Responses to Comments

on the

Advanced Clean Cars Environmental Analysis

California Environmental Protection Agency
AIR RESOURCES BOARD

Released March 12, 2012

to be considered at the

March 22, 2012 Board Hearing

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1.0 INTRODUCTION

To meet the requirements of the California Environmental Quality Act (CEQA) under ARB's Certified Regulatory Program, the California Air Resources Board (ARB) staff prepared and circulated for public review the Environmental Analysis (EA) for the Advanced Clean Cars (ACC) Program, which analyzed amendments to California's Low-Emission Vehicle Criteria Air Pollutant and Greenhouse Gas (LEV III), Zero Emission Vehicle (ZEV), and Clean Fuels Outlet (CFO) regulations. The ACC EA was released for public review on December 12, 2011 for a 45-day public review and comment period that concluded on January 27, 2012 at the Board Hearing. ARB received 12 comment letters addressing the EA.

Comment letters received are posted in the comment logs on the ARB website at:
http://www.arb.ca.gov/lispub/comm/bccommlog.php?listname=leviiighg2012,
http://www.arb.ca.gov/lispub/comm/bccommlog.php?listname=zev2012, and
http://www.arb.ca.gov/lispub/comm/bccommlog.php?listname=cfo2012.

ARB also received a number of oral comments at the Board hearing held on January 26 and 27, 2012.

On February 22, staff posted three 15-day change notices of modified regulatory text, one for each regulation that provided modified regulatory language based on staff's further suggested modifications, as released at the Board hearing and the Board's overall direction. One additional comment related to the EA was submitted during that comment period, which closed on March 8, 2012.

Staff prepared the following responses to public comments that will be considered by the Board at the March 22, 2012 public meeting.

This document presents verbatim the comments received that raise significant environmental issues and ARB's written responses to those comments. All comments have been reviewed and considered by ARB staff in preparing these responses. In accordance with ARB's Certified Regulatory Program and CEQA, the Board will consider the written responses to comments on the EA for approval prior to taking final action on the regulations that comprise the ACC Program.

This document includes responses to comments on the EA only. Staff will also prepare written responses to all public comments, not just EA comments, for purposes of the Administrative Procedures Act. The complete written responses to all comments will be included in the Final Statement of Reasons (FSORs) prepared for the each rulemaking. Upon their completion, the FSORs will be made available in electronic form on the ARB rulemaking webpage at:

http://www.arb.ca.gov/regact/2012/leviiighg2012/leviiighg2012.htm,
http://www.arb.ca.gov/regact/2012/zev2012/zev2012.htm, and
http://www.arb.ca.gov/regact/2012/cfo2012/cfo2012.htm

1.1 Requirements for Responses to Comments

Responses to public comments are prepared in compliance with the California Environmental Quality Act (CEQA) and with ARB's certified regulatory program, which states:

> *Public Resources Code (PRC) section 60007. Response to Environmental Assessment*
>
> *(a) If comments are received during the evaluation process which raise significant environmental issues associated with the proposed action, the staff shall summarize and respond to the comments either orally or in a supplemental written report. Prior to taking final action on any proposal which significant environmental issues have been raised, the decision maker shall approve a written response to each such issue.*

In CEQA, PRC section 21091 also provides direction regarding the consideration and response to public comments. While the provisions refer to environmental impact reports, proposed negative declarations, and mitigated negative declarations, rather than a certified regulatory program document, this section of CEQA contains useful information for preparation of a thorough and meaningful response to comments.

PRC section 21091(d) states:

> *(1) The lead agency shall consider comments it receives … if those comments are received within the public review period.*
>
> *(2) (A) With respect to the consideration of comments received …, the lead agency shall evaluate comments on environmental issues that are received from persons who have reviewed the draft and shall prepare a written response pursuant to subparagraph (B). The lead agency may also respond to comments that are received after the close of the public review period.*
>
> *(B) The written response shall describe the disposition of each significant environmental issue that is raised by commenters. The responses shall be prepared consistent with section 15088 of Title 14 of the California Code of Regulations, as those regulations existed on June 1, 1993.*

Title 14 of the California Code of Regulations (CCR) (State CEQA Guidelines) section 15088 contains useful information and guidance for preparation of a thorough and meaningful response to comments. It states, in relevant part, that specific comments and suggestions about the environmental analysis that are at variance from the lead agency's position must be addressed in detail with reasons why specific comments and suggestions were not accepted. Responses must reflect a good faith, reasoned analysis of the comments.

Title 14 CCR section 15088 (a – c) states:

> *(a) The lead agency shall evaluate comments on environmental issues received from persons who reviewed the draft EIR and shall prepare a written response. The Lead Agency shall respond to comments received during the noticed comment period and any extensions and may respond to late comments.*
>
> *(b) The lead agency shall provide a written proposed response to a public agency on comments made by that public agency at least 10 days prior to certifying an environmental impact report.*
>
> *(c) The written response shall describe the disposition of significant environmental issues raised (e.g., revisions to the proposed project to mitigate anticipated impacts or objections). In particular, the major environmental issues raised when the Lead Agency's position is at variance with recommendations and objections raised in the comments must be addressed in detail giving reasons why specific comments and suggestions were not accepted. There must be good faith, reasoned analysis in response. Conclusory statements unsupported by factual information will not suffice.*

1.2 Comments Requiring Substantive Responses

Substantive responses are limited to comments that "raise significant environmental issues associated with the proposed action," as required by PRC section 60007(a). Therefore, responses specific to comments made on the EA prepared for the ACC Program are provided, consistent with the provisions of PRC section 60007. As explained above, other substantive comments are responded to in writing in the FSORs. Where a comment raises both an issue related to and issues not related to the EA, the EA-related comments are responded to in this document and the reader is referred to the non-EA- related responses in the FSORs. ARB conservatively included comments and responses in this document if the comment raises an environmental issue even if the comment does not directly pertain to the adequacy of the EA.

2.0 RESPONSES TO COMMENTS

ARB received 12 comment letters that included comments that raised environmental issues and several oral comments during the January Board Hearing. The list in Table 1 identifies the commenters that submitted environmental comments and commenter information. The specific EA-related written comments are reproduced here verbatim from the comment letters. The comment letters are provided below in hyperlinked text. The associated attachments to the comment letters are provided at: http://www.arb.ca.gov/lispub/comm/bccommlog.php?listname=leviiighg2012, http://www.arb.ca.gov/lispub/comm/bccommlog.php?listname=zev2012, and http://www.arb.ca.gov/lispub/comm/bccommlog.php?listname=cfo2012.

