:	HC_{Exh}	=	112.28 + 2 x 36.70	= 185.68 lb/3yr

HC_{Evap}	=	88.2 lb/3 yr	
NOx	=	33.67 + 2 x 32.41	= 98.49 lb/3yr
PM	=	1.33 lb/3yr	

Annual Weighted Surplus Emission Reductions: (185.68/3 + 88.2/3 + 98.49/3 + 20*(1.33/3))/2000 = 0.0665 weighted tons/yr

Project Life: 3 years CRF: 0.360 Total Cost: $1,500

Annualized Cost: 0.360 * $1,500 = $540/yr

Cost Effectiveness: $540/0.0665 tons = **$8,121** per weighted ton

Example 3 – High Emitter VAVR Project, LEV Replacement Vehicle

In 2009, a 1984 high emitting vehicle weighing 3,400 lbs was retired and replaced by a 2004 ARB-certified low emission vehicle (LEV), as specified in the district contract with the owner. The results of the retired vehicle's ASM test are noted below. The district's VAVR program did not include protocols for measuring PM but included a BAR-approved protocol for measuring evaporative emissions. Default PM emission reductions were obtained from Table D-2. Evaporative emission reductions include both the default emission reductions from Table D-2 and extra emission reductions as the vehicle failed the evaporative emissions test. The vehicle miles traveled averaged over the last prior two years were documented by the district to be 10,042 mi/yr. The total cost to the district was $2,650 which included an extra $1,000 incentive toward the purchase of the LEV.

Pollutant	HC_{Exh}	NOx	CO	
	ASM5015	1750	771	0.200
	ASM2525	1600	660	0.100

Using Table D-5 conversion equations, the retired vehicle's year 1 emission rates were:

HC_{Exh}	6.1023 g/mi
NOx	2.1303 g/mi

The emission rates for the 1984 retired vehicle in years 2&3 were derived from the ASM cut points found in Table D-7 and were determined to be:

	5015			2525		
	HC_{Exh}	CO	NOx	HC_{Exh}	CO	NOx
A	67.0	0.52	850	42.1	0.32	680.0
B	212963.0	979.63	894444.5	212963.0	979.63	894444.5

Using the equation Std. = A + B/(weight), ASM cut points for a 3,400 lb vehicle were:

5015			2525		
HC_{Exh}	CO	NOx	HC_{Exh}	CO	NOx
129.64	0.8081	1113.07	104.74	0.6081	943.07

Using Table D-5 conversion equations, the retired vehicle's years 2&3 emission rates were:

HC_{Exh}	2.0899 g/mi
NOx	2.0633 g/mi

The 2004 LEV replacement vehicle emission rates in 2009 were from Table D-12 and are:

HC_{Exh}	0.0448 g/mi
NOx	0.1678 g/mi

Emission Reductions: (Yr 1)	HC_{Exh}	=	(6.1023 – 0.0448) x 10,042)/454 = 133.99 lb/yr
	NOx	=	(2.1303 – 0.1678) x 10,042)/454 = 43.41 lb/yr
Emission Reductions: (Yr 2 & 3)	HC_{Exh}	=	(2.0899 – 0.0448) x 10,042)/454 = 45.24 lb/yr
	NOx	=	(2.0633 – 0.1678) x 10,042)/454 = 41.93lb/yr
Emission Reductions: (Yr 1, 2, & 3)	PM	=	1.36 lb/3 Yr
	HC_{Evap}	=	52.5 lb/3 yr + 3*14.5/yr = 96.0 lb/3 yr
Total Reductions:	HC_{Exh}	=	133.99 + 2 x 45.24 = 224.47 lb/3yr
	HC_{Evap}	=	96.0 lb/3 yr
	NOx	=	43.41 + 2 x 41.93 = 127.27 lb/3yr
	PM	=	1.36 lb/3yr

Annual Weighted Surplus Emission Reductions: (224.47/3 + 96.0/3 + 127.27/3 + 20*(1.36/3))/2000 = 0.07916 weighted tons/yr

Project Life: 3 years CRF: 0.360 Total Cost: $2,650

Annualized Cost: 0.360 * $2,600 = $936/yr

Cost Effectiveness: $936/0.07916 weighted tons = **$11,824** per weighted ton

Example 4 – High Emitter VRV Project

A 3,800 lb high emitting 1994 passenger vehicle was brought in for repair assistance in 2008. The repair brought the vehicle into compliance with the Smog Check emissions standards for the vehicle's model year and vehicle class. The total cost of repair was $637. Additional program costs of $1,300 per vehicle included remote sensing for vehicle identification and a systematic diagnosis prior to repair. As this program did not include protocols for measuring PM or evaporative emissions, PM reductions were not quantified. Default evaporative emission reductions were added pursuant to section C.2. of Chapter VIII The vehicle miles traveled of 10,128 mi/yr were from Table D-9. ASM Standards were calculated following the methodology used in Example 2. The pre and post ASM test results and standard were:

	ASM 2525			ASM 5015		
	HC_{Exh}	NOx	CO	HC_{Exh}	NOx	CO
Pre	1870	945	0.178	2070	854	0.306
Post	45	437	0.090	75	487	0.150
Std.	48	704	0.454	83	688	0.481

Using the conversion equations from Table D-5, the pre-repair ASM test results converted to emission rates were:

HC	14.5658 g/mi
NOx	1.1784 g/mi

Using the conversion equations from Table D-5, the post-repair ASM test results converted to emission rates were:

HC	0.5527 g/mi
NOx	0.8477 g/mi

Emission Reductions:

HC_{Exh} = (14.5658 – 0.5527) x 10,128/454 = 312.61 lb/yr

HC_{Evap} = 14.5 lb/yr

NOx = (1.1784 – 0.8477) x 10,128/454 = 7.38 lb/yr

Annual Weighted Surplus Emission Reductions: (312.61 + 14.5 + 7.38 + 20*(0))/2000 = 0.1672 weighted tons/yr

Project Life: 1 year CRF: 1.00 Total Cost: $1,937

Annualized Cost: 1 x $1,937 = $1,937/yr

Cost Effectiveness: $1,937/0.1672 tons = **$11,585** per weighted ton reduced

Example 5 High Emitter VAVR Projects – Two Speed Idle

An un-tampered 1981 passenger vehicle with exhaust gas recirculation, a 268 cid engine, and a VMT of 6,632 mi/yr is tested by the TSI test on June 2, 2008. The total cost for scrapping was $1,500. As TSI tests do not measure PM and NOx, no NOx emission reductions are included, and default PM emission reductions are assumed. No evaporative emission testing is done, so default evaporative emission reductions are assumed. The following TSI test results were obtained after dilution corrected according to the BAR protocol. TSI pass/fail standards were obtained from Table D-8.

TSI Test	Results	Standards
High Speed Idle HC	650 ppm	120 ppm
High Speed Idle CO	3.0 %	1.5 %
Low Speed Idle HC	2000 ppm	150
Low Speed Idle CO	0.0000 %	1.5 %

TSI test results exceed TSI standards, and the vehicle is a high emitter. Consistent with BAR's TSI protocol, the low speed idle CO value of 0.0000% is replaced by 0.0100 % before using Table D-6 equations to convert TSI readings to an FTP HC_{exh} emission rate. The predicted FTP HC_{Exh} emission rate is 24.7013 g/mi. Note: Using an exel spreadsheet to calculate the AGE term, vehicles "birth" date, 01/01/1981, is subtracted from the TSI test date, 06/02/2008, and divided by 365 before subtracting 9.0570. The retired vehicle's years 2&3 predicted FTP HC emission rate is derived from Table D-8's TSI standard HC_{Exh} emission rate, calculated using Table D-6 equations, and is 3.4275 g/mi.

The fleet average HC emission rate for an unknown replacement vehicle in 2008 is taken from Table D-11 and is:

HC_{Exh} = 0.1417 g/mi

Emission Reductions: (Yr 1) HC_{Exh} = (24.7013 – 0.1417) x 6,632/454 = 358.76 lb/yr

Emission Reductions: (Yr 2 & 3) HC_{Exh} = (3.4275 – 0.1417) x 6,632)/454 = 48.00 lb/yr

Emission Reductions: (Yr 1, 2, & 3)
PM = 1.33 lb/3 yr
HC_{Evap} = 58.9 lb/3 yr

Total Reductions:
HC_{Exh} = 358.76 + 2 x 48.00 = 454.76 lb/3yr
HC_{Evap} = 58.9 lb/3 yr
PM = 1.33 lb/3yr

Annual Weighted Surplus Emission Reductions: (454.76/3 + 58.9/3 + 20*(1.33/3))/2000 = 0.09004 weighted tons/yr

Project Life: 3 years CRF: 0.360 Total Cost: $1,500

Annualized Cost: 0.360 * $1,500 = $540/yr

Cost Effectiveness: $540/0.09004 tons = **$5,997** per weighted ton reduced

Example 6 High Emitter VRV Projects – Two Speed Idle

Using the information in Example 5, evaporative emissions and emission control repairs brought the vehicle into compliance with both the low-pressure evaporative test and the TSI emission standard for hydrocarbon. The total cost to the district for the repair of the vehicle was $637. Default PM and evaporative emission reductions are assumed. The pre-repair TSI test result converted to an emission rate is:

$$HC_{Exh} = 24.7013 \text{ g/mi}$$

Using the conversion equations from Table D-6, the post-repair emission rate is derived from the TSI standard from Table D-8 and is:

$$HC_{Exh} = 3.4275 \text{ g/mi}$$

Emission Reductions: HC_{Exh} = (24.7013 – 3.4275) x 6,632/454 = 310.77 lb/yr
HC_{Evap} = 14.5 lb/yr

Annual Weighted Surplus Emission Reductions: (310.77 + 14.5)/2000
= 0.1626 weighted tons/yr

Project Life: 1 year CRF: 1.00 Total Cost: $637

Annualized Cost: 1 x $637 = $637/yr

Cost Effectiveness: $637/0.1626 tons = **$3,917** per weighted ton

APPENDIX F

DESCRIPTION OF CERTIFICATION AND VERIFICATION

I. New Engine Certification

The Air Resources Board (ARB) certifies engines destined for sale in California and provides the engine manufacturers with an Executive Order (EO) for each certified engine family. An example of an EO is shown in Figure F-1. The EO includes general information about the certified engine such as engine family, displacement, horsepower rating(s), intended service class, and emission control systems. It also shows the applicable certification emission standards as well as the average emission levels measured during the actual certification test procedure. For the purpose of the Carl Moyer Program, the certification emission standards are used to calculate emission reductions. The certification emission standards are shown in the row titled "(DIRECT) STD" under the respective "FTP" column headings for each pollutant. For instance, the Cummins 8.3 liter natural gas engine illustrated in Figure F-1 was certified to a combined oxides of nitrogen plus non-methane hydrocarbon (NOx+NMHC) emission standard of 1.8 g/bhp-hr, a carbon monoxide (CO) emission standard of 15.5 g/bhp-hr, and a particulate matter (PM) emission standard of 0.03 g/bhp-hr.

In the case where an EO shows emission values in the rows labeled "AVERAGE STD" and/or "FEL", the engine is certified for participation in an averaging, banking, and trading (AB&T) program. AB&T engines (i.e., all FEL-certified engines) are not eligible to participate in the CMP for new vehicle purchase projects since emission benefits from an engine certified to an FEL level are not surplus emissions.

II. Retrofit System Verification

The ARB's verification procedures provide a way to thoroughly evaluate the emission reduction capabilities and durability of a variety of emission control strategies as part of a retrofit in-use program. It ensures that emission reductions achieved by a control strategy are both real and durable and that production units in the field are achieving emission reductions which are consistent with their verification.

The ARB has a verification procedure for in-use strategies to control emissions from diesel engines (diesel emission control systems or DECS). The verification procedure requires a minimum PM reduction of at least 25 percent. If a diesel emission control strategy also reduces NOx emissions by at least 15 percent, that reduction can also be verified. Emission control strategies for diesel engines are verified based on a tiered verification classification shown in Table F-1 below. It is the responsibility of the diesel emission control strategies manufacturer to provide data to verify emission reduction claims. The ARB issues Executive Orders for verified emission control strategies destined for sale in California. An example of an EO for a retrofit emission control system for diesel engines is shown in Figure F-2.

Figure F-1
Sample Executive Order

ARB Executive Order
for Heavy-Duty On-Road Engines

California Environmental Protection Agency AIR RESOURCES BOARD	CUMMINS INC.	EXECUTIVE ORDER A-021-0340 New On-Road Heavy-Duty Engines

Pursuant to the authority vested in the Air Resources Board (ARB) by Health and Safety Code (HSC) Division 26, Part 5, Chapter 2; and pursuant to the authority vested in the undersigned by HSC Sections 39515 and 39516 and Executive Order (EO) G-02-003; and

Pursuant to the December 15, 1998 Settlement Agreement (SA) between ARB and the manufacturer, and any modifications thereof to the Settlement Agreement;

IT IS ORDERED AND RESOLVED: That the engine and emission control systems produced by the manufacturer are certified as described below for use in on-road motor vehicles with a manufacturer's GVWR over 14,000 pounds. Production engines shall be in all material respects the same as those for which certification is granted.

MODEL YEAR	ENGINE FAMILY	ENGINE SIZE (liter)	FUEL TYPE (CNG/LNG=compressed/liquefied natural gas; LPG=liquefied petroleum gas)	STANDARDS & TEST PROCEDURE	INTENDED SERVICE CLASS (L/M/H HDD=light/medium/heavy heavy-duty [HD] diesel; UB=urban bus; HDO=HD Otto)
2003	3CEXH0505CBK	8.3	CNG / LNG	Diesel	UB

SPECIAL FEATURES & EMISSION CONTROL SYSTEMS	ENGINE MODELS / CODES (rated power in horsepower, hp)
TBI, OC, HO2S, TC, CAC, PCM	CG-280 / 8012 (280 hp), CG-275 / 8009 (275 hp), CG-250 / 8006 (250 hp), CG-250 / 8003 (250 hp)

GVWR=gross vehicle weight rating TWC/OC=three-way/oxidizing catalyst WU (prefix) =warm-up cat. O2S=oxygen sensor HO2S=heated O2S TBI=throttle body fuel injection MFI=multi port fuel injection SFI=sequential MFI DDI/IDI=direct /indirect diesel injection TC/SC=turbo/super charger CAC=charge air cooler EGR=exhaust gas recirculation AIR=secondary air injection PAIR=pulsed AIR SPL=smoke puff limiter ECM/PCM=engine /powertrain control module EM=engine modification 2 (prefix)=parallel (2) (suffix)=in series HC=hydrocarbon NMHC=non-methane HC NOx=oxides of nitrogen CO=carbon monoxide PM=particulate matter HCHO=formaldehyde g/bhp-hr=grams per brake horsepower-hour

The following are the exhaust emission standards (STD), or family emission limit(s) (FEL) as applicable, and certification levels (CERT) for this engine family under the "Federal Test Procedure" (FTP) (Title 13, California Code of Regulations, (13 CCR) Section 1956.1 (urban bus) or 1956.8 (other than urban bus)), and under the "Euro III Test Procedure" (EURO) in the Settlement Agreement, including EURO's "Not-to-Exceed" standard(s). "Diesel" CO certification compliance may have been demonstrated pursuant to Code of Federal Regulations, Title 40, Part 86, Subpart A, Section 86.091-23(c)(2)(i) in lieu of testing. (For flexible- and dual-fueled engines, the CERT values in brackets [.] are those when tested on conventional test fuel. For multi-fueled engines, the STD and CERT values for default operation permitted in 13 CCR Section 1956.1 or 1956.8 are in parentheses.)

	EURO'S NOT-TO-EXCEED STD						NMHC: *		NOx: *		NMHC+NOx: 2.25		PM: 0.0375	
* = not applicable	HC		NMHC		NOx		NMHC+NOx		CO		PM		HCHO	
	FTP	EURO	FTP	EURO	FTP	EURO	FTP	EURO	FTP	EURO	FTP	EURO	FTP	EURO
(DIRECT) STD	*	*	*	*	*	*	1.8	1.8	15.5	15.5	0.03	0.03	*	*
AVERAGE STD	*	*	*	*	*	*	*	*	*	*	*	*	*	*
FEL	*	*	*	*	*	*	*	*	*	*	*	*	*	*
CERT	*	*	*	*	*	*	1.7	1.4	2.0	1.3	0.01	0.005	*	*

BE IT FURTHER RESOLVED: That certification to the FEL(s) listed above, as applicable, is subject to the following terms, limitations and conditions. The FEL(s) is the emission level declared by the manufacturer and serves in lieu of an emission standard for certification purposes in any averaging, banking, or trading (ABT) programs. It will be used for determining compliance of any engine in this family and compliance with such ABT programs.

BE IT FURTHER RESOLVED: That the listed engine models have been certified to the FTP optional NOx, or NMHC+NOx as applicable, and PM emission standard(s) listed above pursuant to 13 CCR Section 1956.1 or 1956.8.

BE IT FURTHER RESOLVED: That for the listed engine models, the manufacturer has submitted the materials to demonstrate certification compliance with 13 CCR Sections 1965 (emission control labels), and 2035 et seq. (emission control warranty).

BE IT FURTHER RESOLVED: That the listed engine models are conditionally certified subject to the following conditions: (1) The SA is in effect; (2) The manufacturer is in compliance with all applicable California emission regulations, and all SA's applicable requirements and any modifications thereof; (3) This EO is void with respect to any engine within this family determined to have a defeat device as that term is defined in the test procedures and SA. Any engine produced under the voided EO remains subject to stipulated penalties under the SA. Such penalties would begin to accrue upon manufacture of the first engine under this EO; (4) This EO expires at midnight on December 31, 2002; (5) Production of any engine within this family under this EO is acceptance of all conditions in this EO; and (6) ARB reserves the right to disapprove certification of this family, or any families using the same or similar auxiliary emission control device (AECD) strategies as this family is employing, based on all available information.

The Bureau of Automotive Repair will be notified by copy of this Executive Order.
Executed at El Monte, California on this 2nd day of October 2002.

Allen Lyons, Chief
Mobile Source Operations Division

Table F-1
Verification Levels for Diesel Emission Control Strategies

Pollutant	Emission Reduction	Classification
PM	< 25%	Not Verified
	≥ 25%	Level 1
	≥ 50%	Level 2
	≥ 85%, or ≤ 0.01 g/bhp-hr	Level 3
NOx	< 15%	Not Verified
	≥ 15%	Verified in 5% Increments

ARB staff also has a retrofit verification procedure for large spark-ignited engines (LSI). This procedure can be used to verify retrofit systems to reduce NOx and HC emissions from LSI engines. Emission control strategies for LSI engines are verified based on a tiered verification classification shown in Table F-2 below.

Table F-2
LSI Emission Control System Verification Levels

Classification	Percentage Reduction (HC+NOx)	Absolute Emissions (HC+NOx)
LSI Level 1 (1)	> 25% (2)	Not Applicable
LSI Level 2 (1)	> 75% (3)	3.0 g/bhp-hr (3)
LSI Level 3a (1)	> 85% (4)	0.5, 1.0, 1.5, 2.0, 2.5 g/bhp-hr
LSI Level 3b (5)	Not Applicable	0.5, 1.0, 1.5, 2.0 g/bhp-hr

Notes:
(1) Applicable to uncontrolled engines only
(2) The allowed verified emissions reduction is capped at 25% regardless of actual emission test values
(3) The allowed verified reduction for LSI Level 2 is capped at 75% or 3.0 g/bhp-hr regardless of actual emission test values
(4) Verified in 5% increments, applicable to LSI Level 3a classifications only
(5) Applicable to emission-controlled engines only

Figure F-2
Example of an EO for a Retrofit Emission Control System

State of California
AIR RESOURCES BOARD

EXECUTIVE ORDER DE-04-006-05

Pursuant to the authority vested in the Air Resources Board (ARB) by Health and Safety Code, Division 26, Part 5, Chapter 2; and pursuant to the authority vested in the undersigned by Health and Safety Code Section 39515 and 39616 and Executive Order G-02-003;

Relating to Exemptions under Section 27156 of the Vehicle Code, and Verification under Sections 2700 through 2710 of Title 13 of the California Code of Regulations

Johnson Matthey, Inc.
Continuously Regenerating Technology (CRT®) Particulate Filter

ARB has reviewed Johnson Matthey, Inc.'s request for verification of the CRT® Particulate Filter. Based on an evaluation of the data provided, and pursuant to the terms and conditions specified below, the Executive Officer of ARB hereby finds that the CRT® Particulate Filter reduces emissions of diesel particulate matter (PM) consistent with a Level 3 device (greater than or equal to 85 percent reductions) (Title 13 California Code of Regulations (CCR) Sections 2702 (f) and (g) and Section 2708). Accordingly, the Executive Officer determines that the system merits verification and, subject to the terms and conditions specified below, classifies the CRT® Particulate Filter as a Level 3 system, for the applications listed in Table 1 and engine families listed in Attachment 1.

Table 1: Appropriate Applications for the CRT® Particulate Filter

Diesel Emission Control Strategy	Application
CRT® Particulate Filter	All On-Road Applications only

The aforementioned verification is subject to the following terms and conditions:

- The engines are originally manufactured from model year 1994 through 2006 having the engine family numbers listed in Attachment 1.
- The engines do not employ exhaust gas recirculation, except for those engine families specified in Table 2 of Attachment 1.
- The engines are not used in a hybrid (e.g., diesel/electric) configuration.
- The application must have a duty cycle with an average temperature profile greater than 260 degrees Celsius for 40 percent of the operating cycle.
- The engine may or may not have a pre-existing original equipment manufacturer oxidation catalyst.
- The engine must not have a pre-existing diesel particulate filter.

1

- The engine must be certified in California for on-road applications.
- The engine must be certified at a PM emission level of at most 0.1 grams per brake horsepower-hour (g/bhp-hr), and greater than 0.01 g/bhp-hr.
- The engine must be four-stroke.
- The engine must be turbocharged.
- The engine can be mechanically or electronically injected.
- The engine should be well maintained and not consume lubricating oil at a rate greater than that specified by the engine manufacturer.
- Lube oil, or other oil, should not be mixed with the fuel.
- The engine must be operated on:
  - diesel fuel (e.g. not alternative diesel fuels) with a sulfur content of no more than 15 parts per million by weight or
  - B20 defined, based on volume, as a mixture of 20 percent neat biodiesel (B100) that complies with ASTM D6751 and 80 percent diesel (e.g. not alternative diesel fuels) with a sulfur content of no more than 15 parts per million by weight.
- The other terms and conditions specified below.

IT IS ALSO ORDERED AND RESOLVED: That installation of the CRT® Particulate Filter, manufactured by Johnson Matthey, Inc. of 380 Lapp Road, Malvern, Pennsylvania 19355, has been found not to reduce the effectiveness of the applicable vehicle pollution control system, and therefore, the CRT® Particulate Filter is exempt from the prohibitions in Section 27156 of the Vehicle Code for installation on heavy-duty on-road vehicles listed in Attachment 1.

This exemption is only valid provided the engines meet the aforementioned conditions.

The CRT® Particulate Filter basic design is a diesel oxidation catalyst followed by a diesel particulate filter and a backpressure monitor. The major components of the CRT® Particulate Filter are identified in Attachment 2.

This Executive Order is valid provided that installation instructions for the CRT® Particulate Filter do not recommend tuning the vehicle to specifications different from those of the vehicle manufacturer.

Changes made to the design or operating conditions of the CRT® Particulate Filter, as exempted by ARB, which adversely affect the performance of the vehicle's pollution control system, shall invalidate this Executive Order.

No changes are permitted to the device. The ARB must be notified in writing of any changes to any part of the CRT® Particulate Filter. Any changes to the device must be evaluated and approved by ARB. Failure to do so shall invalidate this Executive Order.

Marketing of the CRT® Particulate Filter using identification other than that shown in this Executive Order or for an application other than that listed in this Executive Order shall be prohibited unless prior approval is obtained from ARB.

This Executive Order shall not apply to any CRT® Particulate Filter advertised, offered for sale, sold with, or installed on a motor vehicle prior to or concurrent with transfer to an ultimate purchaser.

As specified in the Diesel Emission Control Strategy Verification Procedure (Title 13 CCR Section 2706 (g)), the ARB assigns each Diesel Emission Control Strategy a family name. The designated family name for the verification as outlined above is: CA/JMI/2001/PM3/N00/ON/DPF01.

Additionally, as stated in the Diesel Emission Control Strategy Verification Procedure, Johnson Matthey, Inc. is responsible for honoring the required warranty (Section 2707) and conducting in-use compliance testing (Section 2709).

In addition to the foregoing, ARB reserves the right in the future to review this Executive Order and the exemption and verification provided herein to assure that the exempted and verified add-on or modified part continues to meet the standards and procedures of CCR, Title 13, Section 2222, et seq and CCR, Title 13, Sections 2700 through 2710.

Systems verified under this Executive Order shall conform to all applicable California emissions regulations.

This Executive Order does not release Johnson Matthey from complying with all other applicable regulations.

Violation of any of the above conditions shall be grounds for revocation of this Executive Order.

Executed at El Monte, California, this 15th day of August 2005.