Table 1. List of Commenters

Comment Number on ARB website	Commenter/ Affiliation	Link
Low-Emission Vehicle Criteria Air Pollutant and Greenhouse Gas (LEV III) Regulation		
LEV III - L9	Loren Marz	http://www.arb.ca.gov/lispub/comm/bccomdisp.php?listname=leviiighg2012&comment_num=16&virt_num=9
LEV III - L10	Klaus Land, Mercedes-Benz	www.arb.ca.gov/lists/leviiighg2012/17-klaus_land_testimony_1-26-2012.doc
LEV III - L11	LEV III 15-Day - 11	http://www.arb.ca.gov/lispub/comm/bccomdisp.php?listname=leviiighg2012&comment_num=88&virt_num=11
LEV III - L29	Chris Bliley, Growth Energy	http://www.arb.ca.gov/lists/leviiighg2012/37-carb_comments_01252012.pdf
LEV III - L34	Azita Khalili, BMW	http://www.arb.ca.gov/lists/leviiighg2012/44-20120125_bmw_comments_ghg_leviii_final.pdf
LEV III - L38	Katherine Yehl, Volvo Car Corporation	www.arb.ca.gov/lists/leviiighg2012/49-carb_clean_cars_package_vcc_comments_final.pdf
Zero Emission Vehicle Regulation		
ZEV - L2	Dan Mars	http://www.arb.ca.gov/lispub/comm/bccomdisp.php?listname=zev2012&comment_num=4&virt_num=2
ZEV - L74	Loren Marz	http://www.arb.ca.gov/lispub/comm/bccomdisp.php?listname=zev2012&comment_num=97&virt_num=74
Clean Fuels Outlet Regulation		
CFO - L8	John Braeutigam, Valero	www.arb.ca.gov/lists/cfo2012/10-valero_comments_2012_proposed_amendments_to_the_clean_fuels_outlet_regulation.pdf
CFO - L15	Daniel Sinks, Conoco Phillips	www.arb.ca.gov/lists/cfo2012/21-conocophillips_comments_1_2012_cfo__hearing.pdf

Table 1. List of Commenters

Comment Number on ARB website	Commenter/ Affiliation	Link
CFO - L26	Cathy Reheis-Boyd, Western States Petroleum Association	http://www.arb.ca.gov/lispub/comm/bccomdisp.php?listname=cfo2012&comment_num=34&virt_num=26
CFO - L27	Miles Heller, British Petroleum	www.arb.ca.gov/lists/cfo2012/35-bp_comments_to_carb_for_clean_fuel_outlet_regulation_-_final_1-25-2012.pdf
Transcript	Edward Olson, Jay Bajaria	http://www.arb.ca.gov/board/mt/2012/mt012712.pdf

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Comment Log Display

Below is the comment you selected to display.
Comment 9 for Low Emission Vehicles III (leviiighg2012) - 45 Day.

First Name: Loren
Last Name: Marz
Email Address: lmarz@charter.net
Affiliation:

Subject: Comments on LEV III Proposed Regulation
Comment:

While fully supporting the spirit of the proposed LEV III Regulation, it doesn’t appear that the impacts of a significant shift to “ZEV” technology such as electric vehicles (EV) have been fully considered. 1

According to a National Academies report (National Academies, "Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use.")...

"...Electric vehicles and grid-dependent (plug-in) hybrid vehicles showed somewhat higher nonclimate damages than many other technologies for both 2005 and 2030. Operating these vehicles produces few or no emissions, but producing the electricity to power them currently relies heavily on fossil fuels; also, energy used in creating the battery and electric motor adds up to 20 percent to the manufacturing part of life-cycle damages...."

This is supported by the latest version of Argonne National Laboratory's GREET model (GREET1_2011 - http://greet.es.anl.gov/) which shows that WTW emissions of particulate matter (PM) in California are higher for EV technology than current "clean diesel" technology. Based on the default "mid-sized" vehicle assumed in GREET for the year 2020... 1 Cont'd

WTW PM10 (diesel) = 0.004 (Feedstock) + 0.009 (Fuel) + 0.030 (Vehicle Operation) = 0.043 g/mi
WTW PM10 (EV) = 0.060 (Feedstock) + 0.006 (Fuel) + 0.021 (Vehicle Operations) = 0.087 g/mi

WTW PM2.5 (diesel) = 0.003 (Feedstock) + 0.005 (Fuel) + 0.016 (Vehicle Operations) = 0.024 g/mi
WTW PM2.5 (EV) = 0.015 (Feedstock) + 0.004 (Fuel) + 0.007 (Vehicle Operations) = 0.026 g/mi

All of these values are based on the California electric generation mix assumed in GREET in 2020.

Exhaust PM from the diesel vehicle assumed in GREET = 0.009 g/mi (PM10); 0.0084 g/mi (PM2.5).

Furthermore, based on certified emissions of the 2003 VW Jetta TDI (example of an "old tech" diesel vehicle), exhaust PM emissions = 0.05 g/mi
(http://www.arb.ca.gov/msprog/onroad/cert/pcldtmdv/2003/volkswagen_pc_a00702

0.05 - 0.009 = 0.041 g/mi more exhaust PM for the "old tech" diesel than that assumed for "clean diesel" in GREET. 1 Cont'd

0.043 g/mi + 0.041 g/mi = 0.084 g/mi WTW PM10 for the "old tech" diesel car, actually less than the 0.087 g/mi WTW PM10 calculated by GREET for EV in California for 2020.

"Old tech" diesel vehicles have been effectively banned for many years under LEV II regulations, to the Air Resources Board's credit, yet mandates are being proposed for vehicle technology (e.g., EV) which may actually increase PM emissions from a WTW perspective above "old tech" diesel engine technology. EPA acknowledges in the Draft RIA for the Proposed Rule to Extend the National Program to Reduce Greenhouse Gases and Improve Fuel Economy for Cars and Trucks - Docket ID No. EPA-HQ-OAR-2010-0799, that all PM2.5 is treated as equally potent in causing premature mortality regardless of source (page 6-35 of the Draft RIA), even specifically mentioning PM2.5 from diesel engine sources. So there appears to be no valid reason from a public health perspective to displace the reduction in PM2.5 emissions from diesel engines with increased PM2.5 emissions from power plants to support EV/PHEV technology. The regulatory push for these "advanced technologies" defies logic from an emissions perspective.

A massive shift to EV/PHEV technology would potentially offset gains made from diesel PM emission reduction mandates. It appears superfluous to propose significant reductions in PM emissions from gasoline/diesel vehicles under LEV III to trivial levels (which I support) yet essentially mandate technology which not only doesn't decrease WTW PM emissions from current technology, it increases WTW PM emissions with respect to pre-2004 (Tier 1) diesel vehicles. 1 Cont'd

I would like to state unequivocally that I support EV/PHEV technology for certain niches (e.g., urban commuter travel), but upstream emissions of this technology really need to be taken into account.

As a disclaimer, I am in no way associated with the auto industry or any support industries to the auto industry, including diesel engine manufacturers.

Thank you for your consideration of these comments.

Respectfully submitted,

Loren Carl Marz, Certified Consulting Meteorologist (#591)

Attachment:

Original File Name:

Date and Time Comment Was Submitted: 2012-01-23 11:01:37

1 Cont'd

If you have any questions or comments please contact Clerk of the Board at (916) 322-5594.

LEV III – L9 Response

9-1 The commenter expresses that “While fully supporting the spirit of the proposed LEV III Regulation, it doesn’t appear that the impacts of a significant shift to “ZEV” technology such as electric vehicles (EV) have been fully considered.” According to a National Academies report (National Academies, "Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use.")...

"...Electric vehicles and grid-dependent (plug-in) hybrid vehicles showed somewhat higher nonclimate damages than many other technologies for both 2005 and 2030. Operating these vehicles produces few or no emissions, but producing the electricity to power them currently relies heavily on fossil fuels; also, energy used in creating the battery and electric motor adds up to 20 percent to the manufacturing part of life-cycle damages...."

ARB prepared an EA for the proposed ACC Program (Appendix B) in accordance with CEQA and its certified regulatory program. The EA analyzes the potential environmental impacts associated with the reasonably foreseeable compliance responses of the regulated community. Discussions related to increased electricity charging infrastructure and demand is located on pages 125 and 126 of Appendix B. ARB found that the charging of battery electric vehicles (BEVs) and transitional zero emission vehicles (TZEVs) has the potential for both positive and negative effects to the electric grid for which timing of charging is a key determining factor. For residential charging, the general case is that the vehicle will begin charging after it arrives at home and is plugged in, typically 5-6 p.m.; however, only about 12 percent of vehicles arrive home during this hour, leading to a distribution of charging onset times. This results in an effective peak charging load of about 700 watts per vehicle. Thus, while residential charging power levels vary from about 1.4 to 7.7 kilowatts, the average effect of a single vehicle on the electric system is far lower. There are significant efforts underway to alter the load shape generated by vehicle charging, whether by use of electricity pricing incentives, actively managed or smart charging, or onboard programming of charging times. These would have the effect of moving the load off the peak. At a system level, due to diversity, the electricity demand of these types of vehicles is relatively low, resulting in minimal effects to utility generation and transmission assets, particularly in the near term. According to the Electric Power Research Institute, the potential stresses on the electric grid can be avoided through asset management, system design practices, and managed charging to shift a significant amount of the load away from system peak (Electric Power Research Institute 2011). Please also refer to response LEV III – L34-1.

Klaus Land
Senior Manager, Certification, Environment and Regulatory Affairs
Mercedes-Benz

Testimony
California Air Recourses Board
Public Meeting
LEV III, CFO, ZEV

January 26th, 2012
Note: Actual speech may vary from this script

Madame Chair and Committee Members,

I am Klaus Land, representing Mercedes-Benz. It is an honor to be here today to comment on the proposed regulations that are before you. The state of California is a very important market for Mercedes-Benz, so it is critical that we pay close attention to the needs our customers in California and the other "177" states as we address the proposed regulations. 1

First, I would like to thank the ARB staff for their tireless effort to work with industry and Mercedes-Benz over the last two years to develop these regulations. It was a very challenging but also a very constructive manner which directly contributed to what we believe in challenging regulations that address the need for cleaner, more efficient vehicles with the realities of consumer demand and technology.

Second, I would like to make comments on 3 important topics:

First topic : US06 PM standard for PC.

There is only one issue in the LEV III criteria pollutant amendment that I would like to raise to the level of this Board.

ARB staff is proposing a new US06 PM Standard of approx. 90% reduction. Due to very short notice industry is still trying to determine the possibility to reach this extremely low standard. Where we and also independent research institutes have concerns is the effect this standard will have on new technologies, especially low-powered, downsized engine technologies and range extenders that will be necessary to meet the new Green House Gas standards. Recent vehicle testing has shown that **these PM standards are not achievable for vehicles with these new technologies.** We recommend a PM standard for passenger cars and light duty trucks of 25 mg/mi or as an alternative a SFTP standard of 10 mg/mi composite This composite formula is also used for other limited criteria pollutants in the LEV III regulation. Real world data from EPA and industry show that US citizen don't drive like the US06 test cycle and therefore there is no negative impact on the environment if ARB will agree to this proposal.

On the other side the CO2 benefit will be extremely high by bringing low powered vehicles into the US market as they are available in the European Union with more than 20 different models.

Second topic: Lack of public fueling hydrogen infrastructure.

Mercedes-Benz is commercializing green house gas reduction technologies including diesel, hybrid, plug-in hybrid, battery electric and fuel cell vehicles. Our concern is the lack of public fueling infrastructure. The Clean Fuels Outlet amendments will assure that ultra-clean fuels such as hydrogen are available to meet vehicle demands brought on by the commercialization of Fuel Cell Vehicles and proposed amendments to the ZEV regulation. 1 cont'd

Mercedes-Benz has almost 20 years of Fuel Cell Development and more than 5 million miles of worldwide operation. More than 1,5 billion US dollars have been invested in technology development. We continue to invest at an annual rate of 30 million dollars into product engineering. 50 million dollars have been invested in starting small volume production of fuel cell stacks the first half of this year. A plan is in place for high volume production ramp up in the years 2015-2017.

Fuel Cell Vehicle Technology has reached a level of maturity and is ready to begin commercialization. Growth of Fuel Cell Vehicle market is highly dependent on area-wide availability of hydrogen refueling stations. As in LEV III, Mercedes-Benz has only one request to the Board on how to improve the CFO – and that is to lower the regional activation trigger. Staff is proposing to add a 10,000 regional vehicle activation trigger that would apply to an air basin before the statewide trigger of 20,000 is reached. We propose a 2,000 regional vehicle trigger for an air basin. The lower trigger complements auto manufacturers' early commercialization plans to market Fuel Cell Vehicles in regional clusters and ensures infrastructure will be there when the vehicles are delivered.

Third and final topic: Zero Emission Vehicle Program.

Finally, the Zero Emission Vehicle Program, while very aggressive, offers flexibilities that we support including TZEV and BEVx. These vehicles use technologies and infrastructure that will advance the commercialization of Zero Emission Vehicles. No ZEV credit should be granted for National GHG over-compliance. This flexibility does not achieve the objective of the ZEV program, and will reduce the number of ZEVs on the roads in California. This will slow the deployment of the required vehicles and infrastructure. 1 cont'd

Thank you for considering these important topics.

LEV III – L10 Response

10-1 The commenter expresses that "ARB staff is proposing a new US06 PM Standard of approx. 90% reduction. Due to very short notice industry is still trying to determine the possibility to reach this extremely low standard. Where we and also independent research institutes have concerns is the effect this standard will have on new technologies, especially low-powered, downsized engine technologies and range extenders that will be necessary to meet the new Green House Gas standards. Recent vehicle testing has shown that these PM standards are not achievable for vehicles with these new technologies. We recommend a PM standard for passenger cars and light duty trucks of 25 mg/mi or as an alternative a SFTP standard of 10 mg/mi composite. This composite formula is also used for other limited criteria pollutants in the LEV III regulation. Real world data from EPA and industry show that US citizen don't drive like the US06 test cycle and therefore there is no negative impact on the environment if ARB will agree to this proposal. On the other side the CO_2 benefit will be extremely high by bringing low powered vehicles into the US market as they are available in the European Union with more than 20 different models."