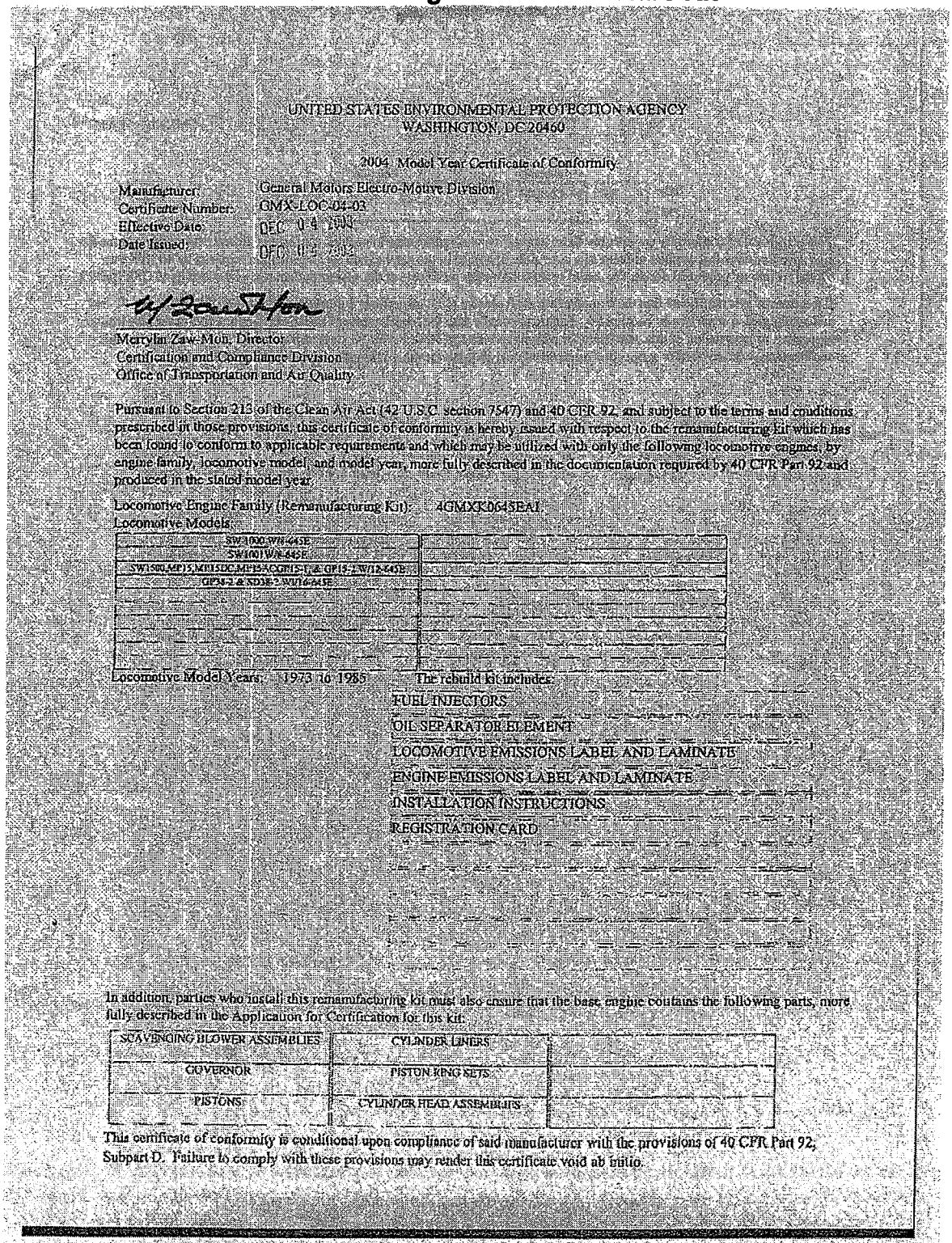
//s//

Robert H. Cross, Chief
Mobile Source Control Division

Attachment 1: ARB Approved Model Year 1994 to 2006 Engine Families for the CRT® Particulate Filter

Attachment 2: Part Numbers and Model Numbers of the CRT® Particulate Filter and Standard Part Numbers of Backpressure Monitor

Figure F-3
Example of U.S. EPA Certificate of Conformity for a Locomotive Engine Remanufacture Kit



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, DC 20460

2004 Model Year Certificate of Conformity

Manufacturer: General Motors Electro-Motive Division
Certificate Number: GMX-LOC-04-03
Effective Date: DEC 0 9 2003
Date Issued: DEC 11 2003

Merrylin Zaw-Mon, Director
Certification and Compliance Division
Office of Transportation and Air Quality

Pursuant to Section 213 of the Clean Air Act (42 U.S.C. section 7547) and 40 CFR 92, and subject to the terms and conditions prescribed in those provisions, this certificate of conformity is hereby issued with respect to the remanufacturing kit which has been found to conform to applicable requirements and which may be utilized with only the following locomotive engines, by engine family, locomotive model, and model year, more fully described in the documentation required by 40 CFR Part 92 and produced in the stated model year.

Locomotive Engine Family (Remanufacturing Kit): 4GMXK0643EAI

Locomotive Models:

SW1000,WH-645E	
SW1001,WH-645E	
SW1500,MP15,MP15DC,MP15AC,GP15-1 & GP15-2,WH-645E	
GP38-2 & SD38-2,WH-645E	

Locomotive Model Years: 1973 to 1985

The rebuild kit includes:

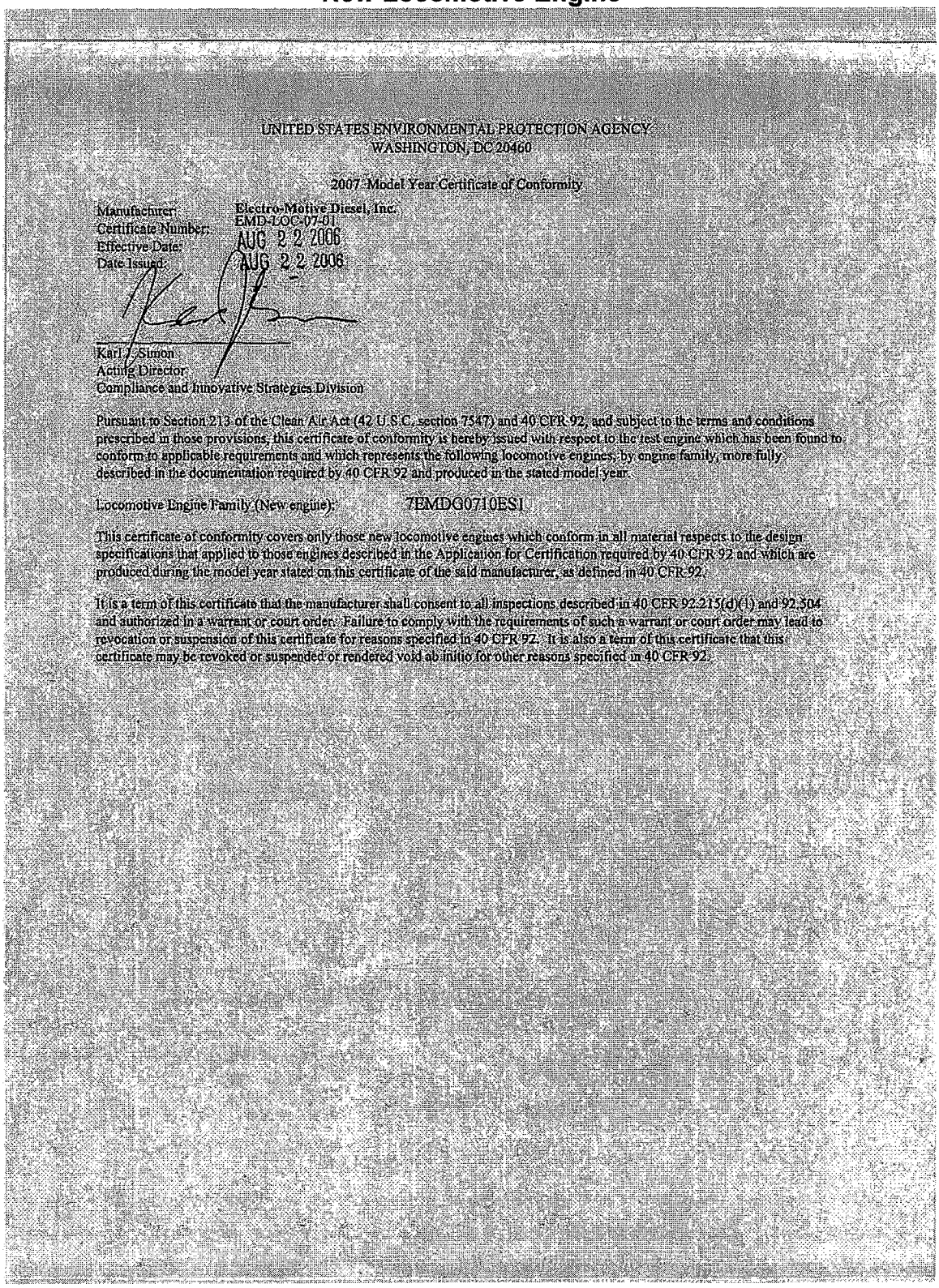
FUEL INJECTORS
OIL SEPARATOR ELEMENT
LOCOMOTIVE EMISSIONS LABEL AND LAMINATE
ENGINE EMISSIONS LABEL AND LAMINATE
INSTALLATION INSTRUCTIONS
REGISTRATION CARD

In addition, parties who install this remanufacturing kit must also ensure that the base engine contains the following parts, more fully described in the Application for Certification for this kit:

SCAVENGING BLOWER ASSEMBLIES	CYLINDER LINERS	
GOVERNOR	PISTON RING SETS	
PISTONS	CYLINDER HEAD ASSEMBLIES	

This certificate of conformity is conditional upon compliance of said manufacturer with the provisions of 40 CFR Part 92, Subpart D. Failure to comply with these provisions may render this certificate void ab initio.

Figure F-4
Example of U.S. EPA Certificate of Conformity for a New Locomotive Engine



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, DC 20460

2007 Model Year Certificate of Conformity

Manufacturer: Electro-Motive Diesel, Inc.
Certificate Number: EMD-LOC-07-01
Effective Date: AUG 22 2006
Date Issued: AUG 22 2006

Karl J. Simon
Acting Director
Compliance and Innovative Strategies Division

Pursuant to Section 213 of the Clean Air Act (42 U.S.C. section 7547) and 40 CFR 92, and subject to the terms and conditions prescribed in those provisions, this certificate of conformity is hereby issued with respect to the test engine which has been found to conform to applicable requirements and which represents the following locomotive engines, by engine family, more fully described in the documentation required by 40 CFR 92 and produced in the stated model year.

Locomotive Engine Family (New engine): 7EMDG0710ES1

This certificate of conformity covers only those new locomotive engines which conform in all material respects to the design specifications that applied to those engines described in the Application for Certification required by 40 CFR 92 and which are produced during the model year stated on this certificate of the said manufacturer, as defined in 40 CFR 92.

It is a term of this certificate that the manufacturer shall consent to all inspections described in 40 CFR 92.215(d)(1) and 92.504 and authorized in a warrant or court order. Failure to comply with the requirements of such a warrant or court order may lead to revocation or suspension of this certificate for reasons specified in 40 CFR 92. It is also a term of this certificate that this certificate may be revoked or suspended or rendered void ab initio for other reasons specified in 40 CFR 92.

APPENDIX G

MINIMUM REQUIREMENTS FOR ELECTRONIC MONITORING DEVICES

This appendix provides the minimum required specifications for electronic monitoring units (EMU) required to be installed on fleet modernization and locomotive projects. Although not required by the Carl Moyer Program Guidelines, districts may choose to require the installation of an EMU system with each new engine for other source categories.

The full purchase of the EMU (including warranty, data retrieval, compilation, and transmission to the district, and the installation cost) is eligible for Carl Moyer Program funding, and may be included when calculating project cost-effectiveness. The following are minimum specifications for the districts to follow. Districts may allow projects with EMUs installed that meet these minimum specifications to complete all reporting through the electronic data system. A district may require additional specifications and/or more stringent specifications at its discretion.

Minimum Specifications

When is the EMU required to operate?

The EMU must be powered at all times during vehicle/equipment operation. If the EMU is battery powered, the battery life must be long enough to ensure the EMU is charged and functional each time the vehicle/equipment is operated.

What will the EMU track?

The EMU must track the geographic position and either the operated hours or the mileage traveled, or both, of the vehicle/equipment.

All data must be recorded while the vehicle/equipment is in operation. The vehicle/equipment position must be updated upon startup and at least once every 30 minutes during vehicle/equipment operation. The time-to-first-fix should be no longer than five minutes.

How must the EMU store and transmit collected data?

The collected data must be provided to the district on a periodic basis, or, at the discretion of the district, the data may be transmitted directly to the district in real-time. The EMU must include either the capability to automatically transmit the stored data from the vehicle/equipment, or enable downloading of the stored data through a port in the device. If the storage method is used, the EMU must have the capacity to store as much data as is necessary to ensure that data is not

over-written prior to any scheduled data retrieval. At the discretion of the district, the stored data may be encrypted, or otherwise protected, and require a password distributed only to the district and ARB.

What data must be recorded?

The EMU must store the time, date, position, elapsed time since last recorded position, elapsed operated hours since last recorded position, and accrued mileage since last recorded position (required for fleet modernization projects). The positional data stored and transmitted must either be accompanied by software which will code raw positional data using the following codes, or directly transmit the positional data pre-coded into these zones;

1. Whether or not the position is in the district boundary (including district coastal boundary for marine projects).
2. Whether or not the position is in California (including its coastal waters).
3. Whether or not the position is outside California (including its coastal waters).
4. Other zones within the district, or other districts in California, may be specified at the discretion of the district.

How often must the collected data be provided to the district?

Periodically (preferably on a monthly basis, but at least quarterly for fleet modernization projects and annually for all other projects), the data must be downloaded and transmitted to the district in an electronic format specified by the district.

What information must be provided to the district?

For each vehicle/equipment the submitted data shall include at least:

- Grant ID number. *(Optional)*
- Vehicle ID, Equipment ID, or Vessel ID.
- Date of download.
- Total accumulated miles and/or hours operated by coded zone described above. All data collected must be reported regardless of whether hours or miles or both were recorded.
- Date and time that any failure or malfunction of the EMU occurred.
- Time periods, if any, that the EMU was not operational.
- Fuel consumption. This is optional, and is not required to be monitored by the EMU. However, liquefied natural gas-diesel and other dual fuel locomotive projects, marine projects, and other fuel based projects are required to monitor and report fuel consumption in their annual reports, as specified in the revised Carl Moyer Guidelines.

How long must the collected data be submitted to the district?

Data collected must be submitted to the district for the lesser of five years or the project life. As noted above, districts may allow projects with EMUs installed to complete all reporting through the electronic data system. For the remainder of the projects life, if any, reporting may continue to be completed through the electronic system, although this is not required. However, reporting must continue to be completed as required in the revised Carl Moyer Guidelines.

How rugged must the EMU be?

The EMU must be tamperproof and be rugged enough to withstand the operating environment of the vehicle/equipment for the expected life of the project, if installed per the manufacturer's instructions.

What are the warranty requirements?

The EMU must have a full repair or equivalent replacement warranty for 5 years. If the project life is less than five years, the warranty may equal the project life. It the project life is longer than 5 years the contract may also contain an option for the participant to extend the warranty beyond the minimum amount (with district approval). This extended warranty may be included when calculating cost-effectiveness for Carl Moyer funding eligibility. The reporting must continue to be completed through the electronic system for the extent of the warranty.

What data must be provided in the event the EMU fails?

The EMU must accurately track vehicle/equipment position and activity during the operation of the vehicle/equipment. If the unit fails to record as described above for a period exceeding 5 percent of the annual reporting period the participant is required to submit as part of the annual report documentation of the vehicle/equipment activity during the missing time period.

Can these minimum specifications be modified by the district?

It will be the responsibility of the district to assure that participants install, operate and report data using the EMU in accordance with these specifications and the requirements contained in the revised Carl Moyer Guidelines. On a case-by-case basis, and with ARB's approval, for projects in which an EMU meeting these specifications is either not available for the vehicle/equipment, or results in additional costs exceeding 10 percent of the project cost (excluding the cost of the EMU), some of these specifications may be modified or deleted, or monitoring and reporting may be allowed using prior ARB approved methods. The district must justify the request for such an exemption, including a demonstration that a reasonable effort (such as an RFP or other means) was made to contract with a supplier for an EMU meeting the minimum specifications.

What about projects in which an EMU is already installed on the vehicle/equipment?

On a case-by-case basis, for projects in which an EMU is already in place on the vehicle/equipment, at the option of the participant and the district, that EMU may be utilized and some of these specifications may be modified or deleted, as approved by ARB. In such cases, it will be the responsibility of the participant to provide information on the specifications of the EMU system and to maintain the EMU system in working condition for the lesser of five years or the project life.

APPENDIX H

DISTRICT BEST PRACTICES FOR PROGRAM ADMINISTRATION

I. Background

This Appendix complements 'Chapter 2 – Program Administration' by describing voluntary Best Practices that go beyond minimum Carl Moyer Program administrative requirements, and which districts can use to run more effective programs. While ARB encourages districts to include these Best Practices in their local programs where possible, not all Best Practices are equally applicable to all air districts. For example, consolidated post-inspections may not be feasible for a rural district with few projects.

Some of following Best Practices are based on Department of Finance and Bureau of State Audits recommendations provided to ARB as part of their reviews of the Carl Moyer Program. Some were requirements that have been moved from the 2005 Guidelines administration chapter to simplify district administration of the Program and provide greater operational flexibility to the districts. Others are practices being used by air districts to improve their implementation of the Carl Moyer Program. All Best Practices identified in this Addendum have end notes with their source. While the end notes may include information on districts that implement the associated best practice, the end notes are not exhaustive in listing every district that implements every best practice.

II. Responding to ARB's Carl Moyer Program Solicitation

Best Practice #1
Districts that have sufficient demand, may request Carl Moyer Program funds in excess of the tentative allocation for their district, as long as the district has sufficient district funds available to match the State Carl Moyer Program funds being requested.

Thus, if and when funds become available from other districts that are unable to accept and keep their tentative allocation, the districts requesting an excess amount are in a position to accept additional funds.[1]

Best Practice #2
The ARB encourages districts to have the district Board approve a multi-year resolution to accept Carl Moyer Program funding and implement the program consistent with the current Guidelines. Since the Carl Moyer Program is now funded through 2015, a multi-year resolution saves the district from having to draft and pass a new resolution each year.[2]

III. Reporting to ARB

Best Practice #3
Districts that commit and expend their Carl Moyer Program funds early (commit with fully executed contracts before June 30 of the first year, expend before June 30 of the second year) may complete the required annual/final report before the due date (August 31). In addition, if a district has completed the commitment (with fully executed contracts) and expenditure of Carl Moyer Program funds by June 30 of the first year, the district may complete one combined annual/final report.[3]

IV. Fiscal Tracking

Best Practice #4
While districts are required to maintain Carl Moyer Program funds in a way that tracks earned interest, the methods for doing so are left to each district. The ARB encourages districts to maintain a segregated depository account for Carl Moyer Program funds. Such an account will draw interest on only the Carl Moyer funds without the need for district staff to compute earned interest.[4]

V. District Outreach

Best Practice #5
While districts are required to market the Carl Moyer Program to all sectors in their community, the methods for doing so are left to each district. The ARB strongly encourages districts to vigorously outreach to all sectors of the community. Below are brief descriptions of the types of practices that can be included as part of a district's outreach activities.[5]

A. List of Interested Parties

Districts can maintain a list of interested parties throughout the year and mail a notification to the parties on the list when funds are available. This list should also include prior applicants, public agencies (e.g. public works departments, sanitation departments, school districts), engine dealers/distributors, and, where appropriate, port authorities and farm bureaus.

B. Local Newspaper Announcement

Districts can put a notification of funds available in local newspapers, in locally-based trade newsletters, including the local farm bureau, and in the trade journals of organizations representing zero-emission technologies such as the Clean Cities Coalition and WestStart-CALSTART.

C. Notification through District Mediums

If the district has a website, the Carl Moyer Program solicitation can be advertised on the district's website. Similarly, if the district has a newsletter, the Carl Moyer Program solicitation can be advertised in the district's newsletter. And, if the district maintains a 24-hour message line, the solicitation can also be advertised there[6]

D. Prior Participants

Districts can solicit additional projects from prior participants with successfully implemented projects, especially during monitoring visits.

E. Small Business

Districts can expand the participation of small business by advertising to targeted industries, offering workshops to the engine dealer network, and offering to assist small business owners with the completion of the application. For example, many urban districts have found the construction industry to be a viable source of projects, when the districts provide outreach, training and technical assistance to the many small businesses that own qualifying equipment.

F. Agricultural Community

Districts with agricultural communities can contact the local agricultural department and request that a flyer be posted that will be visible to farmers when they come in to get their pesticide use permits.

G. Public Presentations

Districts can distribute a brochure or other informational hand-out at events and industry workshops attended.

H. Advertising

Districts can require their grantees to place a logo or decal on the new engine(s) advertising that the engine was funded by the district and ARB with Carl Moyer Program funds.

Best Practice #6

While the ARB strongly encourages districts to outreach to all sectors of their community to increase and improve the applicant pool, districts are also encouraged to develop and implement techniques to measure the effectiveness of their outreach activities.[6]

A. Districts can identify business sectors from which they will obtain applications for more cost-effective projects, evaluate whether their current outreach efforts are reaching those sectors, implement outreach activities to target sectors not being reached, and assess whether their outreach efforts enable them to select projects with more cost effective emission reductions.

B. Districts may conduct incentive program surveys to identify how applicants/participants heard about the incentive programs.

VI. District Applications for Projects

It is not possible for districts to implement both best practices 7 and 8. Each district must assess their implementation of the Carl Moyer Program and decide which (if either) of these practices best suits their district.

Best Practice #7

For consistency throughout the Carl Moyer Program, to assist applicants statewide and to limit confusion, ARB encourages districts to use the same application form for the Carl Moyer Program. The application is available on the Carl Moyer Program web site at http://www.arb.ca.gov/msprog/moyer/admin_forms/admin.htm.[7]

Best Practice #8

When districts operate more then one incentive program, districts may use one application form for all of the incentive programs. This streamlines and simplifies the application process for potential applicants.[8]

VII. Tracking

Districts have a number of best practices for tracking applications, proposed projects and the status of funded projects. The following best practices (numbers 9, 10 and 11) can be used separately or all in conjunction with each other.

Best Practice #9

Districts may use a contract signature tracking sheet which follows the contract from initiation through signing and filing. The tracking sheet may list each staff person (i.e. the APCO, the Administrative Analyst, the Contracts and Records Management Coordinator and the Carl Moyer Program Manager) who must review and approve the contract, and includes spaces for initials and date of review.[9]

Best Practice #10
The ARB encourages districts to maintain a hard copy or electronic contract log of all district contracts that tracks the status and location of each contract. An electronic contract log has the advantage of being accessible to all district staff.[10]

Best Practice #11
The ARB strongly encourages districts to maintain a checklist in their project folders to make sure all of the appropriate documentation is there. The check list may define where the specific documentation may be found in the folder or in electronic files. The ARB encourages districts to have another staff member (project manager and field inspector) cross check these folders to verify that the folder is complete. Such a checklist makes it easier for staff (current and new) and auditors to know project status and where documentation may be found.[11]

VIII. Environmental Justice

Environmental Justice refers to the requirement (HSC section 43023.5) that districts, with a population of over one million residents, distribute Program funds in a manner that directly benefits low-income communities and/or communities of color that are disproportionately impacted by air pollution. The Program requirements for environmental justice may be found at section 28(m) of the administration chapter of these Guidelines. Districts may enhance environmental justice implementation using best practices 12 through 16.

Best Practice #12
The ARB encourages districts with a population of less than one million inhabitants to incorporate an environmental justice component in their local Carl Moyer Program. [12]

Best Practice #13
The ARB encourages districts to periodically reassess their environmental justice policies and procedures, particularly their definition of environmental justice areas.[13]

Best Practice #14
To target communities with greater exposure to air pollutants, districts may include a measure of pollution (i.e. level of particulate matter in the community) or the effects of pollution (i.e. cancer hot spots) in the districts' approach for identifying disproportionately impacted communities.[14]

Best Practice #15
To maximize emission reductions in districts that competitively rate and rank their applications, districts may include a measure of the cost per ton of emission reductions when selecting projects in disproportionately impacted communities.[15]

Best Practice #16
To ensure funds from the environmental justice set-aside continue to benefit disproportionately impacted communities, districts may include a contract requirement that the projects selected from disproportionately-impacted areas continue to provide benefits from reduced emissions to those communities through the end of the project life.[16]

IX. Project Selection

Best Practice #17
To expand the applicant pool and provide an opportunity for engine owners that operate in more than one district, the ARB encourages districts to refrain from setting a minimum percent operation in the district and to jointly fund inter-district projects.[17]

Best Practice #18
To ensure the district is not providing a grant to a company that has outstanding permit violations, districts may check their Program applications against their list of companies that have a notice of violation with the district. Using this practice, one district was able to get a potential grantee to pay the outstanding fine.[18]

Best Practice #19
To expand the applicant pool to include more small businesses and to capture the emission reductions from an otherwise under-represented group, districts may provide a preference (in the form of scoring or as a set-aside) for small businesses.[19] For the purpose of this best practice a small business might be defined as in the following examples:

- An owner-operated business for the on-road and marine categories
- The same as in the applicable fleet rule (if any). For example, in ARB's Off-Road Fleet Rule a small business is defined as one with total fleet horsepower less than or equal to 2500 horsepower.
- A Class 3 railroad for the locomotive category.

Best Practice #20
To assist districts in their determination of credible and/or good faith applications, districts may refer to the Carl Moyer Program Status Report which contains category specific averages for costs, usage, etc. It can be found at http://www.arb.ca.gov/msprog/moyer/status/status.htm. Districts may also refer to their own or neighboring districts' averages from past projects.[20]

X. Commitment of Funds to Projects

Best Practice #21
ARB strongly encourages districts to commit funds to projects and fully execute contracts as soon as possible, prior to the June 30th deadline. This allows more time for completing projects. This may also allow for projects to be completed before the deadline, thus maximizing the ability to gain early emissions reductions.[21]

Best Practice #22
To reduce the administrative burden resulting from multiple contracts for one project owner with more than one funded engine/vehicle/piece of equipment, districts may use one contract per project owner.[22]

Best Practice #23
To more easily track the progress of Carl Moyer funded projects and provide the ability of the district to take appropriate action if a project veers off track, the ARB encourages districts to include detailed project milestones in contracts.[23]

Best Practice #24
To help districts ensure that they have sufficient time to perform the required post inspections and pay project owners before the two-year availability of Program funds expires, ARB strongly encourages districts to require projects to be completed before the statutory limit for expending the funds. Districts have had good results with requiring completion of projects within six to twelve months of contract execution.[24]

Best Practice #25
The ARB encourages districts to obtain delegated authority from their governing boards to approve Carl Moyer Program projects and execute contracts. As an alternative for district governing boards that prefer to maintain approval authority over higher-risk projects, districts are encouraged to obtain delegated authority to approve more routine projects or projects costing less then a certain amount. This allows districts to commit funds to projects expeditiously, providing more time for project implementation. [25]

Best Practice #26
For districts where the governing board desires retaining approval of contracts, district staff may invite the engine owners to attend the governing board meeting and have the board representative and engine owners execute the contracts as part of or right after the board meeting. This expedites the execution process and provides a positive forum for the governing board.[26]

Best Practice #27
Districts can require engine owners to attend an informational training prior to signing their contracts. This ensures the engine owners understand their

contractual obligations and may be used as an efficient process for the districts to get contracts fully executed and distributed.[27]

Best Practice #28
To ensure contracts are fully executed in a timely fashion, the ARB encourages districts to include a term that cancels the contract if it is not executed by the engine owner in a specified time frame (e. g. 30 days). [28]

Best Practice #29
For all categories where insurance is not otherwise required, districts may include insurance requirements that would cover the cost of the engine, equipment, and/or vehicle. This reduces the risk of emission reductions being lost if projects are destroyed.[29]

XI. Inspections

Best Practice #30
To make the administration of the program more efficient and effective, districts may conduct consolidated inspections whenever practicable. For example, a district may perform multiple inspections at the same site on the same day.[30]

XII. Engine Destruction

Best Practice #31
To ensure old engines are not reintroduced into the California market, they must be destroyed in a way that renders them useless.[31] Therefore, ARB recommends districts use one of the following methods of rendering the engine useless:

A. With a blow torch heat up the part of the engine to be broken. Break a 5-inch jagged-edged hole in the engine with a sledge hammer. The hole should catch a water jacket or oil galley. Alternatively, take off the oil pan and break the hole right above the oil pan lip or rail.