Although this comment does not directly relate to the adequacy of the EA prepared for the proposed ACC Program, and therefore, no written response is required in accordance with ARB's certified regulatory program at CCR section 60007, subdivision (a), this comment is responded to in this document because it mentions potential impacts on the environment.

The SFTP PM standards were based on testing of a wide range of vehicles, which showed that, even at high mileage on some older vehicles with gasoline direct injection (GDI), there is no evidence that manufacturers will have difficulty meeting the proposed 10 mg/mi standard. Although Mercedes-Benz has raised the concern that potential future vehicles with low power-to-weight ratios may not be able to meet the proposed standard, based on testing at ARB facilities and discussions with other manufacturers, staff firmly believes that with properly designed engines the 10 mg/mi standard is achievable, even considering power-to-weight ratios. Therefore, staff does not support Mercedes Benz's recommended alternate standards which would loosen their stringency. Additionally, data shows that vehicles in the real world are sometimes driven in the aggressive manner accounted for by the US06 cycle. For this reason, staff believes that the US06 cycle is appropriate.

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March 8, 2012

Chairman Mary Nichols and Board Members
California Air Resources Board
1001 "I" Street
Sacramento, CA 95814

Re: Alternative Phase-in Schedule for Particulate Standards

Dear Chairman Nichols and members of the Board,

The International Council on Clean Transportation submits this letter in response to your request for public comment given in your "Notice of Public Availability of Modified Text and Availability of Additional Documents and Information" posted February 22, 2012 as part of the process of adopting amendments to the Low Emission Vehicles Program (LEV III). We have reviewed the enclosures to the notice and have concerns regarding the proposed *alternative phase-in schedule for particulate standards* contained in Enclosure A.

In this notice, staff propose an alternative compliance pathway for manufacturers of passenger cars and light-duty trucks required to be 100 percent compliant with a 3 mg/mi standard in 2021 and a 1mg/mi standard in 2028. It establishes a crediting scheme that awards automakers for more rapid introduction of vehicles that meet these new standards. While we are not opposed in principle to alternative compliance pathways, since they do provide useful flexibility to automakers, we do question the need for this alternative for meeting the particulate matter standards. There are currently multiple pathways for meeting a 3 mg/mi and 1mg/mi standard 1
using existing technology that includes gasoline port-fuel injection engines, center-mounted injection and improved injection timing for gasoline direct injection engines, after treatment using affordable wall-flow gasoline particulate filters, diesel vehicles fitted with diesel particulate filters, improved management of engine oil consumption, and introduction of alternative fuel vehicles including natural gas and electric. In our view, the proposed phase-in schedule for both the 3 mg/mi and the 1 mg/mi standards provides adequate flexibility that automakers are already well suited to meet. It is also our view that an alternative compliance scheme would be more appropriate in the 2017-2025 time period if credits were made applicable toward to the more stringent 1 mg/mi standard rather than the 3 mg/mi standard.

Nonetheless if staff conclude after reviewing the above options that additional flexibility is necessary and that only an alternative compliance mechanism can provide this, we strongly urge a reconsideration of the proposed crediting scheme. Under the proposed scheme, a manufacturer would be permitted to introduce no more than 22% of new vehicles meeting a 3 mg/mi standard in the year 2020, as opposed to the 70% that would be required under the current phase-in schedule. In addition, an automaker may choose to meet this with essentially no change to existing vehicle or engine technology until 2021. Even more, an automaker would be permitted to introduce higher emitting vehicles in each of the five years leading up to 2021. These vehicles would be permitted to emit as much as 10 mg/mi, which some gasoline direct injection engines could approach[1]. In a worst-case scenario, the proposed alternative compliance scheme could result in a significant net increase in particulate emissions compared with the current phase-in schedule.

The language of the alternative compliance proposal makes clear that the intent is to provide flexibility to automakers "… as long as equivalent PM emission reductions are achieved …" However, this intent is not borne out by the proposed crediting scheme. First, the proposed language does not make clear that 100% compliance is required in the years 2021 and 2028 with a 3 mg/mi and 1 mg/mi standard, respectively. It is not our belief that staff intends to eliminate this requirement. Language should be added to the proposal to make absolutely clear the requirement remains in place. Second, the crediting scheme considers only the share of vehicles that meet the revised standard when it should be based on the emissions themselves. Staff should reconsider their crediting scheme and restructure it such that changes in emissions are weighted rather than changes in fleet mix. These improvements are necessary to ensure that the alternative compliance mechanism achieves the same emission reductions as the current proposal.

In summary, the proposed alternative compliance mechanism for meeting the proposed LEV III particulate matter standards is flawed and should not be adopted in its current form. Staff should reconsider and revise their proposal such that (1) 100% compliance with a 3mg/mi and 1mg/mi standard is required in each of the years 2021 and 2028; and (2) either no alternative compliance pathway is provided, or a restructured alternative compliance pathway is provided that ensures no net increase in emissions relative to the original phase-in schedule. 1 cont'

We hope these comments provide productive feedback, and we are happy to respond to any follow-up questions you or your staff may have. Please communicate directly with Ray Minjares, Program Lead of the ICCT Climate and Health Program via email at ray@theicct.org or by phone at 415-202-5748. As always, we very much appreciate your efforts that have made California a leader in adopting the world's cleanest vehicles.

Best wishes,

Alan Lloyd,
President
International Council on Clean Transportation

Cc James Goldstene

[1] See Table 3 in http://www.arb.ca.gov/regact/2012/leviiighg2012/levappp.pdf

LEV III – 15-Day - L11 Response

11-1 The commenter expresses that "Under the proposed scheme, a manufacturer would be permitted to introduce no more than 22% of new vehicles meeting a 3 mg/mi standard in the year 2020, as opposed to the 70% that would be required under the current phase-in schedule. In addition, an automaker may choose to meet this with essentially no change to existing vehicle or engine technology until 2021. Even more, an automaker would be permitted to introduce higher emitting vehicles in each of the five years leading up to 2021. These vehicles would be permitted to emit as much as 10 mg/mi, which some gasoline direct injection engines could approach1. In a worst-case scenario, the proposed alternative compliance scheme could result in a significant net increase in particulate emissions compared with the current phase-in schedule.