B. Using a plasma (or an oxy-acetylene) torch, cut a hole of at least four inches in diameter over at least one crank shaft journal sufficient to destroy the crank bearing and mount. To prevent the reuse of the engine heads, using the same torch, cut a line to a depth of ¼ to ½ inch around the entire accessible mating surface between the engine block and each head.

XIII. Project Owner Reporting

Best Practice #32
To better track the progress of projects, districts may require progress reports during the project completion phase of the contract.[32]

Best Practice #33
To increase engine owners' responsiveness to reporting requirements, districts may withhold payments of a small, set proportion (five or ten percent) of the contract amount until the project owner satisfactorily submits all required progress and annual reports.[33]

Best Practice #34
To minimize the information required from engine owners and make the format for annual reporting simple and convenient, districts may use the sample forms provided on the Carl Moyer Program website at http://www.arb.ca.gov/msprog/moyer/moyer.htm. In addition, ARB encourages districts to make the reporting forms and timetables for reporting part of their contracts.[34]

XIV. District Responses to Non Performing Projects

The administrative chapter requires districts to work with nonperforming grantees to ensure Program requirements are met and emission reductions are achieved. The chapter also requires districts to make all reasonable efforts to recoup Program funds from nonperforming grantees to ensure funded emission reductions are achieved. Best practices 35 and 36 relate to those requirements.

Best Practice #35
In the event a project is not meeting the terms of a contract, a district can use the following best practices for maintaining the agreement and obtaining the emission reductions.[35] Please note that each best practice is based on particular conditions.

A. If an applicant sells an engine or vehicle during the project completion term, the district can execute a new (novation) agreement with the new owner. The agreement should incorporate the original agreement (with a copy), so the new owner is fully informed and the State's interest is protected. A sample novation agreement is posted on the ARB Carl Moyer Program website at http://www.arb.ca.gov/msprog/moyer....

B. If an applicant's usage is below the amount listed in the application/contract, the district can extend the term of the contract to capture the required usage. This practice may be used only if

the emission reductions, during the extended term, are surplus to any regulatory requirement.

Best Practice #36
In the rare event that the district is unable to secure the emission reductions through the means listed in best practice # 35 (above), section 36(b) of the administration chapter of these Guidelines requires districts to make all reasonable efforts to recoup the funds. In doing so, the ARB strongly encourages districts to follow a progressive course of action, devised in consultation with their legal counsel. Districts should document the course of action and results in the project file. A progressive course of action may include, but is not limited to, the following steps:[36]

A. Program staff attempts to negotiate an appropriate resolution with the engine owner.

B. Legal counsel writes the engine owner a letter demanding repayment of the funds or some other suitable resolution.

C. The district takes legal action against the engine owner for noncompliance, especially if fraud or malfeasance is involved. If a district plans to take legal action against an engine owner, the district should inform ARB. This information is especially important if fraud or malfeasance is involved.

XV. Transparency of the Program

Best Practice #37
To provide the public with information on the Carl Moyer Program in each district, ARB strongly encourages districts to report annually to their governing board and to post the annual report on the district's website. Such a report should include the following topic areas:[37]

A. Total applications received for current year's funds

B. Efforts and results of outreach to potential environmental justice, and small business project owners

C. A list of the funded projects

D. The status of the commitment and expenditure of the current year's funds

E. The status of the commitment and expenditure of previous years' funds

F. District monitoring and auditing efforts and results, including any audits completed by independent third parties

G. The status of emissions reductions by projects in the implementation phase of their contracts, including reasons for and solutions to shortfalls for projects that do not perform as projected

H. Outstanding features and accomplishments of the district

I. Challenges for the district in implementing the Carl Moyer Program

J. The district's policies and procedures

XVI. Forms and Formats

Best Practice #38
Several districts have been recognized for having model forms and formats that other districts may want to use. These forms and formats have been made electronically available on the Carl Moyer Program webpage at http://arb.ca.gov/. These forms and formats include, but are not limited to, the following:

- An incomplete application notification letter
- A sample notification of award letter
- A pre- and post-inspection form
- A Novation of Agreement

Before using any of the posted forms or formats the district should be contacted to check for updated forms and formats that may have not been posted.

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[1] Recommendation from the Administration Chapter of the 2005 Carl Moyer Program Guidelines
[2] Sacramento Metropolitan Air Quality Management District practice
[3] Recommendation from the Administration Chapter of the 2005 Carl Moyer Program Guidelines
[4] Butte County Air Quality Management District and Glenn County Air Quality Management District practice
[5] Department of Finance audit recommendation and Health and Safety Code section 44290; 5a-common practice among districts: 5b-trade journals San Luis Obispo Air Pollution Control District practice & Farm Bureau Newsletter Monterey Bay Air Pollution Control District practice; 5c-common practice in districts' newsletters & solicitation on 24-hour message line San Joaquin Valley Air Pollution Control District practice; 5d-common practice among districts; 5e-workshops with engine dealers San Joaquin Valley Air Pollution Control District practice & outreach, training and technical assistance to construction industry Sacramento Metropolitan Air Quality Management District practice; 5f-common practice among districts; 5g-San Joaquin Valley Air Pollution Control District practice; and, 5-h- Sacramento Metropolitan Air Quality Management District and Ventura County Air Pollution Control District (for boats) practice

[6] Bureau of State Audits audit recommendation; 6A- Bureau of State Audits audit recommendation; and, 6B- Sacramento Metropolitan Air Quality Management District practice
[7] Department of Finance audit recommendation
[8] Bureau of State Audits audit recommendation
[9] Butte County Air Quality Management District, San Joaquin Valley Unified Air Pollution Control District and Santa Barbara Air Pollution Control District practice
[10] Butte County Air Quality Management District and San Joaquin Valley Unified Air Pollution Control District practices
[11] Sacramento Metropolitan Air Quality Management District and San Joaquin Valley Unified Air Pollution Control District practice
[12] Recommendation from the Administration Chapter of the 2005 Carl Moyer Program Guidelines
[13] Bureau of State Audits audit recommendation and South Coast Air Quality Management District practice
[14] Bureau of State Audits audit recommendation and Bay Area Air Quality Management District and South Coast Air Quality Management District practice
[15] Bureau of State Audits audit recommendation and South Coast Air Quality Management District practice
[16] Bureau of State Audits audit recommendation and Bay Area Air Quality Management District practice
[17] Bureau of State Audits audit recommendation
[18] Sacramento Metropolitan Air Quality Management District practice
[19] Recommendation from the Administration Chapter of the 2005 Carl Moyer Program Guidelines
[20] San Joaquin Valley Unified Air Pollution Control District practice
[21] South Coast Air Quality Management District practice and Bureau of State Audits audit recommendation
[22] Bureau of State Audits audit recommendation
[23] Bureau of State Audits audit recommendation and Bay Area Air Quality Management District practice
[24] Bureau of State Audits audit recommendation and Bay Area Air Quality Management District practice
[25] Bureau of State Audits audit recommendation
[26] Ventura County Air Pollution Control District practice
[27] South Coast Air Quality Management District practice
[28] Recommendation from the Administration Chapter of the 2005 Carl Moyer Program Guidelines
[29] Requirement from the Administration Chapter of the 2005 Carl Moyer Program Guidelines, which has been reduced to a Best Practice based on cost benefit analysis for particular source categories (i.e. marine and ag pumps)
[30] Bureau of State Audits audit recommendation
[31] Requirement from the Administration Chapter of the 2005 and 2008 Carl Moyer Program Guidelines 31a- San Joaquin Valley Unified Air Pollution Control District practice
[32] South Coast Air Quality Management District and Ventura County Air Pollution Control District practice
[33] South Coast Air Quality Management District practice
[34] Department of Finance audit recommendation
[35] To fulfill this requirement of the Administration Chapter of the 2008 Carl Moyer Program Guidelines 35a-a common practice for districts though the posted novation agreement is from San Joaquin Valley Air Pollution Control District; and 35b- common practice among districts
[36] To fulfill this requirement of the Administration Chapter of the 2008 Carl Moyer Program Guidelines 36b- San Luis Obispo Air Pollution Control District's staff worked with a non-Moyer grantee when his vessel's mooring released during a storm, ran aground and was destroyed. The engine that was submerged in sea water was overhauled and the grantee agreed to use the engine to replace an old engine in a different vessel. Even though the district had good results with this negotiated settlement, the district has since strengthened their contract language to provide more contractual rather than negotiated resolutions.
[37] Recommendation from the Administration Chapter of the 2005 Carl Moyer Program Guidelines

CALIFORNIA AIR RESOURCES BOARD

NOTICE OF PUBLIC MEETING TO CONSIDER REVISIONS TO THE 2008 LOWER-EMISSION SCHOOL BUS PROGRAM GUIDELINES AND FUNDING ALLOCATIONS

The Air Resources Board (the Board or ARB) will conduct a public meeting at the time and place noted below to consider the approval of staff's proposed revisions to the Lower-Emission School Bus Program Guidelines (Guidelines) and proposed funding allocations to local air districts for distribution to participating local school districts. The Lower-Emission School Bus Program is an incentive program that pays all or most of the cost of new, clean, and safe school buses and retrofit devices. The current guidelines were amended and approved by the Board in February 2006 and need to be updated. The revised Guidelines will be used by the ARB and local air pollution control and air quality management districts (air districts) to implement the Lower-Emission School Bus Program, with nearly $200 million in funding authorized by Proposition 1B, the Highway Safety, Traffic Reduction, Air Quality, and Port Security Bond Act of 2006, and its enabling legislation, SB 88 (Stats 2007, Ch 181). The protocols in the guidelines also apply to certain other local funding mechanisms for lower-emission school bus projects. This funding will allow the replacement of all remaining pre-1977 model year buses (buses manufactured before federal safety standards). In addition, more than 1,000 additional high-polluting pre-1987 buses will also be replaced, and over 3,000 retrofit devices that significantly reduce toxic particulate emissions will be installed.

DATE: March 27, 2008

TIME: 9:00 a.m.

PLACE: California Environmental Protection Agency
Air Resources Board
Byron Sher Auditorium
1001 I Street, 2nd Floor
Sacramento, California 95814

This item will be considered at a one-day meeting of the Board, which will commence at 9:00 a.m. on Thursday, March 27, 2008. Please consult the agenda for the meeting which will be available at least 10 days before March 27, 2008 to determine when this item will be considered.

For individuals with sensory disabilities, this document is available in Braille, large print, audiocassette or computer disk. Please contact ARB's Disability Coordinator at (916) 323-4916 by voice or through the California Relay Services at 711, to place your request for disability services. If you are a person with limited English and would like to request interpreter services, please contact ARB's Bilingual Manager at (916) 323-7053.

BACKGROUND

Program History: The Lower-Emission School Bus Program is a grant program administered by the ARB that provides funds to purchase new buses for California's public schools, and to retrofit in-use diesel school buses with emission control devices to reduce their toxic particulate matter (PM) emissions. The primary goal of the Lower-Emission School Bus Program is to reduce the exposure of school children to both cancer-causing and smog-forming pollution. The program does not impose any regulatory requirements on school districts and their participation in the program is voluntary.

The Lower-Emission School Bus Program was initiated in the 2000-2001 fiscal year. The first Guidelines were issued in December 2000 and updated in May 2003 and June 2004 to incorporate necessary administrative and technical modifications. The program guidelines were revised again in March 2006 to facilitate the replacement of the oldest public school buses still in-use in California.

In its first seven years, the Lower-Emission School Bus Program has replaced about 600 pre-1987 school buses with new buses and equipped about 3,800 buses with diesel retrofit devices. Historically the program has funded about 75 to 95 percent of the cost of the new bus, and the full cost of purchase and installation of retrofit devices. The exception was the 2005-2006 fiscal year funding, which paid the full bus cost for pre-1977 bus replacements. The proposed Guideline revisions again allow full replacement cost for the remaining pre-1977 buses, but require school district match funds for all other replacement buses. Local air districts may use local funds, such as AB 923 and AB 2766 motor vehicle registration fee surcharge, to pay the school district match. The proposed Guidelines continue the policy of providing full funding for purchase and installation of diesel retrofit devices.

Funding and Legislative Direction: Since its inception and through the 2005-2006 fiscal year, funding for the Lower-Emission School Bus Program totaled slightly over $100 million. In November 2006, California voters approved Proposition 1B, the Highway Safety, Traffic Reduction, Air Quality, and Port Security Bond Act of 2006 which will provide an additional $200 million for public school bus replacement and ARB-verified diesel retrofit device installation. Funding will be available to local air districts as early as May 2008 and must be fully expended by June 30, 2011. SB 88, the enabling legislation, includes the following legislative direction for expenditure of these funds:

- First, funding will be used to replace the remaining pre-1977 model year school buses in California.
- The remaining funding will be allocated to air districts based on each air district's share of the 1977 through 1986 model year school bus population.
- Air districts will have the discretion to determine how to allocate their funding between replacement of 1977-86 school buses and installation of ARB-verified

diesel PM retrofit devices. The Guidelines will require air districts to propose and commit to a retrofit funding target. ARB staff recommends a 25% funding goal for the retrofit activity.

In addition, SB 88 requires increased accountably for program expenditures. Implementing agencies are required to submit semiannual and final reports to the ARB and ARB is required to submit those reports to the Department of Finance. As required by the enabling legislation, the revised Guidelines include provisions for air district reports to ARB and the audit of project expenditures.

ARB staff conducted two workshops in September 2007, in Sacramento and El Monte, and held a working group meeting in February 2008 to present the proposed Guideline revisions and to obtain comment on the proposed revisions.

Need for the Program: The Lower-Emission School Bus Program has focused on replacing pre-1987 model year buses because they emit high levels of oxides of nitrogen (NOx) and PM, both of which cause harmful health effects. Targeting funds to replace pre-1977 model year buses is a priority because these older buses are not only high-emitters, but also are not subject to federal motor vehicle safety standards for school buses, which first took effect in April 1977.

Limited transportation budgets on both local and state levels make it difficult to replace these older buses. Because of the low annual mileage typical of school buses they generally cannot meet cost-effectiveness qualifications of the Carl Moyer Program.

The Board is tentatively scheduled to consider a Proposed "Regulation to Reduce Emissions from Diesel Particulate Matter, and Other Pollutants from In-Use Heavy-Duty Diesel-Fueled Vehicles" in the fall of 2008. This proposed regulation is designed to reduce both NOx and PM emission from heavy-duty on-road private fleets, including, school buses in public and private fleets. As proposed, the in-use fleet of school buses will be required to be retrofitted with Level 3 particulate traps beginning December 31, 2010. This funding will significantly help school districts comply with the proposed rule, but will not be sufficient to cover the full need.

PROPOSED FUNDING ALLOCATION

Based on the legislative direction within SB 88, staff proposes to allocate funding as follows:

- Funding for replacement of pre-1977 buses will be allocated to air districts in accordance with the population of subject buses in the district.
- Remaining funding will be allocated to air districts based on each district's share of 1977-1986 school buses.
- Air districts may determine how to allocate their funding between replacement of 1977-86 school buses and installation of ARB-verified Level 3 diesel retrofit devices to reduce PM emissions from in-use school buses.

PROPOSED GUIDELINE REVISIONS

The proposed Guideline revisions include new program requirement protocols and criteria specific to the allocation of the $200,000,000 in state funding. Additionally, the proposed Guidelines include modifications to provide greater funding and program accountability.

The proposed Guideline revisions are summarized below:

- Revised funding allocations to reflect replacement of pre-1977 model year buses first, followed by replacement of the next oldest group of school buses, model year 1977-86 buses.
- Air districts will have the option of allowing a larger air district or the ARB, with assistance from the California Air Pollution Control Officers Association, implement the program on their behalf.
- Strengthened administrative requirements, reporting requirements and added audit provisions to comply with bond accountability as reflected in the Governor's Executive Order S-02-07.
- New program timetable, including the date by which funds must be obligated and expended.
- Requirement for school district match funding for replacement school buses.
- Allow air districts to use 2 percent of its program funding for outreach and administration, and an additional 5 percent of its retrofit funding to support retrofit outreach to eligible school districts and implementation.

AVAILABILITY OF DOCUMENTS

The ARB staff will present the proposed revisions to the Guidelines and the proposed allocations of the 2007-2008 fiscal year State budget funds to the Board for consideration at the March 27, 2008 Board meeting. Copies of the proposed Guidelines, including a discussion of the environmental impacts of the proposal, may be obtained from the Board's Public Information Office, 1001 "I" Street, 1st Floor, Environmental Services Center, Sacramento, CA 95814, (916) 322-2990, prior to the scheduled meeting. These documents may also be obtained from ARB's internet site at http://www.arb.ca.gov/bonds/schoolbus/schoolbus.htm

SUBMITTAL OF PUBLIC COMMENTS AND AGENCY CONTACT PERSON

Interested members of the public may present comments orally or in writing at the meeting, and in writing or by e-mail before the meeting. To be considered by the Board, written submissions not physically submitted at the meeting must be received **no later than 12:00 noon, March 26, 2008,** and addressed to the following:

Postal mail: Clerk of the Board, Air Resources Board
1001 "I" Street, Sacramento, California 95814

Electronic submittal: http://www.arb.ca.gov/listpub/comm/bclist.php

Facsimile: (916) 322-3928

Please note that under the California Public records Act (Government Code section 6250 et. Seq.), your written and oral comments, attachments, and associated contact information (e.g., your address, phone, email, etc.) become part of the public record and can be released to the public upon request. Additionally, this information may become available via Google, Yahoo, and other search engines.

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. Further inquiries regarding this matter should be directed to Earl Landberg, Air Pollution Specialist, (916)323-1384, or elandberg@arb.ca.gov

CALIFORNIA AIR RESOURCES BOARD

James N. Goldstene
Executive Officer

Date: 2/28/08

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.

PROPOSED REVISIONS TO THE 2008 GUIDELINES



Release Date: February 29 2008
Meeting Date: March 27, 2008

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EXECUTIVE SUMMARY

Since 2001, the Air Resources Board's (ARB or Board) Lower-Emission School Bus Program has been a mainstay of the Board's incentive programs to protect vulnerable populations, particularly California's school children, from the harmful effects of air pollution. With its first funding appropriation of $50 million, the Board set forth a program to reduce school children's exposure to smog-forming and cancer-causing pollution by providing grants to upgrade our State's aging school bus fleet. Over the past seven years, State funds totaling just over $100 million have replaced 600 of the oldest, most polluting public school buses, and equipped about 3,800 other diesel buses with ARB-verified pollution control equipment that significantly reduces toxic particulate matter emissions.

A further measure of the program's success lies in our partnerships formed with local air districts and school districts, and the working relationships developed with school bus distributors. At the program's inception, staff estimated about 6,600 pre-1987 model year buses remained operating in California's public schools. Of those, nearly 1,900 predated minimum federal motor vehicle safety standards effective in early 1977. Today, staff estimates less than 2,800 pre-1987 model year buses remain in use and fewer than 100 are of the oldest vintages – the pre-1977 model years. Such significant progress is only achieved through the cooperative and dedicated funding efforts at both the State and local levels, and through combined outreach support.

This progress also serves to highlight that our work is not yet finished and demonstrates the need for continued funding to build on the program's past successes. Additional program funding is now available through Proposition 1B, the Highway Safety, Traffic Reduction, Air Quality, and Port Security Bond Act of 2006. Approved by California voters in November 2006, this bond act designates $200 million to replace old, high-polluting public school buses and to retrofit middle-aged diesel buses--those that still have a substantial service life--with ARB-verified pollution control equipment.

Enabling legislation, Senate Bill 88 (Stats 2007 Ch 181), prescribes the funding criteria and other requirements for the expenditure of the Proposition IB funds, while Governor Schwarzenegger's Executive Order S-02-07 (EO S-02-07) contains further directives to ensure robust fund accountability and program oversight. Incorporating these requirements, this report presents the staff's proposed funding allocations from Proposition 1B and revisions to the existing Lower-Emission School Bus Program Guidelines (Guidelines) for the use of these funds. When approved by the Board, these Guidelines will provide the protocols for use by the ARB staff and local air districts in implementing the program. With the Proposition 1B funds, we estimate the program will replace over 1,100 high-polluting buses, including the last of the pre-1977 buses, with new, clean models, and retrofit up to 3,500 existing diesel buses with ARB-verified pollution control equipment. Some of these low-emitting new buses may be on the road by the end of the year, while every one of the new and retrofitted buses will be in service transporting California's school children no later than June 30, 2011.

Significant program changes proposed by staff for this funding cycle include:

- Air district funding allocations as prescribed by Senate Bill 88. This legislation directs the ARB to allocate funds to account for air districts' populations of pre-1977 model year buses and their percentage shares of the statewide 1977-1986 model year bus population.
- Air district discretion to determine how to apportion funds between new bus purchases and retrofits. While Senate Bill 88 provides air districts with funding flexibility (after dedicating sufficient funds to replace all pre-1977 buses), these Guidelines will require air districts to propose and commit to a retrofit funding target. The ARB recommends a goal of designating 25% of program funds for the retrofit of in-use diesel school buses.
- A choice of either direct local air district implementation, regional implementation by a neighboring air district, or State level implementation. Proposition 1B funds spent within each air district will be the same regardless of the implementation option chosen by the air district.
- Increased program oversight and accountability, including expansive performance milestones and more comprehensive reporting and documentation retention requirements, designed to improve program efficiency and maximize the use of State grant funds, as directed by Executive Order S-02-07 and Senate Bill 88.
- Utilization of a new Lower-Emission School Bus Program database to provide transparency and accountability to the public on the use of the Proposition 1B funds. We expect this user-friendly database to be operational in spring 2008.
- Modified requirements for both the new bus purchase and retrofit program components that incorporate the latest technology developments.

These changes are necessary to effectively and efficiently manage the large infusion of program funding available from Proposition 1B. Through the revised program structure, the ARB will strengthen existing partnerships with local air districts and school districts, and forge new ones, to provide California's school children with safe, low-polluting school transportation.

I. PROGRAM OVERVIEW

The Lower-Emission School Bus Program is a grant program that provides funds to purchase new buses to replace old, high-emitting public school buses, and to equip in-use diesel school buses with retrofit devices that significantly reduce toxic particulate matter (PM) emissions. It is administered by the ARB and implemented by local air quality management and air pollution control districts (air districts). The primary goal of the Lower-Emission School Bus Program is to reduce school children's exposure to both cancer-causing and smog-forming pollution. The program does not impose any regulatory requirements on school districts and their participation in the program is voluntary.

This document describes proposed revisions to the Lower-Emission School Bus Program Guidelines (Guidelines) to comply with requirements of Proposition 1B, the Highway Safety, Traffic Reduction, Air Quality, and Port Security Bond Act of 2006, and its enabling legislation, Senate Bill 88 (SB 88; Stats 2007 Ch 181) and the accountability requirements of Governor Schwarzenegger's EO S-02-07, as well as to make necessary administrative and technical updates.

A. Background

Since 2000, the Lower-Emission School Bus Program has provided over $100 million in State funding for new alternative fuel and diesel school buses for California's public school districts, and retrofit devices for existing in-use diesel buses.

In its first seven years, the Lower-Emission School Bus Program replaced about 600 pre-1987 model year public school buses with new, lower-emitting models and equipped about 3,800 in-use buses with ARB-verified diesel retrofit devices. Historically, the program has funded about of 75 percent to 95 percent of the cost of the new bus. The exception was during the 2005-2006 fiscal year funding cycle when program funds were used to pay the full purchase cost for pre-1977 model year bus replacements. Proposed revisions to these Guidelines will continue the policy to provide full funding for pre-1977 model year replacements, but will require match funding for 1977-1986 model year bus replacements.

B. Need for the Program

The Lower-Emission School Bus Program has made significant strides in reducing school children's exposure to diesel-related pollution through a combination of State and local funding. The primary focus has been on replacing buses manufactured prior to 1977. These buses do not meet federal motor vehicle safety standards and were not subject to oxides of nitrogen (NO_x) and PM emission control. ARB staff estimates that fewer than 100 pre-1977 school buses remain in service in California's public schools. It is a priority to replace these old buses because they lack minimum federal motor vehicle safety equipment and are high-polluting. An average 2007 model year bus emits about 95 percent less toxic PM and over 85 percent less NO_x than a pre-1977 model year bus.

The Lower-Emission School Bus Program has sought to reduce emissions from the remaining public school bus fleet by replacing 1977-1986 model year school buses (which had minimal NOx control and no PM controls), and by retrofitting middle-aged diesel school buses that are not eligible for replacement with program funds. Funding from Proposition 1B can replace approximately 1,000 of the 1977-1986 buses and retrofit up to 3,500 in-use diesel buses.

The Lower-Emission School Bus Program provides a needed source of funds to accelerate the replacement and retrofit of California school buses, thus reducing school children's exposure to toxic PM emissions. Even after expending the Proposition 1B funds however, ARB staff estimates about 1,700 1977-1986 model year public school buses will remain in service, as well as over 15,000 1987 model year and newer diesel buses that are eligible for retrofits.

C. Program Funding

In November 2006, California voters approved Proposition 1B, the Highway Safety, Traffic Reduction, Air Quality, and Port Security Bond Act of 2006. Proposition 1B provides $200 million for school bus retrofit and replacement to reduce air pollution and to reduce children's exposure to diesel exhaust. From these funds, about $7 million were set aside for bond financing costs. The State Legislature appropriated $193 million in the 2007-2008 fiscal year budget to the ARB for the Lower-Emission School Bus Program. SB 88 allows up to five percent of the funds to be used for program administration; however, the ARB proposes to use less than one percent for program administration. This leaves approximately $191 million available for expenditure in local air districts, including allowable administrative expenses (see Table I-1 of this chapter).

D. Bond Accountability

EO S-02-07 requires significant and robust accounting procedures for Proposition 1B bond funds following a three-part accountability structure that addresses Front-End, In-Progress, and Follow-Up Accountability. The ARB's plan, as approved by the Department of Finance (DoF), includes a Front-End Accountability following the open public process in developing and proposing these Guidelines. Once approved, the Guidelines will set the requirements by which each local air district shall implement its local school bus program, as well as the criteria for selecting and paying for eligible school bus projects. ARB's In-Progress Accountability, for ease of tracking and transparency, will require air districts to report semi-annually using the ARB's web-based Bond Accountability Database. Finally, ARB's Follow-Up Accountability will be accomplished by conducting audits of district programs, including grant recipients. Follow-up audits will be used as an enforcement mechanism to ensure Proposition 1B funds are spent appropriately and emission reductions are achieved as intended through this program.

E. Emission Reductions

After expenditure of all the Proposition 1B funds to replace old, high-emitting buses and to retrofit in-use diesel buses, ARB staff estimates that the program will provide emission reductions of approximately 3,000 tons of NO_x, 200 tons of PM, and 22,000 tons of CO_2 through 2020.

F. Impact of Upcoming Regulations

The Board is scheduled to consider the Proposed Regulation to Reduce Emissions from Diesel Particulate Matter, and Other Pollutants from In-Use Heavy-Duty Diesel-Fueled Vehicles (In-Use On-Road Heavy-Duty Diesel Vehicles Regulation) in the fall of 2008. This proposed regulation would require that school buses be retrofitted with ARB-verified diesel emission control strategies (retrofits) that reduce the emissions of diesel PM. ARB strongly encourages air districts to implement local robust school bus retrofit programs to assist school districts prior to implementation of the proposed regulation.

G. Summary of Guideline Revisions

The proposed new guidelines are the result of a significant allocation of funding from Proposition 1B. Since this funding is from bond proceeds, it is subject to EO S-02-07, which requires significant and robust accountability procedures to be in place to ensure that State funds are spent properly and that California's citizens can measure the progress of school bus replacements and retrofits in their local areas.

1. Implementing Agency

The ARB is responsible for overall administration of the Lower-Emission School Bus Program. Historically, the ARB has worked closely with the California Energy Commission (CEC) and local air districts to implement the program statewide in previous years. Due to resource priority issues within the CEC, ARB staff is now proposing that all air districts, including those in which CEC previously implemented the program, have the opportunity to self-implement the program via grants from the ARB. However, air districts will also have the option of allowing a larger air district, or the ARB implement the program on their behalf. ARB is also discussing with the California Air Pollution Control Officers Association (CAPCOA) the possibility of providing funding for CAPCOA to assist in the ARB implementation. Funding will be the same within an air district regardless of the implementation option it selects.

2. Funding Allocations

Funding will be allocated following the criteria set forth in SB 88. SB 88 directs the ARB to allocate Proposition 1B funds by first setting aside funds to replace the remaining 1976 and older model year school buses in California. Remaining funds are to be allocated to air districts based on each district's share of the 1977 through 1986 model year school bus population. After ensuring funding for replacing all pre-1977 model year buses, SB 88 provides flexibility by allowing air districts the discretion to determine how to split their remaining allocation between replacing and retrofitting buses. A complete list of pre-1977 model public school buses that are eligible for replacement is

provided in Appendix F. Table I-1 includes bus populations and allocations broken down by seven of the larger air districts and the remaining group of 28 air districts. Appendix B provides a complete breakdown of each air district's funding allocation.

Table I-1
Proposed Lower-Emission School Bus Program Funding Allocations

	Pre-1977 MY Bus Population	1977 – 1986 MY Bus Population	Total Allocation (including admin)
Larger Air Districts			
Bay Area	4	118	$8,400,000
Monterey	8	90	$7,100,000
Sacramento	1	134	$9,100,000
San Diego	2	80	$5,600,000
San Joaquin Valley	10	567	$39,150,000
South Coast	9	1,034	$70,100,000
Ventura	4	66	$5,000,000
Subtotal	38	2,089	$144,450,000
Remaining 28 Air Districts			
Subtotal	36	630	$46,930,000
TOTAL STATEWIDE	74	2,719	$191,380,000

3. Eligible Applicants and Project Types

Eligible applicants for school bus replacements include public school districts and Joint Powers Authorities (JPA). For school bus retrofit projects, applicant eligibility has been extended to include private transportation contractors that provide transportation for public schools.

Eligible project types will continue to include replacements of pre-1987 school buses and retrofits for the middle-aged in-use diesel school bus fleet (1987 model year and newer buses). Staff is proposing funding caps for both replacement and retrofit projects. For school bus replacements, not more than $140,000 will be provided by State Program funds, with additional funding not to exceed 10 percent of the new bus purchase grant award for alternative fuel infrastructure, if required. Diesel-fueled school bus replacement costs should be significantly less than the cost cap. Depending on the technology chosen for the replacement bus the cost cap may not cover the entire cost for an alternative-fueled or electric-hybrid school bus. For school bus retrofits, the proposed funding cap is $20,000 per retrofit; this cap includes allowable funding for lifetime cleaning costs of the device and the purchase of back-up filters, to allow retrofitted school buses to stay in operation when the buses primary filter is undergoing routine cleaning and maintenance. Because State funds are limited, funding caps are necessary to maximize funding to pay for a greater number of projects statewide.

4. Applying for Funds

School districts will be contacted by their local air districts or ARB/CAPCOA about funding opportunities. However, it would be in the best interest of the school district to

ensure their contact information is up-to-date and understand the timelines of their local implementing agency[1]. In general, those school districts with pre-1977 model year buses identified in Appendix F will be contacted shortly after Board approval of the proposed guidelines. School districts that wish to replace pre-1987 model year buses or wish to retrofit buses should look for proposal requests from their implementing agency later this year.

Applications must be obtained from, and submitted to, the implementing agency. Successful applicants must enter into a contract with the implementing agency and adhere to all contract requirements, which include meeting project milestones and incorporating minimum contract requirements, as set forth by the implementing agency, in purchase order agreements with vendors. Successful applicants must also ensure that school buses and retrofit devices are operated and maintained according to the manufacturer's warranty specifications and to the applicable ARB retrofit device verification Executive Orders. Chapters III and IV provide specific project requirements for both school bus replacements and retrofits.

Successful applicants will be subject to audit by the DoF, ARB, or the local air district. Hence, successful applicants must retain the records and documents listed in Appendix E.

5. School Bus Replacements

All school buses eligible for replacement must be replaced with 2007 model year or newer buses equipped with engines certified to 1.4 grams per brake horsepower-hour (g/bhp-hr) NO_x or cleaner and 0.01 g/bhp-hr PM. Because pre-1977 model year public school buses predate federal safety standards, they are a priority to replace. Consistent with previous guidelines, public school districts will not be required to provide match funds when replacing these buses. Applicants must enter into contracts with the implementing agency and have new buses ordered for pre-1977 model year replacements by February 1, 2009.

To maximize the use of State funds, school districts will be required to provide $25,000 in match funding when replacing eligible 1977-1986 model year school buses. However, air districts may use their local funds (e.g., AB 923 funds, AB 2766 funds) to assist school districts with the match funding requirement. While Proposition 1B funds provide the opportunity for a large-scale State program, these funds alone are not sufficient to upgrade every bus eligible for replacement. At the local level, air districts have a greater ability to analyze the specific needs of the school districts in their regions and to determine how to best assist eligible school districts with the match funding requirements. Every air district that generates funds through AB 923 (the $2.00 portion of motor vehicle registration surcharge fees) can reasonably provide the match funding for buses eligible for replacement in their respective regions. Historically, the new bus

[1] School districts can identify who their implementing agency is after June 30, 2008, by checking the ARB website: http://www.arb.ca.gov/bonds/schoolbus/schoolbus.htm

purchase funds have been oversubscribed throughout the State and we expect this to continue as we move forward in the program.

All school buses replaced under the program must be dismantled within 60 days of receipt of the new, replacement bus. For new buses, proof of new vehicle delivery and dismantling of the replaced vehicle must be provided before payment is made by the implementing agency.

6. Retrofits

Retrofits continue to be a vital component in the ARB's regulatory and incentive programs. Because retrofits are the most cost effective method of reducing emissions from school buses, providing the greatest health benefit per dollar spent by reducing toxic PM emissions, the Board designated 25 percent of the total program funds to school bus retrofits in previous funding cycles. However, SB 88 precludes the ARB from designating a specific retrofit allocation and instead provides air districts the discretion to apportion funds between new bus purchases and retrofits. As such, these Guideline revisions require air districts to propose and commit to a retrofit funding target; the ARB recommends that air districts dedicate 25 percent of their allowable allocations to school bus retrofits. For air districts where ARB implements the local program, ARB proposes a goal of 25 percent of the funds to pay for retrofits. Public school districts and private transportation providers that contract with public school districts are eligible to receive program funds to retrofit their 1987 and newer model year buses with ARB-verified Level 3 devices.

7. Air District Program Administration

To address the requirements of EO S-02-07, greater specificity has been added to the proposed new administrative requirements that are included in these Guidelines. These are detailed in Chapter V, Program Administration. In summary, these new proposed requirements include:

- Air districts must submit policies and procedures for local implementation of the Lower-Emission School Bus Program.
- Specific contractual terms between air districts and successful applicants.
- Provisions for ARB program oversight and audit responsibility.
- Program accountability: Air districts must report to the ARB semiannually.

In recognition of the fact that increased accountability will require additional air district resources, air districts may use up to two percent of their total allocations of State program funds for implementation and outreach costs. Additionally, an air district may use up to five percent of the funding that it designates to retrofits (in addition to the aforementioned two percent of its total allocation) for implementation and outreach costs for the retrofit component of its program.

Air districts must account for administrative and project funds separately. Expenditures of Lower-Emission School Bus Program State program funding, including funds used to cover administrative costs, are subject to audit.

8. Timetable

ARB will mail grant agreements to individual air districts in late spring 2008. Hence, Proposition 1B funds would be available at that time. Districts will have until June 30, 2008, to sign the grant agreements and accept funds. Air districts will receive their initial funding disbursements for the replacement of pre-1977 model year public school buses upon ARB's approval of the local air districts' Policies and Procedures for program implementation. To receive subsequent fund disbursements, air districts must meet specific milestones to ensure program and fund accountability. These milestones are discussed in detail in Chapter V, Section G. The ARB has designed a timeline that allows an air district to receive up to 65 percent of its total allocation through June 30, 2009. The ARB anticipates some school bus projects will begin as early as fall 2008; however, all State program funding must be paid out by June 30, 2011.

II. ISSUES

This chapter addresses several significant issues affecting the development of the revised Lower-Emission School Bus Program Guidelines. Specifically, it contains brief overviews on oldest bus replacement, alternative fuel engine availability, funding for CNG fuel tank replacement, and matching fund requirements for 1977 – 1986 model year bus replacements.

A. Oldest Bus Replacements

Senate Bill 88 requires air districts to use their funds dedicated to new school bus purchases (after replacing eligible pre-1977 model year buses) to "replace the oldest school buses of model years 1977 to 1986, inclusive, within the district. " In previous years when the program was not bound by Legislative requirements for 1977-1986 bus replacements, the Guidelines provided school districts and air districts the flexibility to choose which buses to replace within this model year group. Because these buses have the same basic emission characteristics, there is no significant emission benefit associated with retiring an older bus versus a newer bus in this model year range.

School transportation fleet managers have advised ARB (and continue to do so) that they prefer the discretion to determine which of these buses to retire in order to keep their best performing buses in service. They report that, in some cases, their older buses in the 1977-1986 model year range have been repowered with newer engines or rebuilt and restored; these are the buses they would like to keep on the road in the absence of sufficient funds to replace all the 1977-1986 model year buses. Nonetheless, SB 88 prescribes the directive that the oldest buses shall be replaced. To implement this directive in a practical manner for a large-scale State program, the ARB staff is proposing that air districts shall award funds to replace the eligible oldest buses within their respective regions based on the applications received from school districts and that meet the requirements of these Guidelines. Additional information regarding this replacement mechanism is contained in Chapter III.

B. Alternative Fuel Engine Availability

The purchase of alternative fuel school buses, primarily CNG buses, has been an integral strategy in advancing the program's goal to reduce school children's exposure to cancer-causing and smog-forming pollution. School buses powered by CNG engines are inherently low in NO_x and PM. However, as heavy-duty diesel engines have achieved significantly lower emission levels once only attained by alternative fuel engines, the number of available alternative fuel engines certified each year has decreased.

John Deere, the leading manufacturer of CNG school bus engines discontinued new production of their CNG engines in 2007. John Deere's departure from the CNG engine market leaves a significant void in the alternative fuel school bus sector and creates uncertainty regarding the availability of future CNG engines for use in school buses. Under these Guidelines, an alternative fuel (propane) engine is eligible for program

funding (as identified in Table G-1). An additional alternative fuel engine (CNG) suitable for school bus applications is anticipated to be available later this year

C. Alternative Fuel/Diesel Funding Split for New Buses

With the adoption of the first Lower-Emission School Bus Program Guidelines in December 2000, the Board designated two-thirds of the new bus purchase funds to lower-emitting alternative fuel school buses (primarily CNG) and one-third of the new bus purchase funds to lower-emitting diesel school buses. While the Board's original intent was for this policy to be implemented on a regional basis, reduced funding levels during subsequent years of the program required ARB to implement this policy as a statewide goal, not a regional mandate.

For the 2005-2006 FY funds, the Board suspended the fuel funding split in order to facilitate the legislatively-directed replacement of California's oldest pre-1977 public school buses, in order of oldest bus first, but directed staff to reinstitute the funding split as a goal in subsequent funding years. When the Board issued this directive in February 2006, the primary school bus CNG engine manufacturer, John Deere had not announced its exit from the CNG engine market and, therefore, staff could not anticipate the disruption in CNG school bus engine availability that began in late 2007. Though a small number of John Deere engines are currently available and it is anticipated that Cummins will be moving into the school bus CNG engine market, staff does not recommend a specific funding goal for alternative-fueled engines, but acknowledges that certain air districts may want to encourage these engines.

D. CNG Fuel Tank Replacement

The Department of Transportation requires on-board CNG fuel tanks to be visually inspected every three years or 36,000 miles and replaced at the end of the manufacturer's recommended service life, which is typically 15 years. At the end of their service life, the fuel tanks on a CNG school bus must be replaced in order for the bus to remain in service. Since a typical school bus in California operates for 25 years or more, CNG school buses purchased in the early to mid- 1990s will require fuel tank replacements to remain on the road serving California's school children.

While developing the current Guidelines, ARB staff evaluated the feasibility of using a portion of the Proposition 1B funds available for bus replacements and retrofits to pay for fuel tank replacements on in-use CNG buses with expiring or expired tanks. Based on the legislative intent of Proposition 1B and constraints in the text of SB 88, ARB's legal staff has concluded that the funds cannot be used to pay for fuel tank replacements on older CNG buses.

The ARB staff encourages school districts to consult their local air districts regarding the availability of eligible funding sources, such as AB 2766 motor vehicle surcharge fees, to pay for or offset a portion of the cost to replace expiring or expired CNG fuel tanks. Some local air districts, notably the San Joaquin Valley Air Pollution Control District,

have already assisted school districts with the purchase of replacement fuel tanks for older CNG buses.

E. Matching Funds for 1977 – 1986 Model Year School Bus Replacements

These Guidelines continue the policy in previous guidelines of requiring a match contribution for new bus replacements. The policy ensures a cooperative relationship between the State, local air districts, and the school district further extending funds to maximize the number of eligible school buses that can be replaced. Therefore, school districts are required to contribute $25,000 in matching funds when replacing an eligible 1977 – 1986 model year bus through the Lower-Emission School Bus Program. Consistent with the match funding policy in previous Guidelines, air districts may also choose to provide the matching funds from an eligible funding source (e.g., motor vehicle surcharge fees) to assist school districts in need.

During the development of this Guideline revision, staff evaluated mechanisms to foster participation in the program's retrofit component that would have limited air districts' abilities to provide matching funds for new bus purchases. Specifically, air districts would have had the ability to provide a school district's matching fund contribution only if a school district obtained a matching fund waiver by agreeing to install ARB-verified retrofits on eligible buses, or by demonstrating that its fleet was already retrofitted or ineligible for retrofits. This mechanism was intended to encourage and incentivize retrofits in school bus fleets and to provide the means by which air districts could financially assist school districts.

Staff, however, is not including this mechanism in the revised Guidelines due to recent modifications to the ARB's proposed regulation for in-use on-road heavy-duty diesel-fueled vehicles. If approved by our Board, this proposed regulation could require school bus fleets to equip eligible buses with verified diesel emission control systems (i.e., ARB-verified retrofit devices) as soon as December 31, 2010. The ARB staff requires that air districts include a retrofit funding goal in their required Policies and Procedures Manuals to provide funds for school bus retrofits prior to implementation of the proposed regulation. Furthermore, it will behoove both school districts and air districts to familiarize themselves with this regulatory proposal, and we encourage school bus fleets to participate in the public rulemaking process for this proposed regulation, which is planned for presentation to the Board in mid-2008. More information regarding this regulatory effort, including appropriate ARB staff contacts and draft regulatory language, can be accessed from the ARB's web site at:
http://www.arb.ca.gov/msprog/onrdiesel/onrdiesel.htm .

III. LOWER-EMISSION SCHOOL BUS REPLACEMENT PROGRAM REQUIREMENTS

The school bus replacement program funds the purchase of new lower-emission school buses and infrastructure. With about $191 million available for grants, ARB staff estimates that all the remaining eligible pre-1977 model year school buses and about 1,000 additional 1977 to 1986 model year public school buses will be replaced with new clean school buses that also comply with the most recent motor vehicle federal safety standards

The following sections describe the proposed protocols and criteria for the expenditure of program funds, as well as for new bus purchase funds from other sources of State funding which have specifically required that the Lower-Emission School Bus Program Guidelines be followed. It is important to understand that State program funds may only be used on school bus replacement projects that meet proposed criteria outlined in this chapter.

A. Eligible Buses and Infrastructure

This section provides a description of eligible program applicants and equipment.

1. Eligible Applicants

Public school districts in California that own their own buses are eligible to receive funding for the replacement of older school buses. Where a Joint Power Authorities (JPA) has been formed by several public school districts, and the JPA holds ownership of the school buses, then the JPA is also eligible to participate. School transportation contractors are not eligible to apply for school bus replacement funds. Also, school bus purchases by non-profit agencies, private schools, and other private companies are not eligible for State program funding.

2. Buses Eligible for Replacement

Older in-use diesel or gasoline school buses with a manufacturer's gross vehicle weight rating (GVWR) greater than 14,000 pounds may be eligible for replacement. Buses of this weight rating must be equipped with heavy-duty engines. To be eligible for replacement, buses must have a current CHP safety certification (CHP form 292) as of December 31, 2005, and have continuous safety certification from that point forward. This requirement will ensure unused buses are not revived in order to get funding. The period of certification must include the time a school district is awarded funding to replace the bus. The bus must also be currently registered with the Department of Motor Vehicles. While diesel-fueled buses are primarily targeted for replacement, gasoline-fueled buses that do not include an original-equipment catalytic converter are also eligible per the replacement priority given below.

SB 88 which provides legislative direction for the expenditure of Lower-Emission School Bus Program funds requires that all pre-1977 model year buses be replaced first. Hence the replacement of buses manufactured prior to April 1, 1977, when federal

motor vehicle safety standards applicable to school buses went into effect, is a priority for the school bus replacement program. Staff proposes that local air districts commit by fully executed contract, all of their State program funds designated for pre-1977 model year school bus replacements by February 1, 2009. In addition, all replacement buses for pre-1977 model year buses must be paid for and in operation no later than February 1, 2010.

After ensuring funding for replacing pre-1977 buses, air districts will have the discretion to determine how to split their funding allocations between new school bus purchases (to replace 1977-1986 model year buses) and in-use bus retrofits (i.e., retrofitting in-use diesel buses with ARB-verified Level 3 devices). ARB staff estimates about 75 percent of the remaining funds will be used to pay for the replacement of up to 40 percent of all remaining eligible 1977-1986 buses (~2700 remaining). SB 88 states that an air district will replace the oldest school buses of model year 1977 to 1986. Therefore, air districts must preferentially choose for replacement the oldest school buses within their district that have applied for replacement and that meet the terms and conditions of these guidelines.

All school buses replaced under the program must be dismantled in accordance with the definition of "dismantle" set forth in these Guidelines in Appendix A: Glossary of Administrative Terminology. School districts must ensure that the old school bus is dismantled within 60 days of the receipt of the new, replacement bus. For new buses, proof of new vehicle delivery and dismantling of the replaced vehicle must be provided before payment is made by the implementing agency.

3. Replacement Bus Requirements

Only replacement buses may be funded by this program, fleet expansion buses are not eligible for funding. New heavy-duty buses with engines that run on either diesel or an alternative fuel are eligible for funding, if the engines emissions are less than or meet the criteria shown in Table III-1. Program funds can only be used to purchase a new school bus that is equipped with essential or standard equipment. The recipient school district must make an enforceable commitment to own and operate the new bus for at least five years.

Alternative-fueled buses may be powered by natural gas, liquefied petroleum gas (LPG or propane), electricity, methanol, or ethanol fuels, provided that the other program requirements are met. Commercially available hybrid school buses may be partially eligible for funding. If a public school district elects to purchase a hybrid electric school bus as their replacement bus, the program will cover the cost of the hybrid school bus up to the cost cap for replacement buses described in Section D of this chapter, provided that the other program requirements are met.

B. Emission Standards and Certification Levels for School Buses

The ARB adopted more stringent emission standards for 2007 and subsequent model year new heavy-duty diesel engines (HDDE), and the regulation became effective in

November 2002 (see Title 13, California Code of Regulations, section 1956.8). More stringent emission standards were adopted for NO_x, non-methane hydrocarbons (NMHC), and PM.

Table III-1 below, shows the emission criteria that replacement school buses need to meet in order to qualify for program funding. Stating in 2007, the average heavy-duty NO_x emission standard is 1.2 g/bhp-hr. For this program, ARB will allow new buses that meet up to 1.44 g/bhp-hr NO_x emission standards, as there are a couple of common school bus engines that come in at this level. The 2007 model year Cummins ISB 6.8 liter diesel fueled engine is currently certified to a significantly higher level, 2.2 g/bhp-hr NO_x+NMHC FEL. As such, its NO_x + NMHC emission level does not qualify it for funding under the Lower-Emission School Bus Program.

Table III-1
Emission Criteria for Use of Lower-Emission School Bus Program Funding

2007-2009 Model Year		2010 Model Year	
NO_x (g/bhp-hr)*	PM (g/bhp-hr)	NO_x (g/bhp-hr)	PM (g/bhp-hr)
1.44 NO_x FEL	0.01	0.2	0.01

FEL: family emission limit
g/bhp-hr: grams per brake horsepower-hour
* Both the NO_x FEL and the NO_x+NMHC FEL must be at or below 1.44 g/bhp-hr.

Table G-1, lists some ARB-certified heavy-duty school bus engines that are available in California and are eligible for funds under this program.

C. CNG Fueled School Buses

CNG fueled buses have proven to be very popular with school districts. The South Coast Air Quality Management District (SCAQMD) has had a fleet rule in effect that has required the purchase of new alternative-fuel school buses when replacing or adding school buses within a fleet. Other air districts have been very proactive in advocating CNG fueled school bus purchases. CNG engine availability issues have become a concern for school districts wishing to purchase additional alternative fueled school buses.

1. CNG Infrastructure and Fuel Tank Replacement

Ten percent of new bus funding for alternative-fueled buses may be used for refueling infrastructure when no local CNG refueling site is available or the existing local CNG refueling site is inadequate. This equates to about $14,000 per bus based on a $140,000 new CNG bus cost, excluding applicable sales tax. Infrastructure monies must be fully expended by the same deadline(s) by which the monies to purchase new buses must be fully expended. Infrastructure funds cannot be automatically set aside. Infrastructure funds may be utilized only if they can be tied to infrastructure funds spent for the specific bus purchased.

A typical school buses life of 25 years results in the need to replace the natural gas fuel tanks at lease once during the life of the bus. Based on the legislative intent of Proposition 1B and the constraints in the text of SB 88, Proposition 1B funds are not allowed to be used for the replacement of CNG fuel tanks on school buses. School districts should consult with their local air districts regarding the application process to receive AB 2766 funds for fuel tank replacement on in-use CNG-fueled school buses.

2. SCAQMD School Bus Fleet Rule

The SCAQMD adopted fleet rules in April 2001 requiring the purchase of alternative-fueled vehicles for certain fleets of 15 or more vehicles, when government funding for the incremental cost is available. SCAQMD Rule 1195, which applies specifically to school bus fleets, includes exemptions which allow diesel-fueled bus purchases in certain cases. However, the exemptions dealing with lack of available infrastructure and the lack of funding for infrastructure have sunset. For the past several years, the SCAQMD has only funded alternative-fueled school buses. However, some school districts in the SCAQMD still have an all diesel-fueled school bus fleet. Nothing within these guidelines is intended to supersede the SCAQMD rule. Therefore, school districts within SCAQMD may only be able to purchase alternative-fueled replacement school buses.

D. Cost Cap

Staff is proposing a cost cap per new school bus of $140,000. Combined with the match contribution (discussed below), diesel-fueled buses are expected to come well under the cost cap, CNG-fueled buses would be at the cost cap level, and hybrid buses would still be significantly over the cost cap. The cost cap is applicable to the cost of the replacement bus only including tax; funding for infrastructure to support alternative-fueled and hybrid-electric school buses is available in addition to the cost cap.

A typical transit style model year 2008 diesel-fueled school bus is estimated to cost approximately $140,000, including sales tax. When factoring in the match funding requirement of $25,000 for each replacement bus, State program funds would pay approximately $115,000 of the replacement cost. A 2007 model year CNG-fueled school bus costs approximately $160,000. Therefore, State program funds would pay $135,000 towards the replacement cost of this bus. Finally, hybrid-electric school buses

are currently estimated to cost above $200,000, in this case, State program funds would only provide $140,000 towards the replacement cost of this school bus.

Regardless of the type of fuel, no more than $140,000 may be spent to replace a school bus with State program funds. ARB staff proposes that the Board grant the ARB's Executive Officer the authority to raise the cost cap, if needed, to accommodate future price increases.

E. Match Funds

School districts are not required to provide match funds for pre-1977 model year school buses, replaced with State program funding. This includes those buses manufactured before April 1, 1977. For the replacement of 1977-1986 model year buses, staff proposes that school districts must pay a $25,000 match per bus (about 18 percent of $140,000). This match requirement may be paid by the air district from eligible funding sources such as AB 2766 or AB 923 funds. The match requirement not only fosters a cooperative relationship between the State, the local air district and the participating school district, but also extends the program funds, replacing as many public school buses as possible.

Historically, the Lower-Emission School Bus Program has allowed air districts to provide match funding for new buses purchased through the program. Other grant funds, such as air district funds (e.g. motor vehicle registration fee monies) can be used to satisfy the school districts match fund obligation to the extent the other grant or funding language allows this. Proposition 1B funds alone are not sufficient to replace every 1977-1986 model year bus eligible for replacement. As partners in the Lower-Emission School Bus Program, air districts must share in the responsibility to provide low-polluting school transportation. At the local level, they have a greater ability to analyze the specific needs of the school districts in their regions and to determine how to best assist eligible school districts with the match funding requirements (e.g., air district provides full or partial match funds, based on school districts' needs). Every air district that generates funds through AB 923 (the $2.00 portion of motor vehicle registration surcharge fees) can reasonably provide the match funding for buses eligible for replacement in their respective regions.