Although this comment does not relate directly to the adequacy of the EA or its impact analysis, this comment is being responded to in this document because the commenter asserts that there may be an increase in criteria pollutant emissions as a result of the Alternative Compliance Phase-in provision. The Alternative Compliance Phase-in is designed to provide equivalent emissions reductions, and an increase in emissions is highly unlikely. However, in fall of 2012, when a National greenhouse gas program is in place, ARB will revisit the Alternative Particulate Phase-in provision, and clarify that 100 percent compliance is required for the final year of phasing.

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growth energy™
America's Ethanol Supporters

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PHONE 202.545.4000 FAX 202.545.4001 GrowthEnergy.org

January 25, 2012

California Air Resources Board
1001 I Street
Sacramento, California 95812

Dear Chairwoman Nichols and Members of the Air Resources Board:

Growth Energy is the leading trade association for America's ethanol producers and supporters. Growth Energy promotes expanding the use of ethanol in gasoline, decreasing our dependence on foreign oil, and creating American jobs here at home. We are pleased to have this opportunity to provide comments at the public hearing to consider the "LEV III" amendments to the California Greenhouse Gas and Criteria Pollutant Exhaust and Evaporative Emissions Standard and Test Procedures and to the On-Board Diagnostic System Requirements for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and to the Evaporative Exhaust Requirements for Heavy Duty Vehicles.

Our comments focus on two priorities:

First, we believe that by removing incentives to produce flexible fuel vehicles (FFVs) for the model year 2016 and later years, the proposed amendments will cause automakers to cease production of FFVs, and that any greenhouse gas benefits of the Federal Renewable Fuel Standard will be lost. We recommend projecting ethanol usage factors for FFVs, so that the automakers can incorporate the projected usage into their planning decisions for the future. 1

Second, CARB and the EPA have long recognized that vehicle technology and the fuel employed with that technology need to work in concert as an integrated "system" so that vehicles can operate efficiently and achieve the lowest technologically emission targets. We believe that CARB did not completely examine the impact of fuel parameter changes that could enable additional engine technologies to improve efficiency and ultimately improve emissions. Specifically, we are recommending one new fuel for vehicles model year 2017 and later (in addition to legacy FFVs) with an octane rating of 94 accomplished with a 30 percent blend of ethanol (E30). This new fuel used in conjunction with new engine technologies would provide even more clean air benefits than CARB is currently proposing. CARB is obligated by the California Government Code, the California Environmental Quality Act, and the California Health and Safety Code to propose and adopt only those regulations that maximize public benefits, minimize public and private costs, and afford maximum protection to the environment in a cost-effective manner. Those requirements can only be met by reducing vehicular emissions through new fuel standards.

Attached you will find our basis and support for these recommendations, and we would urge you to consider our recommendations as you finalize your greenhouse gas and vehicle emission program. We would be happy to work with you and your staff to provide whatever information you may need as this program will have far reaching impact on both the automotive and fuel industries for years to come. 1 cont'd

If you have any questions, please contact Chris Bliley, Growth Energy's Director of Regulatory Affairs, at 202-545-4000. Thank you in advance for your consideration.

Sincerely,

Tom Buis

Tom Buis, CEO

777 North Capitol Street, NE, Suite 805, Washington, D.C. 20002
PHONE 202.545.4000 FAX 202.545.4001

LEV III – L29 Response

29-1 The commenter expresses that "...CARB and the EPA have long recognized that vehicle technology and the fuel employed with that technology need to work in concert as an integrated "system" so that vehicles can operate efficiently and achieve the lowest technologic(ally) emission targets. We believe that CARB did not completely examine the impact of fuel parameter changes that could enable additional engine technologies to improve efficiency and ultimately improve engines. Specifically, we are recommending one new fuel for vehicles model year 2017 and later (in addition to legacy FFVs) with an octane rating of 94 accomplished with a 30 percent blend of ethanol (E30). This new fuel used in conjunction with new engine technologies would provide even more clean air benefits than CARB is currently proposing. CARB is obligated by the California Government Code, the California Environmental Quality Act, and the California Health and Safety Code to propose and adopt only those regulations that maximize public benefits, minimize public and private costs, and afford maximum protection to the environment in a cost-effective manner. Those requirements can only be met by reducing vehicular emissions through new fuel standards."

The commenter advocates a new fuel standard to reduce vehicular emissions that falls outside the scope of the proposed ACC Program analyzed in the EA. The EA was prepared for the ACC Program in accordance with ARB's certified regulatory program and CEQA. This comment and a response is included in this document because it mentions the California Environmental Quality Act. However, this comment does not directly relate to the adequacy of this EA prepared for the proposed ACC Program, therefore, no further written response is required in accordance with ARB's certified regulatory program at Title 17 CCR section 60007, subdivision (a). Please refer to the FSOR prepared for the LEV III regulation for staff response as to why this recommendation is rejected.

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BMW Group

January 25th 2012

Mr. James Goldstene
Executive Officer
California Air Resources Board
1001 I Street,
Sacramento, California 95814

Re: BMW Comments on the Proposed LEV III and GHG Emission Standards

Dear Mr. Goldstene,

On behalf of BMW AG, BMW of North America, LLC (BMW), BMW appreciates the opportunity to comment on the proposed amendments to the criteria and greenhouse gas regulation's (LEV III & GHG). BMW comments and recommendations on the Zero Emission Vehicle (ZEV) and the Clean Fuel Outlet (CFO) regulations are addressed in a separate letter.

In keeping with our corporate commitment to reducing greenhouse gases, BMW commends ARB for listening and collaborating with automakers in their efforts toward developing this complex ISOR covering model years 2017 to 2025. Additionally, we commend both EPA and NHTSA for their collaboration with ARB toward a single national standard that includes their targets. This would also ensure wise financial and resource investments by the auto industry, as well as increased energy security for the nation.

1. General Comments

BMW strongly supports the continuation of a single national program with the EPA/NHTSA MY 2017-2025 rulemaking in order to avoid conflicting and counter-productive regulations. In July, 2011, we submitted a letter of commitment in support of the proposed framework. 1

To that end, we are very supportive of close cooperation between ARB and federal authorities to develop these standards nationwide. Any action taken in isolation should be avoided; as such an approach may lead to yet another patchwork situation. Therefore, we strongly recommend a single national standard or at least a one to one standard. Continuation of two different standards needs at least the possibility to choose between the standards.
We support fiscal incentives as an additional means to increase the market uptake of more fuel efficient vehicles and improve customer acceptance of fuel saving measures provided they do not distort the development of technology or the market, reward innovation in all market segments equally, and avoid a fragmentation of the US car market.

BMW supports the comments of the Alliance of Automobile Manufacturers addressing the LEVIII and GHG regulation. In addition to those comments, BMW has identified some issues where we have major concerns. The following issues are of particular importance to us.