Eligible air district funds can be also used to offset the higher cost of advanced technologies, such as hybrid-electric and alternative-fueled buses, if the cost for those buses exceeds the total of the cost cap and matching funds. Carl Moyer Program funds cannot be used as a source of the school district match funds.

F. Impact of the Seat Belt Law

Assembly Bill 15 (AB 15: Stats1999 Ch 648) initiated a requirement for lap/shoulder belts for all new school buses manufactured on or after January 1, 2002, that are purchased or leased for use in California, unless specifically prohibited by the National Highway Transportation Safety Administration. Implementation was delayed by Senate Bill 568 (SB 568: Stats 2001 Ch 581) until July 1, 2004, for new Type 2 small school

buses and until July 1, 2005, for new Type 1 large school buses. The use of lap/shoulder belts will limit seating capacity on new buses to a maximum of two per seat.

Currently, school districts within California typically transport two older students per seat and three younger students per seat to comply with federal motor vehicle safety standards. Buses that only transport older children, those in seventh through twelfth grade, are not expected to lose seating capacity. However, school buses that currently transport primary school-aged children at a capacity of three children per seat will lose maximum seating capacity. This lower seating capacity of newer buses is further pressure on school districts to retain their older buses. However, ARB believes that given the opportunity to replace older in-use buses, school districts will elect to replace their older buses with new, cleaner and more efficient school buses that better protect their student's health.

IV. LOWER-EMISSION SCHOOL BUS RETROFIT PROGRAM REQUIREMENTS

The main goal of the Lower-Emission School Bus Program is to reduce children's exposure to diesel emissions from school buses. Retrofits are a vital component of the statewide program as school buses typically remain in service for extended periods of time. Retrofitting in-use diesel school buses will result in significant diesel emission reductions that are immediate, will benefit children's health and are the most cost effective use of these funds. Because of the importance of this component of the program, the ARB has designated a total of $29 million in funds to pay for nearly 4,000 retrofits since the program began in 2000, excluding the current bond funding.

SB 88 which establishes how the Proposition 1B funds for school buses will be allocated, gives air districts the discretion to determine how to split their funding allocations between new school bus purchases and in-use bus retrofits.

This chapter not only presents the criteria for selecting eligible school bus retrofit projects, but it also describes upcoming retrofit regulations as they pertain to school buses and potential impacts to future State funds.

A. Upcoming Retrofit Regulation

Since 1998, when diesel PM was identified as a toxic air contaminant, ARB has been developing and implementing a regulatory program focused on achieving 85 percent reduction in diesel PM emissions by 2020. To date ARB has adopted 17 regulations that reduce both NO_x and PM from heavy-duty on- and off-road fleets, as well as, stationary engines. Following ARB's plan, the Board is tentatively scheduled to consider the Proposed Regulation to Reduce Emissions from Diesel Particulate Matter, and Other Pollutants from In-Use Heavy-Duty Diesel-Fueled Vehicles in the fall of 2008. This proposed regulation is designed to reduce both NO_x and PM emission from heavy-duty on-road private fleets, including, school buses in public and private fleets. Staff expects to propose that, the in-use fleet of school buses be required to be retrofitted with an applicable Level 2 or Level 3 verified diesel emission control strategy beginning December 31, 2010, and 100 percent of the fleet be retrofitted by the end of 2013. Below is a link to the ARB website with information on the proposed in-use on-road heavy-duty regulation http://www.arb.ca.gov/msprog/onrdiesel/onrdiesel.htm .

It is important for the local air districts to have a robust retrofit program in place for local school districts to retrofit applicable school buses before required by the proposed in-use heavy-duty diesel vehicle regulation. This will help assure that state funds are available to help school districts comply with the proposed rule. If these state funds are not used for retrofits, the cost of compliance with regulatory requirements will fall on school districts. The School Bus Program funding timeline, Table D-1, should be reviewed to ensure that retrofit funds are available in a timely manner.

B. Eligibility Requirements

1. Eligible Applicants

Public school districts that own their own buses are eligible to receive funding for retrofits; this also includes Joint Power Authorities (JPAs) formed by several public school districts where the JPA holds ownership of the school buses. Private school transportation providers that contract with public school districts to provide transportation services are also eligible to receive retrofit grant funding. Successful applicants must make an enforceable commitment to own and operate the retrofitted bus for at least five years.

2. Buses Eligible for Retrofit

All 1987 and eligible newer model year in-use diesel-fueled buses with current CHP safety certifications qualify for retrofits, provided there is an ARB-verified retrofit device available for the engine. However, retrofit devices may be more readily obtainable for model year buses 1994 and newer. The cost for available devices and the longer remaining project life of the 1994 and newer model year buses are important considerations when selecting which buses to retrofit. Device installers and vendors can provide assistance in this regard. Both Type I and Type II school buses may be eligible. There is not a GVWR requirement of over 14,000 pounds, however some of the ARB-verified device Executive Orders may require this in their terms and conditions. The focus is on retrofitting the highest polluting buses that can be reliably retrofitted with diesel particulate filters (DPFs)

3. Eligible Diesel Emission Control Devices – Availability, Funding Requirements & Maintenance

All retrofit devices that are purchased with State program funding must be ARB-verified Level 3 retrofit technologies. The ARB verifies diesel emission control strategies as prescribed in Title 13, California Code of Regulations (CCR) sections 2700 through 2710, Verification Procedure, Warranty and In-Use Compliance Requirements for In-Use Strategies to Control Emissions from Diesel Engines.

Level 3 verification is for those technologies achieving at least an 85 percent or greater reduction in PM or less than 0.01 g/bhp-hr emission level. A current list of all ARB-verified devices can be accessed through the ARB web site at: http://www.arb.ca.gov/diesel/verdev/vt/cvt.htm . The use of fuel additives is not allowed by most device Executive Orders and may only be used if expressly stated in the device's Executive Order. Retrofit technologies currently verified for school bus engines are listed in the Appendix H which is current as of January 2008. However, school districts or other implementing agencies should check this web site prior to ordering any devices for their program, as there may be changes or additions.

Amendments to the Verification, Warranty, and In-Use Compliance Procedures were adopted on March 23, 2006. This regulation raised the NO_2 limit for verified diesel emission control devices to allow continued use of most currently verified devices

through 2007, and created the "Plus" designation for verified technology that achieves more stringent NO_2 requirements. For a device to meet new compliance standards in 2009, a verified device may not increase baseline NO_2 emissions of the engine it is installed on by more than 20 percent beginning January 1, 2009. After the aforementioned date, strategies that do not meet this new compliance standard will not be for sale in California, and will not be fundable.

Some of the retrofit devices are verified for use with biodiesel blends subject to certain conditions. Those conditions are posted on the ARB web site at http://www.arb.ca.gov/diesel/verdev/reg/biodieselcompliance.pdf and are as listed below:

- The biodiesel portion of the blend shall be 20 percent or less of the fuel;
- The use of biodiesel applies to devices verified to reduce only diesel PM; and
- Other alternative diesel fuels such as, but not limited to, ethanol diesel blends and water emulsified diesel fuel are excluded.

Use of biodiesel blends that meet these specifications do not void the warranty for the retrofit devices verified for use with biodiesel blends. Appendix I, provides a more in depth discussion on biodiesel use with retrofits and new school bus engines.

Table IV-1 lists the engines commonly applicable to school buses and the model years that can be retrofit with a diesel particulate filter. Retrofit manufacturers include Cleaire, Donaldson, International, Johnson Matthey, and Lubrizol. More complete information on verified Level 3 retrofit devices and the engines and operating requirements for their application can be found at the ARB web site: http://www.arb.ca.gov/diesel/verdev/level3/level3.htm .

Table IV-1
Common School Bus Engines Eligible for Retrofit

Engine Manufacturer	Applicable Common School Bus Engine Models(a)	Engine Model years(b)
International	DT 466, DT 466E, T444E, 7.3 L, 6.0 L	Broad applicability for 1994 – 2003. Partial availability for 1993 and 2004-2006 Limited availability for pre-1993
Caterpillar	3116, 3126, 3176, C-7	
Cummins	B3.9L, B5.9L, C8.3L, ISB, ISC	

(a) DPFs are applicable to other engine models
(b) Verification as of January 28, 2008. Further verification is currently in progress to potentially include older model year engines.

C. Cost Estimate for Retrofits

ARB will pay up to $20,000 to cover the cost of the retrofit, necessary data logging and installation, and maintenance for the device. In most cases ARB staff expects the cost to be significantly less. These funds will cover the full cost of the retrofit since several passive diesel particulate filter systems are available for about $9,000 and active systems are available for about $16,000. Staff expects the passive type of system to be the most common system funded due to its broad applicability for 1994 and newer model year school buses and its relative low cost. However, active systems (requiring a plug-in for regeneration) are also available that have even greater applicability, especially for older buses. After a cost analysis, if the $20,000 cost cap is prohibitive, districts may contact ARB staff regarding a waiver option. Waivers will be considered only on a case-by-case basis and only if a cost analysis has been performed.

1. Maintenance Costs

Within the $20,000 retrofit funding cap, as discussed above, ARB will allow implementing agencies to allocate up to $2,500 to pay for DPF maintenance (baking and de-ashing). This amount adequately covers anticipated maintenance costs, however; ARB expects it to be less. Hence, documentation in the form of an invoice or purchase order that states the date of maintenance, description of service performed, and cost of service must be submitted to the implementing agency to justify reimbursement of these costs.

DPF devices require periodic maintenance to remove ash caused by motor oil combustion residues. As previously mentioned, depending on the condition of the engine and number of miles driven, periodic maintenance is done every 6 to 24 months. This can be handled by a maintenance contract at the time of device purchase, periodic cleaning by an outside contractor, or cleaning by the bus maintenance personnel. If the bus maintenance personnel perform this function, either a DPF de-asher must be purchased or the DPF must be taken offsite for cleaning. The cleaning option chosen may be based on the number of DPFs to be cleaned, whether buses can be out of service while the DPF is taken off site, and the workload of the maintenance personnel. For fleets that have at least six retrofits, it is more economical for the State to pay for a de-ashing system, rather than periodic maintenance and districts are encouraged to consider this option.

A de-asher to clean retrofit filters on-site may be a cost saving option if several retrofits are in service in a district. This option should be evaluated in terms of the number of DPFs on existing buses, including all new replacement buses which come with a filter, the expected lifetime cleaning costs of the DPFs, and the cost of the de-ashing system versus the cost per cleaning. The ARB estimates a cost of $2,500 over an expected 11-year remaining bus life based on the assumption that the DPF requires cleaning once every two years at a cost of up to $400 per cleaning.

Implementing agencies may also use State funds to pay for spare back-up filter(s). During normal filter maintenance, retrofit devices are removed from the school bus for

several hours for cleaning and de-ashing. A back-up filter will allow the bus to continue operating during this time. This is an advantage to school districts as there will be no disruption in their ability to provide transportation to students. ARB will only allow funds to pay for one spare filter for up to twenty in service retrofits. The average cost of a spare filter is approximately $3,000.

With the implementation of the upcoming proposed In-Use On-Road Heavy-Duty Diesel Vehicles regulation which will essentially require DPFs be installed on all buses by the end of 2013, ARB will leave it up to the discretion of the implementing agency whether or not to pay for the cost of filter maintenance for school districts. If maintenance costs are not covered, additional DPFs will be able to be purchased and installed on more buses with available Proposition 1B funds, which will further reduce PM emissions.

2. Data Logging

Not every retrofit technology is appropriate for every school bus and every school bus route. Matching the appropriate technology to each bus and route can be accomplished by data logging the bus to determine that the exhaust gas temperatures generated during normal operation meet the regeneration requirements for the device.

To ensure that an appropriate emission control technology is installed on each bus, funding of $300 per bus shall be included in the funded amount to cover the cost of data logging for the candidate bus operating conditions.

D. CHP Inspection Prior to Return to Service

Any school bus that has had an emission control retrofit device installed must receive a CHP safety inspection [(per Title 13, California Code of Regulations (CCR) section 1272(c)] prior to its return to service. This inspection is to determine if the retrofit device installation or other modification was performed according to the manufacturer's procedures and it is required in order to protect the school district and the children in the case of improper installation or modification.

To meet the terms of the retrofit contract, a copy of written documentation from CHP personnel that the retrofitted bus is still structurally acceptable to safely transport students is required. This should be obtained by the applicant after the CHP has conducted an inspection. The school district is required to provide documentation to the air district that consists of:

A copy of a completed CHP form 343 – Safety Compliance Report/Terminal Record Update, OR a copy of a completed CHP form 343A – Vehicle/Equipment Inspection Report Motor Carrier Safety Operations.

V. ADMINISTRATIVE RESPONSIBILITIES OF AIR DISTRICTS AND THE ARB IN IMPLEMENTING THE LOWER-EMISSION SCHOOL BUS PROGRAM

This chapter formalizes the proposed minimum administrative requirements that the ARB and local air districts must follow to implement the Lower-Emission School Bus Program. The chapter outlines the ARB's responsibility for overall program administration and oversight, and describes the minimum administrative requirements that air districts must follow to ensure that program goals are achieved.

Because the funding for the continuation of the Lower-Emission School Bus Program comes from a voter-approved initiative (i.e., Proposition 1B), expenditures from this source are subject to both State requirements and recent mandates outlined in SB 88 and the three-part accountability structure set forth in EO S-02-07. Together, both mandates require an increase in transparency for the bond proceeds expenditure process. Hence, the chapter includes strengthened expenditure, auditing, reporting, records retention, and contract language requirements that are necessary for compliance with State requirements. The unprecedented level of State funding for this round of the Lower-Emission School Bus Program necessitates a more robust oversight process, and proposed program improvements are a result of lessons learned through auditing conducted by the DoF and the ARB.

A. EO S-02-07

Proposition 1B funding must be spent pursuant to the requirements of EO S-02-07, which sets forth a three-part accountability structure for the expenditure of bond proceeds. The ARB's three-part accountability structure for the Lower-Emission School Bus Program consists of: 1) Front-End Accountability: Following an open public process, the Air Resources Board will approve the Guidelines that address the criteria that will govern the expenditure of Proposition 1B funds, and the outcomes that such expenditures are intended to achieve. The Guidelines include funding allocations for local air districts (see Appendix B). 2) In-Progress Accountability: The ARB is required to submit semiannual reports to the DoF to ensure that the projects funded with Proposition 1B proceeds are being executed in a timely fashion and achieving their intended purposes. To facilitate data collection for these reports, implementing agencies will be required to input program information into an on-line transportation bond accountability database that is being developed by the ARB. The database is expected to be operational in spring 2008. 3) Follow-up Accountability: The administrative and implementing agencies must adhere to the record keeping and documentation requirements set forth in the Guidelines, and these agencies are subject to audit.

B. SB 88

SB 88 directs the ARB to allocate Proposition 1B funds by first setting aside funds to replace the remaining 1976 and older model year school buses in California. Remaining funds are to be allocated to air districts based on each district's share of the 1977-1986 model year school bus population. After ensuring funding for replacing all pre-1977 model year buses, SB 88 provides flexibility by allowing air districts the

discretion to determine how to split their remaining allocation between replacing 1977-1986 model year buses and retrofitting buses. SB 88 states that an air district will replace the oldest school buses of model year 1977 to 1986. Therefore, air districts must preferentially choose for replacement the oldest school buses within their district that have applied for replacement and that meet the terms and conditions of these guidelines. Proposed air district funding allocations are provided in Appendix B.

In addition to setting the key allocation provisions for Proposition 1B funding for the Lower-Emission School Bus Program, SB 88 also:

- Requires recipient (also known as implementing) agencies to submit semiannual and final reports to the ARB, and requires the ARB to submit those reports to the DoF. To reduce the reporting burden on implementing agencies, the bond accountability database is designed to collect data for both bond accountability and SB 88 reporting requirements.

- Requires these Guidelines to:

    - Provide for the audit of project expenditures and outcomes;
    - Require that the useful life of the project be identified as part of the project nomination process; and
    - Require that project nominations have project delivery milestones.

C. Matching Funds

There is no match funding requirement for new buses purchased to replace pre-1977 model year school buses. This includes buses manufactured before April 1, 1977. For the replacement of 1977-1986 model year buses, staff is proposing a match funding requirement of $25,000 per new bus. Matching funds may be provided by the school district, or any other eligible source, including motor vehicle registration fee monies (e.g., Assembly Bill 923 and Assembly Bill 2766 funds) provided by the local air district.

D. Administrative Funds

An air district may use up to two percent of its total allocation of State program funding for implementation and outreach costs. In addition, air districts may use up to five percent of State program funding designated for retrofits to implement the program's retrofit component (in addition to the aforementioned two percent).

Air districts must account for administrative and project funds separately. Expenditures of Lower-Emission School Bus Program State program funding, including funds used to cover administrative costs, are subject to audit.

1. Allowable Costs

Administrative funds shall only be used for costs associated with the program implementation-related tasks outlined in these Guidelines and must be documented by the air district. Administrative funds shall be used for Lower-Emission School Bus

Program implementation and outreach, including: district staff time; consultant fees; printing, mailing, and travel costs; project monitoring and compliance expenses; and indirect costs, such as general administrative services, office space, and telephone services.

2. Required Documentation

Air districts must maintain documentation of Lower-Emission School Bus Program funds used for implementation and outreach. Districts must keep the following documentation:

- Personnel documentation must make use of timesheets or other labor tracking software. Duty statements or other documentation must be used to verify actual hours or percent of staff time devoted to Lower-Emission School Bus Program implementation and outreach.

- Consultant fees must be documented with copies of the consultant contract and itemized invoices.

- Printing, mailing, and travel expenses must be documented with receipts and/or itemized invoices.

- If travel and per diem expenses are used to document program implementation costs, allowable travel costs and per diem rates must be described in the district's Policies and Procedures Manual. District travel cost criteria must be consistent with the district's written travel policies for other district programs. Alternatively, if these definitions are included in local administrative code or other document, the district may cite the document that governs its practices in the Policies and Procedures Manual.

- Indirect cost calculation methodologies, if used to determine indirect costs of program implementation, must be fully described or referenced in the district's Policies and Procedures Manual. Districts must maintain documentation for all costs referenced in the indirect cost calculation formula.

The aforementioned documentation, records, and referenced materials must be made available for review during ARB or other State agency monitoring visits and audits. These records must be retained for the contract term plus two years.

Districts shall reconcile program and fiscal records at least twice per year.

Districts that charge unallowable costs for program implementation or outreach shall be required to substitute eligible implementation and outreach funds equal to the dollar amount found ineligible, or return the funds for the unallowable cost to the ARB.

E. Assembly Bill 923 Funds

Funds provided through Assembly Bill 923 (AB 923, Stats 2004 Ch 707) are another possible source of new school bus purchase funding. This legislation has provided a mechanism for air districts to increase the motor vehicle registration fee surcharge from four dollars to six dollars. The additional two dollar surcharge may be used by air districts for four different clean air categories, including the "new purchase of school buses pursuant to the Lower-Emission School Bus Program adopted by the state board."[2]

AB 923 funds may be used to meet the match funding requirement for replacing 1977-1986 model year buses. If an air district uses AB 923 funds as the primary source of funding to replace a 1977-1986 model year bus, the air district may also cover the match funding requirement with AB 923 funds.

AB 923 requires that the purchase of school buses with AB 923 funds be pursuant to the Lower-Emission School Bus Program Guidelines; however, AB 923 funds are not subject to all of the restrictions, such as the expenditure deadlines, that apply to Lower-Emission School Bus Program State program funding. These Guidelines include provisions to cover requirements specific to 2007 Budget Act funds, as well as provisions generally applicable to all funds to be spent pursuant to the Guidelines.

AB 923 funds allocated to the purchase of new school buses are subject to these Guidelines, with the following exceptions:

- The dates in the Lower-Emission School Bus Program Timetable do not apply to AB 923 funds.

- Air districts should report expenditures of AB 923 funds, including AB 923 funds spent pursuant to the Lower-Emission School Bus Program Guidelines, through a process established within the 2008 Carl Moyer Program Guidelines.

- On a case-by-case basis, an air district may use AB 923 funding as the primary source of funding to replace a school bus that has a CHP safety certification (CHP form 292) that has lapsed in the past. In this instance, the bus must have a current CHP safety certification (CHP form 292), and the air district must make the determination that the school bus is being used regularly by the school district.

F. Assembly Bill 2766 Funds

Revenues collected from the first four dollars of the motor vehicle registration fee surcharge, authorized by the passage of Assembly Bill 2766 (AB 2766, Stats 1990 Ch 1705), are to be used for the reduction of air pollution from vehicles. These

[2] Assembly Bill 923, Firebaugh, Chapter 707, Statutes of 2004. Available at http://www.leginfo.ca.gov/pub/03-04/bill/asm/ab_0901-0950/ab_923_bill_20040923_chaptered.html.

revenues have been used to replace school buses, but also have greater flexibility. These funds may be used by air districts to fund the replacement of on-board fuel tanks on school buses operating on compressed natural gas (CNG), to fund retrofits, or to fund the match requirement.

G. Milestones and Timetable for State Program Funding

This section covers key program milestones, an abridged timetable (Table V-1), and describes remediation plans and reconciliation requirements, for the Lower-Emission School Bus Program. The dates listed in Table V-1 are the final dates for execution of the designated activities conducted with State program funding. The expanded timetable is provided in Appendix D.

1. Milestones

This section further describes some of the major performance milestones set forth in the expanded program timetable (Appendix D). Air districts must meet these milestones in order to demonstrate progress in meeting the goals of the Lower-Emission School Bus Program.

- Beginning on **April 30, 2008**, the ARB will make State program funds available to air districts by mailing Grant Award and Authorization Forms to air districts. An air district may begin requesting funds after its Policies and Procedures Manual (see Section K) is approved by the ARB. An air district must provide the documents listed in Section J.1 to receive its initial disbursement.

- Beginning **February 1, 2009**, when the air districts' first semiannual reports are due, ARB will perform a needs assessment to check each air district's progress and ability to implement a local program.

- By **March 1, 2009**, based upon air districts' February 1, 2009 demonstration of performance, the ARB will determine if direct implementation – that is implementation of a local program by the ARB, with CAPCOA's assistance – of additional local programs is necessary. The funds spent within each air district will be the same regardless of what organization implements the program.

- **August 1, 2009**. If an air district does not meet the milestone(s) for this date, then the air district must submit a remediation plan to the ARB.

- **February 1, 2010**. If an air district does not meet the milestone(s) for this date, then the air district must submit a remediation plan to the ARB.

- **August 1, 2010**. If an air district does not meet the milestone(s) for this date, then the air district must submit a remediation plan to the ARB.

Table V-1 Abridged[(a)] Lower-Emission School Bus Program Timetable	
Dates	Milestones
March 27-28, 2008	Board approves air district allocations and Guidelines
April 30, 2008	Funds made available to air districts
Beginning May 2008 and ongoing	Initial disbursements to air districts based on readiness Policies and Procedures approved by ARB; previous years' funds expended by appropriate deadlines Additional disbursements to air districts based on demonstrated need (i.e., 50% of funds from all previous disbursements under contract) Up to 65% of its total allocation through June 30, 2009 ARB/CAPCOA begin direct implementation of funds, where applicable
June 30, 2008	100% of funds encumbered by ARB through Grant Award and Authorization Forms
February 1, 2009	First semiannual report due/performance milestone(s) (i.e., information entered into database by air district; fiscal/program reconciled; air district prints and signs report and mails it to ARB – these steps must be taken for all semiannual reports and the final report) Districts with pre-1977 buses: 100% of pre-1977 replacements under fully executed contracts and ordered Districts without pre-1977 buses: 10% of retrofit funds and 10% of 1977-1986 bus replacement funds under fully executed contracts
March 1, 2009	Based upon February 1, 2009 demonstration of performance, ARB determines if direct implementation (by ARB/CAPCOA) of additional local programs is necessary
June 30, 2009	Deadline for ARB to encumber all funds
August 1, 2009	Second semiannual report due/performance milestone(s) 50% of an air district's total allocation under fully executed contracts
February 1, 2010	Third semiannual report due/performance milestone(s) 100% of pre-1977 bus replacements paid for and in operation 100% of 1977-1986 bus replacement funds under fully executed contracts and buses ordered 50% of an air district's retrofit commitment under fully executed contracts 10% of an air district's retrofit funds spent and retrofitted buses in operation
June 30, 2010	**Retrofit funding may no longer be available for school buses due to proposed In-Use On-Road Heavy-Duty Diesel Vehicles Regulation**
August 1, 2010	Fourth semiannual report due/performance milestone(s) 100% of an air district's total allocation under fully executed contracts
February 1, 2011	Fifth semiannual report due/performance milestone(s) 25% of 1977-1986 bus replacement funds paid out 50% of retrofit funds spent and projects in operation
April 1, 2011	All new buses delivered and infrastructure completed
June 30, 2011	Deadline for full expenditure of Proposition 1B funds 100% of funds paid out; all projects/equipment in operation Funds outstanding as of this date must be returned to ARB within 60 days
August 1, 2011	Final report due
(a) This table contains a brief overview of milestones. Details regarding the criteria air districts must follow to meet these milestones are provided in the expanded timetable in Appendix D and throughout this chapter of the Guidelines.	

2. Remediation Plans

ARB staff will meet with non-performing districts and develop remediation plans with the objective of meeting program goals, recognizing that the situation will be different in each district.

3. Reconciliation

District Lower-Emission School Bus Program staff shall meet with the appropriate district fiscal staff at least twice per year – particularly in preparation of semiannual and final reports – to reconcile program funds.

H. Implementation Options

There are three options for implementation of the Lower-Emission School Bus Program:

- Self-implementation by an air district
- Regional implementation by a neighboring air district
- Implementation by the ARB with assistance from CAPCOA

The funds spent within each air district will be the same regardless of what organization implements the program. In air districts for which the ARB implements the Lower-Emission School Bus Program, CAPCOA will assist with outreach to school districts and will assist school districts with the application process.

I. Funding Agreements/Awards to Implementing Agencies

The ARB staff will initiate grant award agreements for State program funds:

- With air districts that will implement the Lower-Emission School Bus Programs in their respective regions.
- With school districts directly in air districts that do not implement the Lower-Emission School Bus Program.

Eligible school districts shall be contacted by the air district, ARB, or the CAPCOA and asked to apply for State program funds.