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2. Comments on GHG

- **Upstream Emissions – Proper Allocation of Responsibilities**

ARB's ISOR proposes the inclusion of upstream emissions in the compliance calculation of standards for automakers which seems to be in contradiction to the federal NPRM. The -standards proposed in the ISOR seem to be very similar to the proposed federal standards, but there are fundamental structural differences in achieving these standards. BMW requests that CARB not only set standards comparable to the federal ones but also incorporate the same fundamental structure for achieving these standards. It is our understanding that a single national standard is built on almost complete harmonization of standards and procedures.

ARB's view is not justified, that within a national context there are expected to be significantly lower shares of electric and fuel cell vehicles than in California and higher national grid GHG emissions, and therefore, any non-zero upstream crediting serves as a lesser relative incentive for BEV and PHEV than the proposed ARB GHG crediting based on California's low-GHG grid. Manufacturers are not able to influence the grid mix and therefore differentiating between CARB States and the others in regard to upstream emissions should be avoided. Every such vehicle needs to be counted as zero upstream emissions. Any crediting above zero is a disincentive.

It is a principal question whether automakers are responsible for inclusion of upstream emissions in their compliance calculations or not, and this question is independent from the emission level of the electricity grid. BMW accepts the responsibility of car makers for the vehicle efficiency by which their products use energy – no matter which fuel or energy source. But manufacturers have no control over the carbon content of electricity generation and cannot be held responsible for energy mix decisions made decades ago. 1 cont'd

While it is also acknowledged that the upstream impact of electricity generation needs to be addressed politically at the point of responsibility in order to ensure the credibility of a policy supporting the electrification of road transport, strategic decisions to be taken by car manufacturers for the decades to come should not be burdened by past decisions taken in other sectors: If upstream emissions would be allocated, the comparative advantage of electric vehicles dwindles. Clean Diesel in this case may achieve similar GHG emission reduction results at much lower costs. The attractiveness of electric vehicles for vehicle manufacturers would significantly decrease. Therefore, BMW continues to maintain that electric vehicles, on the merits of their own carbon use, should be counted as zero grams-per-mile vehicles in the greenhouse gas regulations for 2017-2025.

- **Multiplier incentives for electric vehicles**

ARB's ISOR does not include the multiplier incentives for electric vehicles as proposed in the federal NPRM. According to ARB, the proposed ZEV regulation sets sufficient incentives for their market penetration and therefore additional incentives through e.g. multipliers are not needed. This view is not shared by BMW.

Multiplier incentives were part of the proposed framework as announcement by President Obama at the end of July 2011. Depending on automakers strategy and product characteristics, electric vehicles and/or fuel cell vehicles will play a more or less important role in future standards compliance. Without multiplier incentives, standards compliance may be jeopardized due to the proposed very ambitious GHG standards for model years 2017-2025. The BMW commitment to the GHG rules, which has been shown with the signed letter by our CEO Dr. Reithofer and at the White House event in July 2011, has been clearly linked to a complete adoption of the proposal including all flexibilities, such as MAC credits, zero-gram upstream approach multipliers etc. Our calculation of technical ability under the existing market conditions for achieving these very ambitious goals was completely based on the introduction of these flexibilities.

BMW believes that any variation to the federal NPRM, such as different counting of upstream emissions or consideration of different flexibilities, is not goal-oriented towards achievement of single national standards.

- **N2O and CH4 provisions**

BMW supports the option to convert measured N2O and CH4 emissions that are above the applicable standards into CO2-equivalent emissions for compliance purposes The calculation of emission debits on this basis allows them to be offset by other GHG reduction measures. While leading to the same overall GHG reduction impact, this option provides flexibility and still gives an incentive to further work on the reduction of N2O and CH4 emissions.

- **Continuing A/C credits approach is supported** 1 cont'd

o From our point of view, adequate availability of R123yf is highly questionable. Therefore, we greatly appreciate CARB's decision regarding the future adoption of this refrigerant. Currently, no one knows when the supply will be adequately established in the market.

o Credit generation regarding direct (leakage) and indirect (fuel efficiency) emissions is generally supported. Details to be modified from our point of view are listed below. The aim is to ensure best objective methods as well as practicability and fairness.

o Regarding leakage related credits, we would like CARB to reconsider the so called "HiLeakDisincentives". We feel that it must not be allowed to use any unintended fluid or refrigerant in any A/C system. If someone does so, then it would violate the law. So the effects of illegal refrigerant charge cannot be influenced by the manufacturer. Furthermore, this disincentive provokes discussions to use unintended refrigerants. We do not expect that vehicle manufacturers will shift to higher potential leakage rates when using R1234yf instead of R134a – BMW would definitely not do so and our focus will remain on best quality refrigerant circuit tightness for any given refrigerant.

o Regarding fuel efficiency credits, we provide the following comments and recommend some specific changes.

- AC-idle:
  We support the review of AC-idle judgment limits as a function of engine displacement. This supports implementing fuel efficient technologies also in smaller vehicles even

when fuel consumption improvements – which definitely have positive effects during over all typical driving conditions – are not fully visible during small engines idling.

- AC17 test and evaluation:
- We carried out our own AC17 tests after the NPRM publication.
- In our opinion, the AC17 test conditions do not reflect typical average or moderately increased air conditioning loads. Especially the solar load is too high. E.g. according to a FAT study the average North American sun load is around 310 W/m² - already taking into account that driving time periods are variable during a day (e.g. less driving at night). We therefore would expect a maximum value of around 350 W/m² to 400 W/m² (instead of 850 W/m²) for AC17 test. Some of the powerful measures to lower all-the-year fuel consumption also can't be evaluated at the currently suggested AC17 test load – e.g. significant reduction of reheat.
- Reliability of test data is expected to be not better but similar to AC-idle-test.
- Definition of platforms or carlines could be adopted according to the Alliance proposal.
- We are also concerned about determining fuel consumption improvements and credit calculations depending on baseline test results. The generation of baseline car results needs to be properly defined. BMW does not have baseline cars – especially focused on 2017 – they have to be designed and built up for this single test. Therefore, we propose to test a baseline car once for each platform – according to the Alliance carline definition – and the use of these baseline results should be allowed during the entire model year 2017 to 2025 timeframe.

- AC17 test procedure 1 cont'd
- During the 30 minute soak, it is quite difficult to control temperature and humidity properly. A wider tolerance range in this phase of the cycle would help. Even more critical for some modern full automatic test benches is the combination of engine off and 4 mph wind speed because this has significant impact on exhaust gas analysis measurement devices.
  We would prefer a soak definition with a wider tolerance range of temperature and especially humidity and a speed definition of maximum 4 mph (instead of exactly 4 mph).
- Solar load during MAC off phases causes extreme temperature exposure to test drivers. These working conditions are unacceptable and will lead to poor accuracy when trying to meet the given drive cycle requirements. We suggest running MAC off phases without solar load. As MAC is turned off, this has no impact on MAC off fuel consumption.
- Drive cycle definitions should be fully equal to currently used cycles (e.g. some seconds time shift @ HWFET). This would help to keep accuracy and test quality high and to avoid mistakes.

3. Comments on LEV III

BMW strongly supports one of the primary goals in the LEV III regulation – harmonization of the federal and the California criteria emission program. In accordance with the Alliance of Automobile Manufacturers (Alliance) the following issues are of particular importance:

- Harmonization is needed for ARB and U.S. EPA test procedures, certification processes, phase-in requirements, vehicle standards, fleet averages, and certification fuels in order to establish a common set of vehicle criteria emission standards nationwide.

- Stringent criteria emission requirements for LEV III and Tier 3 require the elimination of non-essential requirements and duplication of efforts (e.g. submission of certification data to the agencies, test procedures for PHEVs).

- Particulate Matter (PM) Standards:

  o Technical feasibility of reaching the stringent SFTP single PM standard (10 mg/mile for PCs, 20 mg/mile for LDTs) do not appear to be achievable for all vehicles equipped with new technologies necessary to meet the GHG requirements.
  o More flexibility in meeting the SFTP PM standard is essential for future development and leads to the following recommendation for the PM standard:
  PM = 25 mg/mile for PCs and LDTs or 10 mg/mile composite as an alternative.

  o Within the framework of a harmonized phase-in during 2017-2021, BMW believes it is possible to meet the FTP PM Standard 3 mg/mile, even though additional resources are needed to meet the new requirements with new test procedures and new facilities. 1 cont'd
  However, the proposed MY 2025 FTP PM Standard of 1 mg/mile is considered impossible to achieve with the currently established as well as the under development measurement procedures. BMW recommends to eliminate the 2025 FTP PM Standard 1mg/mile from the regulations and to plan a review of the PM standards with ARB, U.S. EPA, and the industry. The review process should evaluate correlation and variability of new test procedures and facility requirements, consistency and repeatability of measuring PM at low levels (≤3 mg/mile), as well as an evaluation of alternative particulate test methods.

In addition to above mentioned comments on harmonization and PM standard, BMW recommends specific amendments on Appendix A, see attached.

BMW is committed to working constructively with ARB on this matter. If you should have any questions please contact me or Dr. Azita Khalili at (805) 271-7314.

Sincerely,

Thomas C. Baloga
Vice President, Engineering – US

cc: Mary Nichols
Tom Cackette
Bob Cross
Steve Albu
Paul Hughes

Enclosure

Proposed LEV III and GHG Emission Standards,
BMW COMMENTS ON PROPOSED REGULATION ORDER

- **Section § 1961 (b) (1) (B), page A-22**: Table c shows the applicable emission standards to be used in the fleet average equations. According to ARB's Manufacturers Advisory Conversation on rounding of the equation, the results of the equation lead to different values for 2004 through 2014 model year vehicles certified to the optional 150,000 mile "LEV II" standards (e.g. ULEV for PCs and LDTs is 0.03 instead of 0.034). Please ensure the regulatory text does not retroactively change for manufacturers who have planned their vehicle certification in MY 2004 through 2014 based on ARB's Manufacturers Advisory Conversation.

- **Section § 1961.2 (a) (7), page A-42**: BMW recommends to introduce a pooling provision for SFTP like it is already proposed for FTP in California, the District of Columbia, and all states that have adopted California's criteria pollutant emission standards (see page A-54).

- **Appendix D, Test Procedure, page E-2** " 1.1.1. LEV II Exhaust Standards. The following LEV II standards are the maximum exhaust emissions for the intermediate and full useful life from new 2004 through 2019 model year LEVs, ULEVs, and SULEVs, including fuel-flexible, bi-fuel and dual fuel vehicles when operating on the gaseous or alcohol fuel they are designed to use, except that for the 2015 through 2019 model years, SULEV exhaust standards shall only apply to vehicles that receive partial zero-emission vehicle credits according to the criteria set forth in section C.3 of the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles"

In the ZEV Standards and Test Procedures it is required that from MY 2015 all PZEV and TZEV must fulfill LEV III SULEV 30(20) and LEV III Evap. So the intention of the above limitation is unclear. BMW recommends to adjust the regulation language to ensure PZEVs certified under LEV II regulation may be carried over without limitation until MY 2017 and LEV III SULEVs certifications be allowed without limitations starting with model year 2014.

- Harmonizing of different phase-in requirements: depending on product line up, the different phase-in requirements for PM, FTP, SFTP and EVAP standards can lead to a number of model variants and unreasonably high burden for variants near end of model cycle. BMW recommends to allow an alternative harmonized phase in for different standards as follows:

Phase-in	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
PM	10%	20%	40%	70%	100%	
FTP	10%	20%	40%	100%'		
SFTP	10%	20%	40%	70%	100%"	
EVAP		60%	60%	80%	80%	100%
Harmonized Phase-in	**10%**	**20%**	**40%**	**70%**	**100%**	

- In addition to one single harmonized phase-in requirement for all criteria PM, FTP, SFTP, and EVAP), manufacturers should get more flexibility for aligning their model plans with the phase-in requirements by allowing an alternative phase-in with variation in the individual years if the same overall phase-in requirement 2017 to 2021 is achieved.

- **Appendix D, Test Procedure, page F-1** " §86.1823 Durability demonstration procedures for exhaust emissions. ... 4.3 SFTP. These procedures are not applicable to vehicles certified to the SFTP standards set forth in section E.1.2.2."

BMW understands DF's estimated through FTP Cycle may be applied to the LEV III US06 and SC03 emissions as well, in line with Tier 2 SFTP standards.

[i] **Section § 1961. (a) (1), page A-15** *"(1) "LEV II" Exhaust Standards. The following standards are represent the maximum exhaust emissions for the intermediate and full useful life from new 2004 through 2019 ..."*

[ii] **§ 1960.1. (r)** *"4000-Mile Supplemental FTP Emission Standards. ... The SFTP exhaust emission levels from new 2001 through 2020 and subsequent model low-emission vehicles, ultra-low-emission vehicles and super-ultra-low-emission vehicles in the passenger car and light-duty truck class certifying to the LEV II exhaust emission standards in section 1961,"* According to the Test Procedure page E-8 LEV II SFTP Standards could only be applied through MY 2018: *"1.2.1 4,000-mile SFTP Exhaust Emission Standards for Light- and Medium-Duty Vehicles. The following standards represent the maximum SFTP exhaust emissions at 4,000 miles for 2015 through 2018 model year passenger cars, and ..."*

LEV III – L34 Response

34-1 The commenter expresses that "Upstream Emissions – Proper Allocations of Responsibilities ARB's view is not justified, that within a national context there are expected to be significant lower shares of electric and fuel cell vehicles than in California and higher national grid GHG emissions, and therefore any non-zero upstream crediting serves as a lesser relative incentive for BEV and PHEV than the proposed ARB GHG crediting based on California's low-GHG grid. Manufacturers are not able to influence the grid mix and therefore differentiating between CARB States and the others in regard to upstream emissions should be avoided. Every such vehicle needs to be counted as zero upstream emissions. Any crediting above zero is a disincentive.