J. Fund Disbursement to Air Districts

An air district will not receive any disbursements if it has unexpended (i.e., not paid out) State program funds from any fiscal years (FY) prior to the 2005-2006 FY. The air district must either demonstrate that those funds have been paid out, or must return the previously unused funds to the ARB.

Beginning July 1, 2008, air districts that have unexpended funds from the 2005-2006 FY will not be able to receive any disbursements until those funds have been paid out or returned to the ARB.

1. Initial Disbursements

The air districts shall provide the following documents in order to receive their initial disbursements:

- The grant agreement, provided by the ARB, signed by an air district official with fiscal authority.
- A resolution from the air district governing board (or other documentation signed by a duly authorized official) that authorizes the air district to accept the funds.
- A Policies and Procedures Manual (required contents are described in Section K of this chapter)
- A Grant Disbursement Request. The Grant Disbursement Request form must be signed by an air district board-authorized party. If there are stipulations on the Grant Award and Authorization form, all stipulations must be met prior to submitting the initial disbursement request.
- Documentation described in Section Q.1 (Documentation of Expenditure of Previous Grant Awards) of this chapter, if this documentation has not already been submitted.

Initial disbursements will be made to air districts based on their readiness. For its initial disbursement, an air district should request:

- 100 percent of the allocation designated for replacing pre-1977 model year buses, if applicable; and
- 10 percent of the remainder of the allocation; and
- 50 percent of its administrative funds. Air districts will receive one check for both administrative and project funds. However, air districts must account for the administrative and project funds separately.

An air district may receive up to 65 percent of its total allocation through June 30, 2009.

2. Additional Disbursements

Additional disbursements will be made to air districts based on demonstrated need, i.e., at least 50 percent of funds from all previous disbursements must be under contract. For additional disbursements of Lower-Emission School Bus Program State program funds, air districts must submit a Grant Disbursement Request and provide documentation (i.e., copies of fully executed contracts) that 50 percent of the funds from all previous disbursements are under contract.

An air district may request the other half of its administrative funds when 50 percent of the funds in its full Lower-Emission School Bus Program allocation have been committed. The air districts will again receive one check for both administrative and project funds and must account for the administrative and project funds separately.

K. Policies and Procedures Manual

As a prerequisite for receiving the initial funding disbursement, an air district must submit a Lower-Emission School Bus Program Policies and Procedures Manual to the ARB. The manual must describe the district's policies, procedures, and organizational structure for the Lower-Emission School Bus Program. The submitted manual shall apply to the current funding cycle. A complete Policies and Procedures Manual must be submitted to and approved by the ARB, in writing, before a district is eligible to receive its initial funding disbursement. The Policies and Procedures Manual must include, at a minimum:

1. Retrofit Implementation Plan

As an air quality agency, the ARB recognizes that retrofits are an efficient and cost effective means of reducing PM emissions. State program funding for new buses has been well-received and oversubscribed in the past, while greater effort is needed to spend retrofit funds. However, the positive public health impact of State program funding is greater for funds spent on retrofitting in-use diesel buses. Each in-use diesel bus that is retrofitted with a Level 3 diesel particulate filter emits 85 percent less toxic PM. This strategy provides the most cost-effective air quality benefit, since a retrofit costs about 10 percent of the purchase price of a new bus.

The retrofit implementation plan must include the air district's commitment of funds – as a percentage of the amount left over after funds are allocated for replacing pre-1977 model year buses – for equipping in-use buses with ARB-verified Level 3 diesel emission control retrofit devices. The ARB strongly recommends 25 percent. In addition, the air district must describe the steps that it will take to remedy the situation if it falls short of any retrofit-related performance milestones.

2. Air District's Commitment to 1977-1986 Model Year School Bus Replacements

The air district must describe its commitment of funds for replacing 1977-1986 model year school buses. In addition, the air district must describe its process for selecting and awarding funds to replace 1977-1986 model year buses (see Section N of this chapter), and under what conditions air district funds will be used to provide match funding, if applicable. SB 88 states that an air district will replace the oldest school buses of model year 1977 to 1986. Therefore, air districts must preferentially select for replacement the oldest school buses within their district that have applied for replacement and that meet the terms and conditions of these guidelines.

3. Description of Local Program Components

The Policies and Procedures Manual must contain a description of the air district's day-to-day process for implementing the Lower-Emission School Bus Program, as well as the following components:

- Program structure and organization, including coordination with the ARB

- Process for applying for funds from and accepting funds from the ARB
- Project solicitation, evaluation, and selection (including schedule for program implementation)
- Environmental justice (if applicable)
- Fund commitment and expenditure
- Fiscal practices and procedures for payments, interest, and reconciliation
- Project reports
- Contract components and contracting process with applicants
- Invoice review, approval, and payment protocols
- District audits of projects
- Details regarding program components identified in the Administrative Funds section of this chapter

L. Implementing Agencies' Lower-Emission School Bus Program Notification of School Districts

Implementing agencies (air districts or ARB/CAPCOA) shall notify school districts of opportunities to participate in the Lower-Emission School Bus Program. The ARB will monitor the ongoing implementation of both program components and assist the implementing agencies where needed. ARB district liaisons will review semiannual reports, provide technical assistance, and attend outreach events.

1. Outreach

Outreach prior to and during the time frame of program notification is critical for the success of a local program. The implementing agencies should focus their outreach in a way that encourages applications from all school districts, including environmental justice communities and rural districts. Below are brief descriptions of the types of practices that might be included as part of an implementing agency's outreach activities. If possible, implementing agencies should employ all of the following practices.

(a) List of School Districts

Implementing agencies should maintain a list of school districts within their respective regions and the contact information for the school bus fleet maintenance personnel. A notification should be mailed to the contacts on the list when funds are available.

(b) Local Newspaper Announcement

Implementing agencies are encouraged to put an announcement in local newspapers and in appropriate local newsletters.

(c) Web Site Notification

If an implementing agency has a web site, the Lower-Emission School Bus Program opportunity notice should be advertised on the implementing agency's web site. If the implementing agency has a newsletter, the Lower-Emission School Bus Program opportunity notice should be advertised in the implementing agency's newsletter.

(d) Site Visits and Workshops

Implementing agencies are encouraged to conduct site visits or telephone conference calls with school districts, particularly to advise them of the opportunity to participate in the retrofit component of the program. Implementing agencies are also encouraged to hold pre- and post-award funding workshops.

M. Higher-Risk Communities, Including Environmental Justice Communities

It is important that school bus projects funded through the Lower-Emission School Bus Program benefit all communities of California, particularly those disproportionately affected by air pollution. Health and Safety Code (HSC) section 43023.5 requires air districts with a population of one million residents or greater to ensure that not less than 50 percent of the funds appropriated by the State Legislature for programs for the purchase of reduced-emissions school buses "are expended in a manner that directly reduces air contaminants or reduces the public health risks associated with air contaminants in those districts, including, but not limited to, airborne toxics and PM, in communities with the most significant exposure to air contaminants or localized air contaminants, or both, including, but not limited to, communities of minority populations or low-income populations, or both." The ARB, CEC and local air districts have worked cooperatively to implement this requirement affecting State funding appropriations within the Lower-Emission School Bus Program beginning in 2001, when the statute first went into effect.

For the State program funds now available for the Lower-Emission School Bus Program, the Legislature has directed that the funds be allocated following the criteria set forth in SB 88. That legislative directive takes precedence over environmental justice criteria for Lower-Emission School Bus Program State program funding. For AB 923 funding, and for other air district funding, the ARB encourages air districts to consider environmental justice; therefore, a discussion of environmental justice criteria follows.

While HSC 43023.5 affects only State funding appropriations, the ARB encourages air districts to expend their local AB 923 funds dedicated to new school bus purchases, and other local funds used for new school bus purchases, in a manner consistent with the HSC provision.

To assist air districts in their efforts to focus funds for new school bus purchases in communities pursuant to HSC 43023.5, the ARB has developed recommended criteria for use in the Lower-Emission School Bus Program. While the ARB recognizes that communities disproportionately affected by air pollution are not limited to low-income communities and/or communities of color, the ARB-recommended criteria use the percentage of students within a public school district participating in the free and reduced-lunch meal program as a consistent statewide method to identify schools in which to target funds for new school bus purchases. Alternatively, air districts may

develop different criteria, in consultation with ARB staff, to identify communities in which to focus funds for new school bus purchases.

N. Process of Making Awards to Successful Applicants

The implementing agency (air district or ARB/CAPCOA) shall contact all school districts in its respective region. The implementing agency shall determine the application due dates necessary to complete the program according to the expanded program timetable in Appendix D. School districts desiring to replace or retrofit buses must submit an application to the implementing agency by the date(s) determined by the implementing agency.

Buses shall be replaced following the allocation criteria set forth in SB 88. SB 88 states that an air district will replace the oldest school buses of model year 1977 to 1986. Therefore, air districts must preferentially choose for replacement the oldest school buses within their district that have applied for replacement and that meet the terms and conditions of these guidelines. The implementing agency will review the application for completeness and eligibility and award grants through a process that must be described in an air district's Policies and Procedures Manual. The implementing agency must retain documentation of its implementation of that process. School districts shall be notified by mail after awards are approved by the implementing agency.

Applicants for retrofit funding must complete an application for Lower-Emission School Bus Retrofit Program grant money and submit it to their local implementing agency. The implementing agency shall review the application for completeness and eligibility and make grant awards. Applicants shall be notified by mail after awards are approved by the implementing agency.

Staff at the implementing agency shall prepare funding agreements that set forth the terms, conditions, and reporting requirements for each grant. No funds will be released until the school district and the implementing agency have signed the funding agreement.

Implementing agency staff shall notify the ARB when retrofit funding availability is announced and when retrofit funds are released so that ARB may notify CHP of the bus modifications. In practice, this means that when an implementing agency sends out a Lower-Emission School Bus Program opportunity notice to school districts and private transportation contractors to inform them that retrofit funds are available, the air district must send a copy of the opportunity notice to ARB staff. Opportunity notices are often in the form of a program announcement and application package, request for proposal, request for application, etc. In addition, when an implementing agency makes an award of Lower-Emission School Bus Program retrofit funds, the implementing agency must inform ARB of the amount and recipient of the award.

1. Applications

(a) New School Bus Purchase

Air districts must ensure that project applications include the specific information needed to populate the bond accountability database (See Appendix J) and collect the following information:

For each bus that will be replaced:

- Copy of bus registration
- Total mileage
- Mileage for last school year
- Copy of the Inspection Approval Certificate (CHP form 292) that shows that it has been continuously certified as of December 31, 2005.
- Method of bus disposal

For each new bus that will be purchased:

- Assumed date of delivery
- Engine horsepower
- Availability of refueling capability and delivery of fuel by bus delivery date
- Source of any match funding
- If requesting alternative fuel and electric infrastructure funding: demonstrated need based on accessibility of off-site station; cost of CNG slow-fill equipment; cost of recharging station.

Air districts must also ensure that project applications inform applicants that for the purchase of new school buses to replace buses of any eligible model year, the liquidated damages clause set forth in Appendix C: Minimum Contract Requirements of these Guidelines must be included in the terms and conditions of the purchase order agreement between school districts and school bus distributors.

Grant applications must include a resolution from the school district governing board (or a duly authorized official with authority to make financial decisions) authorizing the submittal of the application and identifying the individual authorized to implement the bus replacement project.

(b) School Bus Retrofit

Air districts must ensure that project applications include the specific information needed to populate the bond accountability database (see Appendix J) and collect the following information:

For each bus that is to receive a diesel emission control retrofit device:

- Engine horsepower

Grant applications must include a resolution from the school district governing board (or a duly authorized official with authority to make financial decisions) authorizing the submittal of the application and identifying the individual authorized to implement the retrofit project.

(c) Application Tracking

Implementing agencies must have a system for tracking applications. At a minimum, the tracking system shall include the name and address of the bus owner, whether the application is in regard to a bus replacement or retrofit, and the model year of the bus to be replaced or retrofitted. The implementing agency shall also maintain a copy of each application and a file for each selected project. The tracking system must be retained and made available at the time of an audit.

2. How Awards are Made

Applicants will be notified by mail after awards are approved by the implementing agency. Staff at these agencies shall prepare funding agreements that set forth the terms, conditions, and reporting requirements for each grant.

The payment schedule shall be established in the funding agreement. No funds shall be released until the applicant and the implementing agency have signed the funding agreement. In general, payment will be made as purchase costs are incurred and documentation is provided to the implementing agency. For new buses, proof of new vehicle delivery and dismantling of the replacement vehicle must be provided before payment is made by the implementing agency.

Applicants can only be reimbursed for project costs incurred on or after the date of approval by the implementing agency. The implementing agency will not fund, nor be liable for any portion of, an applicant's cost of preparing and submitting an application.

If the implementing agency issues payment for equipment to vendors, then the implementing agency shall issue payment for equipment to vendors pursuant to the requirements of section 41200, et seq. of the California Education Code (California Proposition 98), to minimize the financial impacts to schools.

3. Reporting Requirements and Records Retention

Implementing agencies will be required to input program information into an on-line transportation bond accountability database that is being developed by the ARB to facilitate compliance with EO S-02-07. The database is expected to be operational in spring 2008.

(a) Reports Submitted to Implementing Agencies

All school districts must report to the appropriate implementing agency upon ordering and delivery of bus(es), and contracts let for, and completion of, any funded alternative

fuel or electric infrastructure funded by State monies. In addition, upon ordering a new bus, a school district must obtain from the school bus distributor a purchase order and a copy of the ARB certification Executive Order for the engine of the bus in the purchase order. Then the school district must submit copies of the purchase order and Executive Order to the implementing agency. The implementing agency must review the purchase order and Executive Order to ensure that the new bus will meet the minimum replacement bus requirements (see chapter titled "Lower-Emission School Bus Replacement Program Requirements") and that the purchase order includes the liquidated damages language set forth in Appendix C: Minimum Contract Requirements. Any other requirements implemented by the implementing agency must be specified in the funding agreements with school districts.

All participating school districts and private transportation contractors must report to the implementing agency upon ordering, delivery, installation, and CHP inspection of diesel emission control retrofit devices. Any other requirements by the implementing agency will be specified in the funding agreements with successful applicants.

(b) Reports Submitted to the ARB

SB 88 requires the ARB to require recipient (also known as "implementing") agencies to submit semiannual progress reports and a final report to the ARB. The ARB must forward those reports to the DoF. Reports must be submitted (i.e., entered into the bond accountability database, printed, signed, and mailed) by the dates listed in Table V-1 and Appendix D. Reports must be signed and dated by the air district's Air Pollution Control Officer and Chief Financial Officer.

Reports must be mailed to:

Attn: Lower-Emission School Bus Program, Mail Stop 7B
Air Resources Board
P.O. Box 2815
Sacramento, CA 95812

To reduce the reporting burden on implementing agencies, the bond accountability database is designed to collect data for both bond accountability and SB 88 reporting requirements. Information that must be reported to the ARB is set forth in Appendix J.

(c) Records Retention

Records must be retained by implementing agencies and applicants for the contract term plus two years. Lists of records that must be retained by implementing agencies and applicants are provided in Appendix E.

O. Liquidated Damages for Late Delivery of School Buses

The ARB will hold liable for liquidated damages the business entity responsible for a delay that results in the failure to deliver program-funded school buses to school districts by February 1, 2010 (for pre-1977 model year bus replacements) or

April 1, 2011 (for 1977-1986 model year bus replacements). Specifically, the liquidated damages will be in the amount of $100 per day per bus for each day a bus is delivered after February 1, 2010 (for pre-1977 model year bus replacements) or April 1, 2011 (for 1977-1986 model year bus replacements). The purpose of charging liquidated damages is to ensure a level playing field for all business entities that stand to profit from the sale of program-funded school buses, to minimize any potential risks to school districts, and to forestall delays in achieving emission benefits. Implementing agencies must review school districts' purchase orders for new buses to ensure that the purchase orders include the liquidated damages clause set forth in Appendix C: Minimum Contract Requirements of these Guidelines.

For the air districts that self-implement the program, the liquidated damages will be administered through a withhold by the ARB of five percent of the total grant fund award to each air district until after April 1, 2011. Upon confirmation by each air district that all program-funded buses have been delivered to school districts by April 1, 2011, the ARB will immediately release the remaining five percent of their respective grant awards to each air district. For each bus delivered late, the air districts shall reduce the grant payment to either the school bus distributor or the school district (depending on the contract arrangements for the payment of bus purchase orders) by $100 per day per bus for each day a bus is delivered after the applicable deadline. The ARB will retain an amount equal to the calculated liquidated damages from the applicable air district's grant withhold. Upon confirmation of final bus delivery to the school districts, the ARB will then release the remaining grant award balance, if any, to the air district.

Any funds generated through the collection of liquidated damages will be used to augment program funding on a statewide basis.

P. Minimum Contract Requirements

All implementing agencies must enter into contracts with applicants that include minimum contract requirements. The summary provided below in Table V-2 is an overview of, not a substitute for, the complete description of minimum contract requirements provided in Appendix C. Each implementing agency shall draft contracts in consultation with the implementing agency's legal staff. Applicants must incorporate the minimum contract requirements in purchase order agreements with vendors.

Table V-2 Overview of Minimum Contract Requirements[a]	
Project Milestones Party Names and Dates Enforcement On-Site Inspections, Audits, and Records Retention Notices Contract Term Project Specifications Funding Caps Invoices Payment	Disposal of Replaced Buses Assumed Date(s) of Delivery New Bus Purchase Delivery Deadlines and Liquidated Damages Infrastructure Deadline Requirement for CHP Safety Inspection After Retrofit Ownership and Operation Maintenance Fuel Additives Non-Compliance Terms
(a) This table is a summary of, not a substitute for, the complete description of minimum contract requirements provided in Appendix C.	

The contract must be fully executed and the project milestones (e.g., delivery, installation, final inspection, and acceptance) shown in the contract must be met before Lower-Emission School Bus Program funds are provided to the vendor.

Q. Accountability and Reporting

As discussed at the beginning of this chapter, a number of elements, including State mandates, record-high funding, and lessons learned, necessitate more robust oversight of the Lower-Emission School Bus Program. This section covers commitment and expenditure of previous grant awards; commitment and expenditure of current State program funding; the project completion deadline; unexpended State program funding; and calculating, tracking, reporting, and expending earned interest.

1. Documentation of Expenditure of Previous Grant Awards

    (a) Retrofits

Air districts that have previously been awarded Lower-Emission School Bus Program retrofit funds must have submitted, or submit with the initial disbursement request document package, documentation of the status of all previous years' retrofit funds. This documentation must, at a minimum, include the following:

- Names and addresses of the applicants that received the funds
- Number of buses retrofitted
- Manufacturer and make of the retrofit device
- Expenditure for each retrofit
- Total expenditure
- Documentation that funds have been committed through fully executed contracts, i.e., copies of executed contracts

- Documentation that funds have been expended, e.g., copies of checks, remittance letters, receipts, etc. Invoices must be sent, and they must be accompanied by some form of proof of payment.

(b) Bus Replacement

Air districts that have previously been awarded Lower-Emission School Bus Program bus replacement funds must have submitted, or submit with the initial disbursement request document package, documentation of the status of all previous years' bus replacement funds. This documentation must, at a minimum, include the following:

- Names and addresses of the school districts that received the funds
- Number of buses replaced
- Model year, manufacturer, and fuel type of each new bus funded
- Expenditure for each new bus
- Location and type of infrastructure funded
- Expenditure for each infrastructure project/installation funded
- Total expenditure
- Documentation that funds have been committed through fully executed contracts, i.e., copies of executed contracts
- Documentation that funds have been expended, e.g., copies of checks, remittance letters, receipts, etc. Invoices must be sent, and they must be accompanied by some form of proof of payment.

2. Expenditures

A Lower-Emission School Bus Program grant award is not considered to be fully expended until all of the funds in the grant award have been paid out by the implementing agency by paying invoices associated with approved projects. The final deadline for full expenditure of Lower-Emission School Bus Program State program funds, including funds that are designated for the purchase of re-fueling infrastructure, is June 30, 2011. Any funds in the grant award that are not expended (paid out) by this date must be returned to the ARB. Any State program funding outstanding (i.e., has not been paid out) as of June 30, 2011 must be returned to the ARB within 60 days.

(a) Invoices

An itemized invoice for a project must be received by the implementing agency before payment may be made. A project invoice must include enough detail to ensure only eligible project costs are being paid for, yet clear and concise enough to be understandable. The air district or ARB shall review the itemized invoice and only pay for eligible expenses.

3. Earned Interest

The air district shall track and report to the ARB the amount of interest earned on State program funds held in air district accounts beginning immediately after receipt of State program funds from the ARB.

The interest income shall be used to fund projects or administrative expenses that comply with these Lower-Emission School Bus Program Guidelines.

(a) Calculation of Earned Interest

Air districts must maintain accounting records (e.g., general ledger) that track interest earned on and expenditures of Lower-Emission School Bus Program State program funds.

- The ARB strongly encourages implementing agencies to maintain their Lower-Emission School Bus Program State program funds in a segregated account.

- If an air district maintains its Lower-Emission School Bus Program State program funds in a non-segregated account, then the air district shall maintain accounting records that first separate Lower-Emission School Bus Program State program funds from other funds administered by the air district, and then further separate interest earned on Lower-Emission School Bus Program State program funds and the related expenditures of that earned interest.

    - The calculation of interest shall be based on an average daily balance or some other reasonable and demonstrable method of allocating the proceeds from the fund back into the program.
    - Each district's methodology for calculating Lower-Emission School Bus Program State program fund interest shall be consistent with how it calculates earned interest for its other fiscal programs.

- Earned interest must be tracked such that it is separately identifiable from other State program funds.

(b) Expenditures for Program Implementation

A district may use up to two percent of earned interest for program administrative costs. This applies whether or not a district segregates its Lower-Emission School Bus Program funds into project and program administration accounts.

(c) Documentation Retention

Documentation of earned interest generation and expenditure shall be retained for a minimum of the contract term plus two years.

(d) Expenditure Deadline

Because all Lower-Emission School Bus Program State program funds must be fully expended by June 30, 2011, interest earned on those funds must also be fully expended by this deadline. Earned interest that is not fully expended by June 30, 2011, must be returned to the ARB within 60 days from the deadline.

(e) Reporting Earned Interest Projects to ARB

Implementing agencies must report to the ARB on the amount of earned interest accumulated on Lower-Emission School Bus Program State program funds. Implementing agencies must also report to the ARB on projects and administrative costs funded with earned interest.

R. ARB Audit of Air Districts

The California Air Resources Board is responsible for overseeing State-funded emission reduction incentive programs such as the Lower-Emission School Bus Program and the Carl Moyer Program. As part of such oversight, ARB has the responsibility and authority to conduct audits (Health and Safety Code §44291 and §39500). ARB's audits of air districts' Lower-Emission School Bus Programs are typically performed in conjunction with audits of districts' Carl Moyer Programs. This maximizes audit efficiency and minimizes the burden on the districts. Such audits are designed to ensure that district incentive programs achieve expected emission reductions and are implemented in a manner consistent with program guidelines and State law. Besides identifying program deficiencies, audits are also designed to provide ARB with a mechanism for identifying the strengths of district programs. ARB's specific audit procedures are described in more detail in the Carl Moyer and School Bus Program Auditing Policies and Procedures Manual.

Oversight and auditing of expenditures of AB 923 funds, including AB 923 funds spent pursuant to the Lower-Emission School Bus Program Guidelines, will be conducted through a process that ARB staff plans to present in the 2008 Carl Moyer Program Guidelines.

1. ARB's Audit Schedule

ARB's audit schedule for the Lower-Emission School Bus Program is largely driven by the audit schedule for the larger Carl Moyer Program, although risk factors for the Lower-Emission School Bus Program are considered when prioritizing districts to audit. It is appropriate to audit both programs under the same schedule for several reasons. First, there is significant overlap in the districts that implement the Carl Moyer and Lower-Emission School Bus Programs; the districts that have historically implemented the Lower-Emission School Bus Program are a subset of the districts that have implemented the Carl Moyer Program. Also, the allocation of State funds for both programs tends to be greatest for the large districts. Accordingly, ARB shall audit a sufficient number of districts each year – commensurate with approximately 10 percent of Carl Moyer Program funds – to ensure proper program implementation. The frequency of district audits is as follows:

- Large districts will be audited at least once every four years.
- Medium districts will be audited at least once every six years.
- Small districts will be audited at least once every eight years.

To ensure objectivity and the efficient use of resources, ARB shall use a risk-based approach to select specific districts for audit during a given year and to select specific district projects to audit. Consistent with this approach, districts that demonstrate good performance when audited will likely be audited less frequently in the future than similarly-funded districts with poorer audit results.

2. ARB's Responsibilities During an Audit

Audits shall be conducted in a manner that reflects the public responsibility and accountability entrusted to ARB. ARB shall maintain open channels of communication with the district under audit. ARB's audit procedures contain a number of provisions to enable open communications. Such provisions include fully explaining the audit's scope and procedure at the beginning of the process, discussing preferred channels of communication with the district, informing the district of potential issues as they unfold, affording numerous opportunities for district input throughout the audit, thoroughly discussing any findings and recommendations with the district during the exit interview, and allowing the district an opportunity to formally respond to the audit report.

To ensure objectivity and predictability, ARB shall base its findings and recommendations on materials such as State law, ARB's Program Guidelines and Advisories, Program Grant Award and Authorizations, e-mail communications between ARB and the district, a district's Policies and Procedures Manual, and a district's local requirements.

All audit reports, district responses, and related documents shall be readily available to the public.

ARB shall conduct sufficient follow-up activities, including assisting districts and conducting follow-up reviews, to ensure that any identified deficiencies are promptly and effectively rectified.

3. Air Districts' Responsibilities During an Audit

Districts shall ensure that program files and other requested information are readily available to audit staff. In addition, district management shall, at a minimum, participate in the entrance and exit interviews and shall ensure that district staff is cooperative with audit staff. District staff shall communicate fully with audit staff and with district management throughout the course of an audit. Districts shall make every effort, including requesting assistance from ARB if necessary, to ensure that identified deficiencies are promptly and effectively rectified. Districts shall report on their progress at specified intervals.

S. Audits Conducted by the DoF

The Lower-Emission School Bus Program is also subject to audit by the DoF as part of the three-part accountability structure set forth in EO S-02-07, which increases transparency in the bond proceeds expenditure process. For more information, visit the Strategic Growth Plan Bond Accountability Web site at http://www.bondaccountability.ca.gov/.

DoF may audit at both the State and local air district levels.

Appendix A

Glossary of Administrative Terminology

Appendix A Glossary of Administrative Terminology

This appendix provides definitions of terms that are used throughout these Guidelines.

Administrative agency/Administering agency. The California Air Resources Board.

CAPCOA: The California Air Pollution Control Officers Association.

Commitment of Funds. Funds are considered to be committed to a project when the air district officially selects an eligible project for funding through any of the following actions:

- The air district's governing board approves a project for funding through a resolution, minute order, letter or other written instrument, or
- The district's Air Pollution Control Officer or other governing board-authorized representative sends the successful applicant a project offer letter, or
- The contract between the implementing agency and the school bus owner is fully executed.

Contract. A contract, grant, or other legally binding and enforceable agreement used by an air district, the ARB, or an applicant to commit and expend funds for a project funded through the Lower-Emission School Bus Program.

Dismantle. To punch, crush, stamp, hammer, shred, or otherwise render permanently and irreversibly incapable of functioning as originally intended, any vehicle or vehicle part.

Equipment. Equipment includes, but may not be limited to, buses, associated refueling infrastructure for alternative-fueled buses, and diesel emission control retrofit devices.

Expend. An implementing agency expends funds from a grant award by paying invoices associated with approved projects.

Fully executed contract. A fully executed contract is one that has been signed and dated by all parties to the contract.

Fully executed Grant Award and Authorization Form. A fully executed Grant Award and Authorization Form is one that has been signed and dated by all parties to the Grant Award and Authorization Form.

Fully expend. A Lower-Emission School Bus Program grant award is considered to be fully expended when all of the funds in the grant award have been paid out by the implementing agency by paying invoices associated with approved projects.

Grant Award and Authorization Form. A Grant Award and Authorization Form is a legally binding and enforceable agreement initiated by the ARB to consign funds for a project funded through the Lower-Emission School Bus Program. This document is sometimes referred to as a grant award agreement, grant agreement, or grant award.

Implementing agencies. Local air districts, and in some instances, the California Air Resources Board.

Order. To obtain a purchase order.

Project. "Project" includes equipment purchase, equipment installation, data logging of buses that are candidates to receive diesel emission control retrofit devices, and associated maintenance of diesel emission control retrofit devices.

Proposition 1B. Proposition 1B, approved by California voters on November 7, 2006, enacts the Highway Safety, Traffic Reduction, Air Quality, and Port Security Bond Act of 2006, which authorizes $200 million for replacing and retrofitting school buses throughout California.

Spend. Expend.

State program funds/State program funding. Funds that were appropriated to the ARB, through the 2007 Budget Act, for the administration of the Lower-Emission School Bus Program. Source of funding: Proposition 1B.

Appendix B

Proposed Air District Funding Allocations

Appendix B Proposed Air District Funding Allocations

This appendix describes the amount of funding that is available, explains how bus populations were estimated, and provides proposed funding allocations.

A. Amount of Funds

Proposition 1B provides $200 million for school bus retrofit and replacement to reduce air pollution and to reduce children's exposure to diesel exhaust. From these funds, about $7 million were set aside for bond financing costs, and the State Legislature has appropriated $193 million in the 2007-2008 fiscal year (FY) budget to the California Air Resources Board (ARB or Board) for the Lower-Emission School Bus Program. SB 88 allows the ARB to use up to five percent for program administration; however, the ARB proposes to use less than one percent – about $1,620,000 – for program administration. This leaves $191,380,000 available to be spent in local air districts (see Table B 1).

B. Proposed Funding Allocation

Proposed funding allocations are provided below in Table B-1. The proposed allocations reflect the allocation provisions set forth in SB 88, and are also based on estimates of school bus populations that are described in Section 1 below. When determining the proposed allocations, staff assumed a cost of $140,000 to replace a pre-1977 MY bus.

1. Estimates of Bus Populations

The populations of buses eligible for replacement under the Lower-Emission School Bus Program were estimated based on information in the 2005 California Highway Patrol (CHP) school bus safety certification database supplemented by information from surveys collected from public school districts operating some 1986 and older MY school buses. When trying to determine replacement eligibility, staff chose school buses owned by public schools and joint powers authorities (JPA), with greater than 14,000 pounds gross vehicle weight rating (GVWR), that were still in the fleet, and having recent CHP safety certifications, if these data were available. Because not all buses had GVWR information in the database, staff also selected for seating capacity, assuming that a bus seating greater than 19 had a greater than 14,000 pounds GVWR. In the 1977-1986 MY bus population, staff included buses not surveyed, thereby potentially including ineligible buses.

With current funding, the ARB projects that over 1,100 new buses will be purchased to replace pre-1987 MY public school buses – all eligible remaining pre-1977 MY buses and about 40 percent of eligible 1977-1986 MY buses. ARB staff estimates that fewer than 100 pre-1977 public school buses are still in operation. Appendix F contains a list of pre-1977 MY public school buses that are eligible for replacement. ARB staff estimates that about 2,700 1977 through 1986 MY buses are still operating in California by public school districts. The draft allocation plans in Table B 1 were developed using

Table B-1 Proposed Lower-Emission School Bus Program Funding Allocations				
Larger Air Districts	Population as of January 2008	Estimated Populations as of October 2007		
	Pre-1977 Population	**1977-1986 Population**	**Percent of 1977-1986 Population**	**Total Allocation (Incl. Admin)**
Bay Area	4	118	4.34%	$8,400,000
Monterey	8	90	3.31%	$7,100,000
Sacramento	1	134	4.93%	$9,100,000
San Diego	2	80	2.94%	$5,600,000
San Joaquin Valley	10	567	20.85%	$39,150,000
South Coast	9	1034	38.03%	$70,100,000
Ventura	4	66	2.43%	$5,000,000
Subtotal	38	2089	77%	$144,450,000
Small and Medium Air Districts (includes remaining 28 air districts)				
	Pre-1977 Population	**1977-1986 Population**	**Percent of 1977-1986 population**	**Total Allocation (Incl. Admin)**
Amador	0	1	0.04%	$140,000
Antelope	0	18	0.66%	$1,200,000
Butte	4	31	1.14%	$2,600,000
Calaveras	0	16	0.59%	$1,100,000
Colusa	0	8	0.29%	$500,000
El Dorado	0	32	1.18%	$2,100,000
Feather River	3	26	0.96%	$2,200,000
Glenn	0	7	0.26%	$470,000
Great Basin	0	11	0.40%	$700,000
Imperial	3	33	1.21%	$2,600,000
Kern	4	13	0.48%	$1,400,000
Lake	0	29	1.07%	$1,900,000
Lassen	0	9	0.33%	$600,000
Mariposa	0	18	0.66%	$1,200,000
Mendocino	3	23	0.85%	$1,950,000
Modoc	0	7	0.26%	$470,000
Mojave	3	44	1.62%	$3,300,000
North Coast	1	44	1.62%	$3,100,000
Northern Sierra	5	23	0.85%	$2,200,000
Northern Sonoma	0	9	0.33%	$600,000
Placer	2	36	1.32%	$2,700,000
San Luis Obispo	0	29	1.07%	$1,900,000
Santa Barbara	1	22	0.81%	$1,600,000
Shasta	3	54	1.99%	$4,000,000
Siskiyou	1	21	0.77%	$1,500,000
Tehama	0	19	0.70%	$1,300,000
Tuolumne	3	19	0.70%	$1,700,000
Yolo-Solano	0	28	1.03%	$1,900,000
Subtotal	36	630	23%	$46,930,000
TOTAL STATEWIDE	74	2719	100%	$191,380,000

the aforementioned bus population estimates and conform to the allocation requirements set forth in SB 88.

Appendix C

Minimum Contract Requirements

Appendix C Minimum Contract Requirements

All implementing agencies participating in the Lower-Emission School Bus Program must incorporate minimum contract requirements in contracts entered into with applicants that have been selected to receive funds under the Lower-Emission School Bus Program. Each implementing agency shall draft contracts in consultation with the implementing agency's legal staff. Applicants must incorporate the minimum contract requirements in purchase order agreements with vendors.

This appendix contains the complete description of the minimum contract requirements that are summarized in Table V-2: Overview of Minimum Contract Requirements.

A. Project Milestones

All contracts shall include project milestones.

B. Party Names and Dates

All contracts shall state the name of the implementing agency and the applicant as parties to the contract. Contracts shall include signature blocks with an area for the dates that the contract is signed.

C. Enforcement

All contracts shall also state that, in addition to enforcement by the air district, the ARB, as an intended third party beneficiary, reserves the right to audit and enforce the terms of the contract at any time during the contract term plus two years.

D. On-Site Inspections, Audits, and Records Retention

All contracts shall include language that allows the air district, the ARB, the California DoF, or their designated representative the right to review and to copy any records and supporting documentation pertaining to the performance of the contract – this includes programmatic and fiscal records and documentation. The applicant shall agree to maintain such records for possible audit for a minimum of the contract term plus two years. The applicant shall agree to allow the auditor(s) access to such records during normal business hours and to allow interviews of any employees who might reasonably have information related to such records. Further, the applicant agrees to include a similar right of the State to audit records and interview staff in any subcontract related to performance of the contract.

All contracts shall include language that allows the air district, ARB, or their designated representative to inspect the project equipment during the entire contract term plus two years and as long as it is still in use after the contract term.

Contracts must require applicants to maintain and retain the project records that are listed in these Guidelines in Appendix E: Records Retention. Records must be retained for the contract term plus two years.

E. Notices

All contracts shall include contact information for both parties to the contract, and how to send and receive notices.

F. Contract Term

All contracts shall specify the term of the contract. The contract term shall include two time frames – "project completion" and "project implementation" – to ensure that the air district and the ARB can fully enforce the contract during the life of the Lower-Emission School Bus Program-funded project.

1. Project Completion

Project completion is the time frame starting with the date of execution of the contract to when the implementing agency confirms that the project has become operational. This includes the time period when equipment is ordered, delivered, and installed. The contract shall include a specified time frame in which project completion shall occur, so that the funds are fully expended by June 30, 2011.

The contract shall also require that no work may begin on the project until the contract is fully executed.

2. Project Implementation

The project implementation time frame begins on the date that an applicant makes the final invoice payment on equipment funded with Lower-Emission School Bus Program State program funds. The project implementation time frame is the second part of the contract term, and must equal no less than five years – the minimum amount of time an applicant must own and operate a bus that is purchased or retrofitted with Lower-Emission School Bus Program funds. The contract shall specify that the owner is required to operate and maintain their Lower-Emission School Bus Program-funded project according to the terms of the contract for the full project implementation period.

G. Project Specifications

Contracts must also contain a statement that the project complies with the Lower-Emission School Bus Program Guidelines and criteria and shall meet all program requirements for the full contract term.

H. Funding Caps

The contract must comply with funding caps for the specific project category as identified in these Guidelines.

I. Invoices

Applicants must submit itemized invoices to the implementing agency.

J. Payment

Before a Lower-Emission School Bus Program payment may be made to a vendor or an applicant, the project contract must be executed, and an eligible itemized invoice must be received by the applicant or implementing agency.

K. Disposal of Replaced Buses

All new bus contract agreements between implementing agencies and school districts must state that the older bus that is replaced shall be dismantled in accordance with the definition of "dismantle" set forth in these Guidelines in Appendix A: Glossary of Administrative Terminology. School districts must ensure that the old school bus is dismantled within 60 days of the receipt of the new, replacement bus. The school district shall obtain and retain the following documentation for the contract term plus two years:

- A copy of the Department of Motor Vehicles Dismantlers Notice of Acquisition/Report of Vehicle to be Dismantled (REG 42); and

- A letter signed and dated by a representative of the entity that dismantled the bus. The letter must state that the vehicle and engine were dismantled in accordance with the definition of "dismantle" set forth in these Guidelines in Appendix A: Glossary of Administrative Terminology. In addition, the letter must include the following information for each dismantled bus:

    - The Vehicle Identification Number, the method used to dismantle the non-engine portion of the bus, and the date the non-engine portion of the bus was dismantled; and
    - The engine serial number, the method used to dismantle the engine, and the date the engine was dismantled.

All new bus contract agreements between implementing agencies and school districts must state that the school districts must send copies of the aforementioned documentation to the implementing agency.

L. Assumed Date(s) of Delivery

All new bus contract agreements between implementing agencies and applicants must state the assumed date(s) of delivery for the new bus(es).

M New Bus Purchase Delivery Deadlines and Liquidated Damages

For the purchase of new school buses to replace buses of any eligible model year, the following clauses must be included in the contract language in which the implementing agency awards funds to school districts, and in the terms and conditions of the purchase order agreement between school districts and school bus distributors:

Liquidated Damages

Time is of the essence in these contracts for the purchase of new school buses to replace older, higher-polluting buses. Failure to timely deliver the new school buses will result in harm to the implementing agency, school districts, schoolchildren, and air quality in the affected school and air districts. Further, every day in which delivery of a new school bus has been delayed may result in additional costs to the implementing agency and school district to rent or lease an equivalent bus or otherwise mitigate the damages from the delay; such costs are definite but unquantifiable at the time of execution of the contract. Therefore, the parties acknowledge and agree to pay liquidated damages for failure to timely deliver the new school buses, as specified below:

Contracts/grant agreements between implementing agency and school districts

For every day after [insert applicable deadline: April 1, 2011 or February 1, 2010] in which a bus has not been delivered as specified in the contract, the school district shall be liable to the implementing agency for liquidated damages in the amount of $100 per day per bus purchased with funds from the Lower-Emission School Bus Program.

Contracts/purchase agreements between school districts and school bus distributors/vendors

For every day after [insert applicable deadline: April 1, 2011 or February 1, 2010] in which a bus has not been delivered as specified in the contract, the school bus distributor/vendor shall be liable to the school district for liquidated damages in the amount of $100 per day per bus purchased with funds from the Lower-Emission School Bus Program.

N. Infrastructure Deadline

Lower-Emission School Bus Program State program funds that are designated for the purchase of re-fueling infrastructure must be fully expended by the same deadline by which the funds to purchase the accompanying new bus(es) must be fully expended.

O. Requirement for CHP Safety Inspection After Retrofit

All retrofit contract agreements between implementing agencies and applicants must include the requirement that each retrofitted bus undergoes a CHP safety certification inspection [per Title 13, CCR section 1272(c)] after the installation of an emission control device and prior to the bus's return to service.

All retrofit contract agreements between implementing agencies and applicants must include the requirement that, after the aforementioned CHP safety certification inspection is done, the applicant must obtain a copy of written documentation from CHP personnel that the retrofitted bus is still structurally acceptable to safely transport students. This documentation shall consist of a copy of a Safety Compliance Report/Terminal Record Update (CHP 343), or a copy of a Vehicle/Equipment Inspection Report Motor Carrier Safety Operations form (CHP 343A).

P. Ownership and Operation

All new bus contract agreements between implementing agencies and applicants must include the requirement that the applicant own and operate the new bus for five years or more.

All retrofit contract agreements between implementing agencies and applicants must include the requirement that the applicant own and operate the retrofitted bus for five years or more.

Q. Maintenance

All retrofit contract agreements between implementing agencies and applicants must include the requirement that the applicant operates and maintains the installed retrofit devices according to the manufacturer's warranty specifications.

All retrofit contract agreements between implementing agencies and applicants must include the requirement that the applicant has diesel particulate filters cleaned periodically (also known as "periodic maintenance" and "baking and de-ashing") 1) throughout their estimated 11-year life, or 2) if a bus is kept for less than 11 years, as long as an applicant owns and operates a retrofitted bus.

All bus replacement contract agreements between implementing agencies and applicants must include the requirement that the applicant operates and maintains the new school bus according to the manufacturer's specifications.

R. Fuel Additives

All retrofit contract agreements between implementing agencies and applicants must include the requirement that fuel additives are not allowed to be used unless specifically identified as allowable in the retrofit device verification Executive Order.

All bus replacement contract agreements between implementing agencies and applicants must include the requirement that fuel additives are not allowed to be used unless specifically identified as allowable in the engine certification executive order.

S. Non-Compliance Terms

Implementing agencies shall include terms to cancel contracts or withhold payment for non-compliance with or not meeting the obligations of the contract, and may include a term that cancels the contract if it is not executed by the owner in a timely manner.

Appendix D

Lower-Emission School Bus Program
Expanded Timetable

Appendix D Lower-Emission School Bus Program Expanded Timetable

This appendix is the complete Lower-Emission School Bus Program Timetable. It is an expanded version of the abridged timetable that is presented in Table V-1 of these Guidelines. The dates shown are the final dates for execution of the designated activities conducted with State program funding.

Table D-1
Expanded Lower-Emission School Bus Program Timetable

Dates	Milestones(a)
March 27-28, 2008	Board approves air district allocations and Guidelines
April 30, 2008	Funds made available to air districts Grant Award and Authorization Forms mailed
Beginning May 2008 and ongoing	Initial disbursements to air districts based on readiness Policies and Procedures must be submitted to, and approved by, ARB Fully executed Grant Award and Authorization Forms must be submitted to ARB Initial disbursements will include: 100 percent of the allocation designated for replacing pre-1977 MY buses, if applicable; and 10 percent of the remainder of the allocation; and 50 percent of administrative funds Additional disbursements to air districts based on demonstrated need (i.e., 50% of funds from all previous disbursements under contract) Up to 65% of its total allocation through June 30, 2009 ARB/CAPCOA begin direct implementation of funds, where applicable
June 30, 2008	100% of funds encumbered by ARB through Grant Award and Authorization Forms

Table D-1 Expanded Lower-Emission School Bus Program Timetable	
February 1, 2009	First semiannual report due/performance milestone(s) (i.e., information entered into database by air district; fiscal/program reconciled; air district prints and signs report and mails it to ARB) Districts with pre-1977 buses: 100% of funding for replacing pre-1977 buses must be under fully executed contracts, and buses must be ordered Districts without pre-1977 buses: Based on commitment in Policies and Procedures, 10% of funds committed to retrofits must be under fully executed contracts Based on commitment in Policies and Procedures, 10% of funds committed to replacing 1977-1986 buses must be under fully executed contracts
March 1, 2009	Based upon February 1, 2009 demonstration of performance, ARB determines if direct implementation (by ARB/CAPCOA) of additional local programs is necessary
June 30, 2009 (deadline for ARB to encumber all funds)	Local funds re-encumbered by ARB, if necessary
August 1, 2009	Second semiannual report due/performance milestone(s) (i.e., information entered into database by air district; fiscal/program reconciled; air district prints and signs report and mails it to ARB) 50% of an air district's total allocation must be under fully executed contracts

Table D-1 Expanded Lower-Emission School Bus Program Timetable	
February 1, 2010	Third semiannual report due/performance milestone(s) (i.e., information entered into database by air district; fiscal/program reconciled; air district prints and signs report and mails it to ARB) 100% of pre-1977 bus replacements paid for and in operation 100% of 1977-1986 bus replacement funds under fully executed contracts and buses ordered 50% of retrofit commitment under fully executed contracts 10% of retrofit funds spent and retrofitted buses in operation
June 30, 2010	**Retrofit funding may no longer be available for school buses due to proposed In-Use On-Road Heavy-Duty Diesel Vehicles Regulation**
August 1, 2010	Fourth semiannual report due/performance milestone(s) (i.e., information entered into database by air district; fiscal/program reconciled; air district prints and signs report and mails it to ARB) 100% of total allocation under fully executed contracts
February 1, 2011	Fifth semiannual report due/performance milestone(s) (i.e., information entered into database by air district; fiscal/program reconciled; air district prints and signs report and mails it to ARB) 25% of funds committed to replacing 1977-1986 buses paid out 50% of funds committed to retrofits paid out and projects in operation
April 1, 2011	All new buses delivered and infrastructure completed
June 30, 2011	Deadline for full expenditure of Proposition 1B funds 100% of funds paid out; all projects/equipment in operation Funds outstanding as of this date must be returned to ARB within 60 days

Table D-1 Expanded Lower-Emission School Bus Program Timetable	
August 1, 2011	Final report due (i.e., information entered into database by air district; fiscal/program reconciled; air district prints and signs report and mails it to ARB)
(a) This table contains a brief overview of milestones. Details regarding the criteria air districts must follow to meet these milestones are provided throughout the chapter titled "Administrative Responsibilities of Air Districts and the Air Resources Board in Implementing the Lower-Emission School Bus Program."	

Appendix E

Records Retention

Appendix E Records Retention

This appendix lists the documents and records that implementing agencies and applicants must retain in their files.

A. IMPLEMENTING AGENCIES

Implementing agencies shall retain files containing:

- The resolution from the local air district governing board (or other documentation signed by a duly authorized official) that authorizes the air district to accept State program funds
- Policies and Procedures Manual
- Grant Disbursement Request forms
- Remediation plans
- Documentation of earned interest generation and expenditure
- Documentation of implementation of the process that is used to select projects and award grants
- Program opportunity notices
- System used to track applications

1. School Bus Replacements

Implementing agencies shall retain files for each funded bus replacement project containing:

- Application
- Resolution from the school district governing board (or a duly authorized official with authority to make financial decisions) authorizing the submittal of the application and identifying the individual authorized to implement the bus replacement project.
- Executed contracts, including those entered into with the ARB and with applicants
- Copy of the purchase order for the new replacement bus
- Copy of the ARB certification executive order for the engine of the new replacement bus in the purchase order
- Invoices
- Proof of payment
- Copy of the Inspection Approval Certificate (CHP 292) for the replaced bus
- Copy of the registration for the replaced bus
- To document the gross vehicle weight rating (GVWR) for any bus that is to be replaced, a photograph of the bus's data tag must be taken and retained in the files. The photograph must be legible and preferably in electronic format.
- Copy of the registration for the new replacement bus
- Documentation of the disposal of the replaced bus. This documentation must include:

- A copy of the Department of Motor Vehicles Dismantlers Notice of Acquisition/Report of Vehicle to be Dismantled (REG 42); and

- A letter signed and dated by a representative of the entity that dismantled the bus. The letter must state that the vehicle and engine were dismantled in accordance with the definition of "dismantle" set forth in these Guidelines in Appendix A: Glossary of Administrative Terminology. In addition, the letter must include the following information for each dismantled bus:

    - The Vehicle Identification Number, the method used to dismantle the non-engine portion of the bus, and the date the non-engine portion of the bus was dismantled; and
    - The engine serial number, the method used to dismantle the engine, and the date the engine was dismantled.

These files shall be retained for the contract term plus two years.

2. School Bus Retrofits

Implementing agencies shall retain files for each bus that is retrofit with State program funds. The files shall contain:

- Application
- Resolution from the school district governing board (or other documentation signed by a duly authorized official) authorizing the submittal of the application and identifying the individual authorized to implement the retrofit project.
- Executed contracts, including those entered into with the ARB and with applicants
- Invoice(s)
- Proof of payment
- A copy of the Safety Compliance Report/Terminal Record Update (CHP 343) or a copy of the Vehicle/Equipment Inspection Report Motor Carrier Safety Operations form (CHP 343A).
- Copy of the ARB retrofit device verification executive order for the device that was funded.
- Documentation in the form of an invoice or purchase order that states date of maintenance, description of service performed, and cost of service.

These files shall be retained for the contract term plus two years.

B. APPLICANTS

Applicants shall retain files containing correspondence with the implementing agency.

1. School Bus Replacements

Applicants shall retain files for each funded bus replacement project containing:

- Application
- Resolution from the school district governing board (or a duly authorized official with authority to make financial decisions) authorizing the submittal of the application and identifying the individual authorized to implement the bus replacement project.
- Vendor quotes
- Executed contracts
- Copy of the purchase order for the new replacement bus
- Copy of the ARB certification executive order for the engine of the new replacement bus in the purchase order
- Invoices
- Proof of payment
- Copy of the Inspection Approval Certificate (CHP 292) for the replaced bus
- Copy of the registration for the replaced bus
- To document the GVWR for any bus that is to be replaced, a photograph of the bus's data tag must be taken and retained in the files. The photograph must be legible and preferably in electronic format.
- Copy of the registration for the new replacement bus
- Documentation of the disposal of the replaced bus. This documentation must include:

    - A copy of the Department of Motor Vehicles Dismantlers Notice of Acquisition/Report of Vehicle to be Dismantled (REG 42); and

    - A letter signed and dated by a representative of the entity that dismantled the bus. The letter must state that the vehicle and engine were dismantled in accordance with the definition of "dismantle" set forth in these Guidelines in Appendix A: Glossary of Administrative Terminology." In addition, the letter must include the following information for each dismantled bus:

        - The Vehicle Identification Number, the method used to dismantle the non-engine portion of the bus, and the date the non-engine portion of the bus was dismantled; and
        - The engine serial number, the method used to dismantle the engine, and the date the engine was dismantled.

These files shall be retained for the contract term plus two years.

2. School Bus Retrofits

Applicants shall retain files for each school bus that is retrofit with State program funds. The files shall contain:

- Application
- Resolution from the school district governing board (or other documentation signed by a duly authorized official) authorizing the submittal of the application and identifying the individual authorized to implement the retrofit project.
- Vendor quotes
- Executed contracts
- Invoice(s)
- Proof of payment
- A copy of the Safety Compliance Report/Terminal Record Update (CHP 343) or a copy of the Vehicle/Equipment Inspection Report Motor Carrier Safety Operations form (CHP 343A).
- Copy of the ARB retrofit device verification executive order for the device that was funded.
- Maintenance records
- Documentation in the form of an invoice or purchase order that states date of maintenance, description of service performed, and cost of service

These files shall be retained for the contract term plus two years.

Appendix F

List of Pre-1977 Model Year Public School Buses Still in Operation in California

Appendix F List of Pre-1977 Model Year Public School Buses Still in Operation in California

Table F-1
List of Pre-1977 Model Year Public School Buses Still in Operation in California as of January 2008

Air District	School District	Mfg date
BAY AREA AQMD	CAMPBELL UNION HIGH SCHOOL DISTRICT	1/1/1976
BAY AREA AQMD	CAMPBELL UNION HIGH SCHOOL DISTRICT	1/1/1976
BAY AREA AQMD	JEFFERSON UNION HIGH SCHOOL DISTRICT	1/1/1976
BAY AREA AQMD	JEFFERSON UNION HIGH SCHOOL DISTRICT	1/1/1976
BUTTE COUNTY AQMD	OROVILLE UNION HIGH SCHOOL DISTRICT	7/1/1976
BUTTE COUNTY AQMD	PARADISE UNIFIED SCHOOL DISTRICT	7/1/1973
BUTTE COUNTY AQMD	PARADISE UNIFIED SCHOOL DISTRICT	7/1/1974
BUTTE COUNTY AQMD	PARADISE UNIFIED SCHOOL DISTRICT	4/1/1975
FEATHER RIVER AQMD	MARYSVILLE JOINT UNIFIED SCHOOL DISTRICT	4/1/1976
FEATHER RIVER AQMD	MARYSVILLE JOINT UNIFIED SCHOOL DISTRICT	7/1/1976
FEATHER RIVER AQMD	SUTTER UNION HIGH SCHOOL DISTRICT	1/1/1976
IMPERIAL COUNTY APCD	BRAWLEY ELEMENTARY SCHOOL DISTRICT	9/1/1973
IMPERIAL COUNTY APCD	BRAWLEY ELEMENTARY SCHOOL DISTRICT	10/1/1973
IMPERIAL COUNTY APCD	BRAWLEY UNION HIGH SCHOOL	11/11/1974
KERN COUNTY APCD	SIERRA SANDS UNIFIED SCHOOL DISTRICT	1/1/1974
KERN COUNTY APCD	SIERRA SANDS UNIFIED SCHOOL DISTRICT	1/1/1974
KERN COUNTY APCD	SOUTHERN KERN UNIFIED SCHOOL DISTRICT	1/1/1974
KERN COUNTY APCD	SOUTHERN KERN UNIFIED SCHOOL DISTRICT	7/1/1975
MENDOCINO COUNTY AQMD	LAYTONVILLE UNIFIED SCHOOL DISTRICT	1/1/1976
MENDOCINO COUNTY AQMD	UKIAH UNIFIED SCHOOL DISTRICT	1/1/1974
MENDOCINO COUNTY AQMD	WILLITS UNIFIED SCHOOL DISTRICT	1/1/1975
MOJAVE DESERT AQMD	NEEDLES UNIFIED SCHOOL DISTRICT	1/1/1974
MOJAVE DESERT AQMD	NEEDLES UNIFIED SCHOOL DISTRICT	9/1/1975
MOJAVE DESERT AQMD	NEEDLES UNIFIED SCHOOL DISTRICT	11/1/1975
MONTEREY BAY UNIFIED APCD	MONTEREY PENINSULA UNIFIED SCHOOL DISTRICT	1/1/1973
MONTEREY BAY UNIFIED APCD	MONTEREY PENINSULA UNIFIED SCHOOL DISTRICT	1/1/1975

Table F-1
List of Pre-1977 Model Year Public School Buses Still in Operation in California as of January 2008

Air District	School District	Mfg date
MONTEREY BAY UNIFIED APCD	NO MONTEREY COUNTY UNIFIED SCHOOL DISTRICT	1/1/1976
MONTEREY BAY UNIFIED APCD	NO MONTEREY COUNTY UNIFIED SCHOOL DISTRICT	1/1/1976
MONTEREY BAY UNIFIED APCD	NO MONTEREY COUNTY UNIFIED SCHOOL DISTRICT	1/1/1976
MONTEREY BAY UNIFIED APCD	SALINAS UNION HIGH SCHOOL	1/1/1973
MONTEREY BAY UNIFIED APCD	SALINAS UNION HIGH SCHOOL	1/1/1973
MONTEREY BAY UNIFIED APCD	SOLEDAD UNIFIED SCHOOL DISTRICT	1/1/1974
NORTH COAST UNIFIED AQMD	FERNDALE UNION HIGH SCHOOL DISTRICT	1/1/1975
NORTHERN SIERRA AQMD	PLUMAS UNIFIED SCHOOL DISTRICT	1/1/1976
NORTHERN SIERRA AQMD	PLUMAS UNIFIED SCHOOL DISTRICT	1/1/1976
NORTHERN SIERRA AQMD	PLUMAS UNIFIED SCHOOL DISTRICT	1/1/1976
NORTHERN SIERRA AQMD	PLUMAS UNIFIED SCHOOL DISTRICT	1/1/1976
NORTHERN SIERRA AQMD	PLUMAS UNIFIED SCHOOL DISTRICT	1/1/1976
PLACER COUNTY APCD	EUREKA UNION SCHOOL DISTRICT	2/22/1975
PLACER COUNTY APCD	WESTERN PLACER UNIFIED SCHOOL DISTRICT	3/15/1974
SACRAMENTO METROPOLITAN AQMD	GALT JOINT UNION SCHOOL DISTRICT	8/19/1976
SAN DIEGO COUNTY APCD	DEHESA SCHOOL DISTRICT	1/1/1975
SAN DIEGO COUNTY APCD	SANTEE SCHOOL DISTRICT	12/1/1974
SAN JOAQUIN VALLEY UNIFIED APCD	CENTRAL UNIFIED SCHOOL DISTRICT	1/1/1973
SAN JOAQUIN VALLEY UNIFIED APCD	CENTRAL UNIFIED SCHOOL DISTRICT	1/1/1975
SAN JOAQUIN VALLEY UNIFIED APCD	EXETER UNION HIGH SCHOOL DISTRICT	5/1/1975
SAN JOAQUIN VALLEY UNIFIED APCD	FRESNO UNIFIED SCHOOL DISTRICT	1/1/1976
SAN JOAQUIN VALLEY UNIFIED APCD	FRESNO UNIFIED SCHOOL DISTRICT	1/1/1976

Table F-1
List of Pre-1977 Model Year Public School Buses Still in Operation in California as of January 2008

Air District	School District	Mfg date
SAN JOAQUIN VALLEY UNIFIED APCD	HICKMAN COMMUNITY CHARTER DISTRICT	1/1/1976
SAN JOAQUIN VALLEY UNIFIED APCD	KINGS CANYON UNIFIED SCHOOL DISTRICT	1/1/1976
SAN JOAQUIN VALLEY UNIFIED APCD	KINGS CANYON UNIFIED SCHOOL DISTRICT	1/1/1976
SAN JOAQUIN VALLEY UNIFIED APCD	KINGS CANYON UNIFIED SCHOOL DISTRICT	12/31/1976
SAN JOAQUIN VALLEY UNIFIED APCD	LAMONT SCHOOL DISTRICT	1/1/1976
SANTA BARBARA COUNTY APCD	CUYAMA JOINT UNIFIED SCHOOL DISTRICT	1/1/1976
SHASTA COUNTY AQMD	GATEWAY UNIFIED SCHOOL DISTRICT	1/1/1974
SHASTA COUNTY AQMD	GATEWAY UNIFIED SCHOOL DISTRICT	8/1/1974
SHASTA COUNTY AQMD	SHASTA UNION HIGH SCHOOL DISTRICT	1/1/1974
SISKIYOU COUNTY APCD	BIG SPRINGS UNION ELEM SCHOOL DISTRICT	5/1/1973
SOUTH COAST AQMD	A B C UNIFIED SCHOOL DISTRICT	12/30/1976
SOUTH COAST AQMD	AZUSA UNIFIED SCHOOL DISTRICT	12/1/1975
SOUTH COAST AQMD	RIM OF THE WORLD UNIFIED SCHOOL DISTRICT	5/1/1973
SOUTH COAST AQMD	RIM OF THE WORLD UNIFIED SCHOOL DISTRICT	5/1/1974
SOUTH COAST AQMD	RIM OF THE WORLD UNIFIED SCHOOL DISTRICT	5/1/1974
SOUTH COAST AQMD	RIM OF THE WORLD UNIFIED SCHOOL DISTRICT	5/1/1976
SOUTH COAST AQMD	RIM OF THE WORLD UNIFIED SCHOOL DISTRICT	5/1/1976
SOUTH COAST AQMD	TEMECULA VALLEY UNIFIED SCHOOL DISTRICT	1/1/1970
SOUTH COAST AQMD	TEMECULA VALLEY UNIFIED SCHOOL DISTRICT	1/1/1976
TUOLUMNE COUNTY APCD	SONORA UNION HIGH SCHOOL	1/1/1974
TUOLUMNE COUNTY APCD	SONORA UNION HIGH SCHOOL	1/1/1976
TUOLUMNE COUNTY APCD	SUMMERVILLE UNION HIGH SCHOOL	1/1/1974
VENTURA COUNTY APCD	FILLMORE UNIFIED SCHOOL DISTRICT	1/1/1972

Table F-1
List of Pre-1977 Model Year Public School Buses Still in Operation in California as of January 2008

Air District	School District	Mfg date
VENTURA COUNTY APCD	FILLMORE UNIFIED SCHOOL DISTRICT	1/1/1972
VENTURA COUNTY APCD	FILLMORE UNIFIED SCHOOL DISTRICT	1/1/1975
VENTURA COUNTY APCD	VENTURA UNIFIED SCHOOL DISTRICT	8/18/1975

APCD = Air Pollution Control District
AQMD = Air Quality Management District
NO = North

Appendix G

School Bus Engines Available in California

Appendix G School Bus Engines Available in California

Table G-1 below describes the heavy-duty school bus engines that have been determined to meet the emission criteria to be eligible for funding under the Lower-Emission School Bus Program. There may be other engine models, not shown, that may meet the emission criteria to be eligible for funding. For engine model year 2008 and 2009, applicants should refer to the engines Executive Order to determine eligibility in the program.

Table G-1
Heavy-Duty School Bus Engines Available in California Engines Meeting 1.4 g NOx + NMHC/bhp-hr

				Certified Emissions g/bhp-hr				
Engine Manufacturer	Model Year	Engine Model	Engine hp Range	NOx FEL	NOx + NMHC FEL	PM std	Fuel	School Bus Manufacturer
Caterpillar	2007	C-7	190 (207)	1.16	1.3	0.01	Diesel	Blue Bird
International	2007	MaxxForce 7	200	-- --	1.2	0.01	Diesel	IC Corp
International	2007	DT 466	210-230	1.10	1.1	0.01	Diesel	IC Corp
International	2007	DT 466	245-300	1.40	1.4	0.01	Diesel	IC Corp
Cummins	2007	ISC	260	1.44	1.4	0.01	Diesel	Blue Bird & Thomas Built
DDC/MB	2007	MBE926	190-330	1.16	1.3	0.01	Diesel	Thomas Built
Clean Fuels	2007	GM 8.1 L	325	-- --	0.5	-- --	Propane	Bluebird

2007 model year John Deere CNG engines certified to 1.24 g/bhp-hr NOx FEL may still be available
2008 model year Cummins ISL G CNG engines are anticipated to be available in school bus configurations in 2008

The 2007 model year Cummins ISB 6.8 liter 200 horsepower (hp) range diesel engine is currently certified to a 2.2 g/bhp-hr NOx+NMHC FEL, and does not qualify for funding under the Lower-Emission School Bus Program.

Appendix H

Types of Retrofit Devices

Appendix H Types of Retrofit Devices

Currently, all verified Level 3 diesel emission control strategies include a diesel particulate filter (DPF). DPFs remove particulate matter in diesel exhaust by filtering exhaust from the engine and are the most commonly available aftertreatment device. Installation involves integrating the DPF into the vehicle's exhaust system. In many cases the DPF replaces the existing engine muffler.

Two basic types of DPFs are typically used: active regeneration and passive regeneration. Successful application of DPFs on new or existing diesel engines requires a robust filter regeneration scheme that periodically oxidizes the collected soot present on the filter to maintain engine backpressure within specified limits. These regeneration methods include both active systems that require supplemental energy to burn off or initiate soot combustion, such as the Cleaire Horizon or passive systems, that are designed to burn off this soot without energy input beyond that provided by the engine exhaust gas, such as the Donaldson DPF. Most Level 3 DPF devices utilize passive technology.

In general, passive DPFs remove particulate matter by collecting particles and oxidizing them during vehicle use. The oxidation process is referred to as regeneration. Passive DPFs typically rely on a precious metal catalyst contained in the filter to allow regeneration at common engine exhaust temperatures. The exhaust temperatures required for regeneration may vary from one control strategy to another. However, there is usually an exhaust temperature requirement of 260 degrees C (500° F) for at least 25 percent of the driving cycle.

For active filters, the regeneration temperature is achieved by means of an external heat source. There is no exhaust temperature requirement for this type of system. This typically involves Installation of an electric or other heat source to increase oxidation in the filter. The currently verified active filter is uncatalyzed and relies on the operator "plugging-in" the vehicle whenever the filter requires regeneration. Infrastructure requirements for these devices typically require a 208 volt, 100 amp dedicated circuit be installed. Regeneration for this type of system is done approximately every 500 miles and usually takes 5 hours.

In addition to collecting soot, filters also collect inorganic based exhaust constituents such as ash, that periodically need to be removed. Engine oil consumption, total ash content of engine lubricant formulations, vehicle duty cycles, filter designs, and fuel-born catalyst dosing rates will all impact ash accumulation rates and the required filter maintenance cleaning intervals. As various types of ash slowly accumulate within the filter, the pressure drop through the filter gradually increases and the backpressure on the engine increases. Since excessively high backpressure on the engine will result in the degradation of engine performance, this ash material needs to be removed periodically. This ash removal or cleaning operation is a necessary filter maintenance procedure.

Generally, filter manufacturers recommend this maintenance to occur every 6 to 24 months depending on the condition of the engine, engine lubricant consumption rates, and the number of miles driven.

Ash cleaning practices include combinations of pressurized dry air streams directed at the exit side of the filter with industrial vacuum devices used on the inlet side to safety collect ash removed from the filter and/or very high temperature treatments of filters that are used before or after air cleaning procedures to remove organic materials and soot that may be contained in the filter.

Because California laws may vary depending on location, ash collected from used filters must be disposed of according to local, state, and/or federal solid waste disposal regulations. If zinc is present in the ash collected from a filter in high concentrations, this material may be characterized as a hazardous waste. The generator of the waste has the responsibility to determine whether their waste is hazardous or not. This generally requires a chemical analysis of the ash sample to determine the zinc content. There are facilities in California that accept hazardous waste from conditionally exempt small quantity generators. Additional guidance concerning acceptable disposable methods is available from the California Department of Toxic Substances Control.

Table H-1 below shows the currently verified Level 3 verified diesel emission control systems that may be applicable to engines found in school buses. There may be diesel retrofit devices that are currently in the verification process that may be suitable for school bus applications. A current and update list of all ARB-verified diesel emission control devices can be found at http://www.arb.ca.gov/diesel/verdev/vt/cvt.htm .

Table H-1 Currently Verified Level 3 Technologies for On-Road School Buses(a) (as of January 2008)					
Plus (+) designates these systems as compliant with 2009 N02 requirements.					
Product Name	PLUS	Technology Type	PM Reduction	NOx Reduction	Applicability
Cleaire Horizon	+	DPF	85%	N/A	Most on-road diesel engines through 2006 model year; Certain MY 2006 and 1993 or older engines with OEM diesel oxidation catalysts; CARB diesel; biodiesel.*
Donaldson DPM		DPF	85%	N/A	1993-2004 on-road; CARB diesel; biodiesel.*
Engine Control System Purifilter (Low Load)	+	DPF	85%	N/A	1994-2004 on-road; CARB diesel; biodiesel.*
Engine Control System Purifilter (High Load)		DPF	85%	N/A	1993-2006 on-road; CARB diesel; biodiesel.*
International Truck and Engine Corporation DPX		DPF	85%	N/A	1994-2003 on-road Navistar (International); CARB diesel.
Johnson Matthey Reformulated CRT		DPF	85%	N/A	1994 - 2006 on-road; CARB diesel; biodiesel.*
Johnson Matthey EGRT	+	EGR/DPF	85%	40%	2000 International DT-466, 2000 Cummins ISM, 2001 Cummins ISB, 1998-2002 Cummins ISC, 2001 Cummins ISL, 2001 MY DDC - 50, and 2001 DDC - 60 on-road; CARB diesel.

(a) The HUSS Umwelttechnik FS-MK device, although verified for engines that are used in school buses, is not at present available for use on school buses in California. Because the HUSS system taps into the fuel system, the CHP requires crash safety testing before they will safety certify a school bus with a HUSS installed.

Appendix I

Biodiesel Use in New and Retrofitted School Buses

Appendix I Biodiesel Use in New and Retrofitted School Buses

Biodiesel is a clean burning alternative fuel, which can be produced from domestic, renewable resources such as soybeans or corn feedstock. Biodiesel refers to the pure form of the fuel or B100. When blended with diesel fuel, the blends are denoted as "BXX" with "XX" representing the percentage of biodiesel contained in the blend. For example, B20 is 20 percent biodiesel and 80 percent petroleum diesel. Use of biodiesel blends is generally expected to reduce diesel particulate matter and organic compounds; however, NOx emissions may increase. These effects tend to increase as the percent of biodiesel in the blended fuel increases. According to the US Environmental Protection Agency B20 can have the effect of increasing NOx emissions between 2-5 percent depending on the feedstock used to make the biodiesel and the petroleum diesel fuel biodiesel is blended with. The use of biodiesel can provide reductions in greenhouse gas emissions when the entire lifecycle of production is compared to that of petroleum diesel fuel. B20 has been estimated to reduce lifecycle greenhouse gas emissions by about 15 percent, and B5 is estimated to provide a lifecycle greenhouse gas emission reduction of about 4 percent.

The ARB is currently involved in the Biodiesel and Renewable Diesel Research Study. This research is evaluating in part the emission characterization of biodiesel, the potential health effects of biodiesel emissions, the mechanism of the excess NOx formation and possible NOx mitigation options. This research is anticipated to be completed in 2009.

The ARB has a draft advisory on biodiesel use that was last revised on November 14, 2006. The ARB staff recommends that if biodiesel blends are used in on-road diesel vehicles, the biodiesel portion of the blend complies with 1) the American Society for Testing and Materials (ASTM) specification D6751 applicable for 15 ppm sulfur content and 2) Title 13, California Code of Regulations (CCR), sections 2281 and 2282 (diesel regulations). ARB staff recommends that biodiesel blends contain no more than 20 percent biodiesel by volume and these fuels should be purchased from a reputable supplier, preferably from a certified BQ-9000 marketer and accredited distributor.

New School Buses

Users of biodiesel blends should determine if the use of biodiesel blends up to 20 percent will affect their engine warranties and are advised to avoid use of fuel that would negate a warranty. Biodiesel blends above 20 percent should not be used in new school buses while the engine warranty is still in effect. Based on current understanding of biodiesel fuels and blending with petroleum based diesel fuel, Engine Manufacturers Association (EMA) members expect that blends up to a maximum of 5 percent (B5) should not cause engine or fuel system problems, provided the B100 used in the blend meets the requirements of ASTM D 6751 and the final blend meets ASTM D 975. The EMA statement on biodiesel can be found at: http://www.enginemanufacturers.org/admin/library/upload/924.pdf If blends exceeding

5 percent are desired, vehicle owners and operators should consult their engine manufacturer regarding the implications of using such fuel. Biodiesel statements issued by school bus engine manufacturers can be found at http://www.biodiesel.org/resources/fuelfactsheets/standards_and_warranties.shtm .

Diesel Retrofit Devices

Vehicles retrofitted with verified devices under Title 13, CCR, sections 2700 through 2710 can use biodiesel blends up to 20 percent, so long as the retrofit method employed on the engine was verified based on the use of commercial diesel fuel meeting CCR, sections 2281 and 2282 and for the purpose of reducing diesel particulates only. Vehicles retrofitted with verified devices for both diesel particulate and oxides of nitrogen must not use biodiesel since biodiesel use may increase nitrogen oxide emissions.

Older school buses that have historically been using petroleum diesel fuel may need to follow certain maintenance procedures to enable a seamless transition to biodiesel blends. Biodiesel can act as a solvent in the fuel tank and fuel system, cleaning fuel system components and causing fouling of fuel lines, injectors and other fuel system components. Therefore, school bus fleets that are considering switching to biodiesel blends must consult with their engines' manufacturer to discuss the proper procedure to follow to ensure that damage is not done to the fuel system. Biodiesel can potentially have a corrosive effect on the fuel systems hoses and o-rings, therefore a school bus fleet operator must consult their engines' manufacturer before converting to biodiesel blends.

The draft ARB advisory on biodiesel use discusses other applicable state requirements that biodiesel blends must meet. Use of biodiesel blends greater than 20 percent are not recommended at this time. The draft advisory is posted on our web site at http://www.arb.ca.gov/fuels/diesel/altdiesel/111606biodsl_advisory.pdf .

Appendix J

List of School Bus Data Fields

Appendix J List of School Bus Data Fields

A. School Bus Program Database Fields Overview

The School Bus Program database has been developed in response to the in-progress accountability requirements associated with the Proposition IB funding for the continuation of the Lower-Emission School Bus Program. The school bus database is designed to collect data submitted by applicants that have entered into fully executed contracts (i.e. contracts signed by both parties.)

The items in the School Bus Program Database Fields List must be completed to the extent possible in order for the required semi-annual reports to be generated accurately. All data fields must be completed once the contract is completed (i.e. when the applicant/vendor has been reimbursed for a completed project.)

B. School Bus Program Database Fields

The tables below list the information that each implementing agency is required to collect and enter for the School Bus Program database. Table J-1 lists the information common to all contracts. Table J-2 lists the information needed for each old bus being replaced. Table J-3 lists the information needed for each new bus being purchased. Table J-4 lists the information needed for each fueling station funded. Table J-5 **Error! Reference source not found.** lists the information needed for each bus being retrofit. Table J-6 lists the information needed about the retrofit device being purchased for the bus listed in Table J-5. Table J-7 is a place holder for listing the information needed for each CNG tank purchased should School Bus Program funds be allowed to be spent on replacing CNG tanks in the future. Table J-8 identifies the information needed to track interest earned and interest spent to date. These fields must be updated every six months, prior to printing the semi-annual report.

Table J-1 School Bus Database Contract Information
Air District Name (whose LESBP funding allocation is funding the projects on contract)
Air District Contract Number
Date Contract Signed
Number of buses to be replaced
Number of buses to be retrofitted
Date of Contract Completion (when applicant/vendor is reimbursed for a completed project)
Amount funded by 07/08 LESBP bond funding
Amount funded by 08/09 LESBP bond funding
Amount funded by LESBP interest earned on bond funding
Applicant Type (school district, JPA, or private transportation agency)
Applicant Name
Applicant Address
Applicant City
Applicant Zip Code
Applicant Contact Person Name
Applicant Contact Person Title
Applicant Contact Person Phone Number
Applicant Contact Person Fax Number
Applicant Contact Person E-mail Address
The following fields repeat to accommodate a non-school district (i.e. JPA or private transportation company) projects with multiple buses or retrofits that may be associated with several school districts.
Select School District associated with project (if not a school district applicant)
Percent of time this (or these) replacement bus (or buses) is (or are) associated with the selected school district (up to 100 percent)
Percent of time this (or these) retrofitted bus (or buses) is (or are) associated with the selected school district (up to 100 percent)

Table J-2 School Bus Database Old Buses being Replaced
Bus Identification Number
Vehicle Identification Number (should be a unique number in database)
Bus Manufacturer
Bus Model
Bus Model Year (should be 1986 or older)
Engine Serial Number (ESN) (should be a unique number in database)
Engine Manufacturer
Engine Model
Engine Model Year
Engine Displacement
Bus Type: C/D/Special Ed
Gross Vehicle Weight Rating (GVWR) (should be greater than 14,000 pounds)
License Plate Number
Fuel Type: Diesel, CNG, Propane, Electric
Current California Highway Patrol Bus Safety Certificate: Yes/No (the LESBP requirement is for the old bus being replaced to be currently certified AND continuously certified since December 31, 2005 AND a that the Air District must have a copy of the current CHP Form 292 in the Air District files)
Documentation of Bus Disposal Method: Yes/No (the Air District must have the Bus Disposal Documentation in the Air District files)
Bus Storage Address
Bus Storage Address 2
Bus Storage City
Bus Storage Zip Code

Table J-3 School Bus Database New Buses being Purchased
Bus Identification Number
Vehicle Identification Number (should be a unique number in database)
Bus Manufacturer
Bus Model
Bus Model Year (should be 2007 or newer)
Engine Manufacturer
Engine Serial Number (ESN) (should be a unique number in database)
Engine Model
Engine Model Year
Engine Displacement
Bus Type: C/D/Special Ed
Gross Vehicle Weight Rating (GVWR) (should be greater than 14,000 pounds)
Fuel Type: Diesel, CNG, Propane, Electric
Purchase Order Date
Date of Bus Delivery
Bus Price
Date Air District/Implementing Agency Reimbursed the School District/Vendor
Amount funded by 07/08 LESBP bond funding
Amount funded by 08/09 LESBP bond funding
Amount funded by LESBP interest earned on bond funding
Match Funding Amount

Table J-4 School Bus Database Fueling Station Information
New Fueling Station Funded: Yes/No
Fueling Station Address
Fueling Station Address 2
Fueling Station City
Fueling Station Zip Code
Cost of Fueling Station
Date Air District/Implementing Agency Reimbursed the School District/Vendor
Amount funded by 07/08 LESBP bond funding
Amount funded by 08/09 LESBP bond funding
Amount funded by LESBP interest earned on bond funding
Number of Buses that Fueling Station would serve
Operational Date

Table J-5 School Bus Database Buses being Retrofit
Bus Identification Number
Vehicle Identification Number (should be a unique number in database)
Bus Manufacturer
Bus Model
Bus Model Year (should be 1987 or newer)
Engine Serial Number (ESN) (should be a unique number in database)
Engine Manufacturer
Engine Model (Air District staff must check if the Level 3 Retrofit Device chosen by the applicant is verified for this bus engine – Check Executive Order on ARB web site)
Engine Model Year
Engine Displacement
Bus Type: C/D/Special Ed
Gross Vehicle Weight Rating (GVWR)
License Plate Number
Fuel Type: CNG, LPG, Electric, Diesel, etc.
Did CHP inspect the retrofitted bus after the retrofit was installed: Yes/No (the retrofitted bus must be inspected post-retrofit installation and before returning to service AND the Air District must have a copy of the inspection documentation [either Form 343 or 343A] in the Air District files)
Cumulative Mileage
Bus Storage Address
Bus Storage Address 2
Bus Storage City
Bus Storage Zip Code

Table J-6 School Bus Database Level 3 Retrofit Devices being Purchased
Level 3 Retrofit Device Manufacturer and Name of Device
Cost of Level 3 Retrofit Device (including tax and installation)
Cost of Additional Expenses (infrastructure, cleaning, data-logging)
Infrastructure Cost
Cleaning Cost
Data-logging Cost
Retrofit Device Dealer/Installer
Retrofit Installation Date
Amount funded by 07/08 LESBP bond funding
Amount funded by 08/09 LESBP bond funding
Amount funded by LESBP interest earned on bond funding
Date Air District/Implementing Agency Reimbursed the School District/Vendor

Table J-7 School Bus Database CNG Tank Replacement Information
Number of CNG tanks
Cost of CNG tanks
Date Air District/Implementing Agency Reimbursed the School District/Vendor
Amount funded by 07/08 LESBP bond funding
Amount funded by 08/09 LESBP bond funding
Amount funded by LESBP interest earned on bond funding
Did CHP inspect the bus after the new CNG tanks were installed: Yes/No (pop-up should state that the CHP requires that the retrofitted bus be inspected post-retrofit installation and before returning to service AND a that the Air District must have a copy of the inspection documentation [either Form 343 or 343A] in the Air District files)

Table J-8 School Bus Database Other Inputs Needed
Total Grant Allocation for the Air District
Spending Target for New Buses
Number of pre-1977 buses in Air District eligible for replacement
Spending Target for Retrofits
Interest Earned to Date
Interest Spent to Date