It is a principle question whether automakers are responsible for inclusion of upstream emissions in the compliance calculations or not, and this question is independent from the emission level of the electricity grid. BMW accepts the responsibility of car makers for the vehicle efficiency by which their products use energy – no matter which fuel or energy source. But manufacturers have no control over the carbon content of electricity generation and cannot be held responsible for energy mix decisions made decades ago.

While is also acknowledged that the upstream impact of electricity generation needs to be addressed politically at the point of responsibility in order to ensure the credibility of a policy supporting the electrification of road transport, strategic decisions to be taken by car manufacturers for the decades to come should not be burdened by past decisions taken in other sectors: If upstream emissions would be allocated, the comparative advantage of electric vehicles dwindles. Clean Diesel in this case may achieve similar GHG emission reduction results at a much lower costs. The attractiveness of electric vehicles for vehicle manufacturers would significantly decrease. Therefore, BMW continues to maintain that electric vehicles on the merits of the own carbon use, should be counted as zero grams-per-mile vehicles in the greenhouse gas regulations for 2017-2025." Please see the comment letter shown above for other issues raised.

Although this comment does not directly relate to the adequacy of the EA prepared for the proposed ACC Program, and therefore, no written response is required in accordance with ARB's certified regulatory program at CCR section 60007, subdivision (a), this comment is responded to in this document because it mentions a potential impact on emissions. The principle difference between California's program and U.S. EPA's is the ZEV mandate. Whether or not inclusion of upstream emissions of ZEVs will act as a disincentive to the manufacturers is irrelevant. The mandate requires a certain percentage of these vehicles to be marketed in California and the177 states, regardless of how manufacturers choose to comply with California's GHG standards. Regarding *the emission impact, under the California program any upstream emissions from ZEVs have to be offset by lower emissions from non-ZEVs. Therefore, removing the requirement would result in higher emissions in California. The LEVIII Staff Report indicates that ARB staff is proposing to credit electric- and hydrogen-powered vehicles according to their incremental emission impact from California-specific low-GHG upstream energy sources that are most likely in the timeframe of the regulation. Advanced electric-drive vehicles, including plug-in hybrid electric vehicle, battery electric vehicle, and fuel cell electric vehicle technology, can be driven primarily or entirely without tailpipe CO_2 emission emissions. Their associated GHG emissions are, instead, upstream from the vehicle at primary energy processing facilities, at electricity generation plants, and throughout the fuel and electricity distribution network. In order to structure the GHG program for the long-term for a diversity of vehicle fuel types, the regulation proposes the implementation of standards that incorporate the relative GHG emissions from battery electric vehicle, plug-in hybrid electric vehicle, and fuel cell electric vehicle technologies as compared to the conventional vehicles that primarily utilize gasoline. The intent then is to establish straightforward performance-based GHG emission provisions that accurately count the upstream emissions in a technology-neutral way that provides industry certainty to plan for GHG requirements as these more advanced ultra-low-GHG technologies enter the market.*

Staff notes that its proposed crediting provision for battery-electric vehicle, plug-in hybrid electric vehicle, and fuel cell electric vehicle technology differs from the expected federal U.S. EPA GHG regulatory program. However, as directed by the Board in Resolution 12-11, staff "…will return to the Board with a new regulatory proposal to accept compliance with the 2017 through 2025 model year National Program as compliance with California's greenhouse gas emission standards in the 2017 through 2025 model years, if the Executive Officer determines that U.S. EPA has adopted a final rule that at a minimum preserves the greenhouse reduction benefits set forth in U.S. EPA's December 1, 2011 Notice of Proposed Rulemaking for 2017 through 2025 model year passenger vehicles." Accordingly, staff intends to propose two compliance options: (1) an automaker chooses to comply directly with California's standards including upstream accounting as specified here or (2) an automaker chooses to comply with the federal U.S. EPA standards; utilizes the federal accounting provisions for battery electric vehicle, plug-in hybrid electric vehicle, and fuel cell electric vehicle technologies in the federal standards; and receives the same federal accounting for these technologies within the California regulation. Staff believes that, consistent with their comments on the ACC program, manufacturers will ultimately choose compliance with the National Program, rendering the upstream emission issue moot.

Staff's non-zero-emission accounting for these technologies' incremental upstream emissions is justified for several reasons. Primarily, the ZEV regulation already requires electric-drive vehicles in California, therefore obviating the need *for special artificial crediting incentives. In addition, ARB's proposed GHG crediting more accurately depicts the science regarding known GHG impacts, more adequately sets the precedent for a future with increasingly more alternative fuel vehicles for 2025 and beyond, more assuredly protects against the environmental repercussions of foregone GHG emissions allowed from battery electric vehicle emission incentives, and better continues ARB's objective in keeping its performance standards technology-neutral. In addition, this accounting reflects California's purpose and intent to evaluate and reduce all GHG emissions – beyond tailpipe CO_2 – from all principal phases of passenger motor vehicle powering and use.*

ARB's position on incorporating the incremental upstream emissions of electric and hydrogen fuel cell vehicles is further justified by several California-specific details that are different from the national US situation. The greater deployment of these advanced technologies in California fundamentally differentiates the State from the US context. The California ZEV regulation as proposed for amendment mandates that over 10% of the new vehicle fleet be some form of battery electric vehicle, plug-in hybrid electric vehicle, or fuel cell electric vehicle technology in 2025. In addition, California has complimentary programs (e.g., Low Carbon Fuel Standard and Renewable Portfolio Standard) that reduce upstream GHG emissions over time, rigorously track these emissions, and provide the basis for accurate GHG emissions accounting. According to staff's analysis, for California's relatively low-GHG electricity and hydrogen, these ZEV-type vehicles will achieve very low GHG emission ratings and therefore would naturally achieve substantially lower GHG emissions than any other known vehicle technologies (e.g., hybrids) by a large margin without artificial incentives.

Nevertheless, staff notes that accepting federal compliance (i.e., with federal upstream crediting incentives) remains valid, owing to the 50-state GHG reduction benefit greatly outweighing the California-alone GHG standard compliance, thus achieving additional emissions reductions benefiting California. Please also refer to response to LEV- III L9-1.

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Katherine H. Yehl
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January 25, 2012

The Clerk
California Air Resources Board
1001 I Street
Sacramento, CA 95814

Subject: Volvo Car Corporation Comments on California's Clean Cars Package

Volvo Car Corporation (VCC) appreciates the opportunity to submit comments in response to California's proposed California's Clean Cars Package.

VCC supports the comments filed by the Alliance of Automobile Manufacturers (Alliance). 1
VCC appreciates CARB staff efforts to engage the auto industry during the development of these regulations. VCC looks forward to continuing to work with CARB and would be pleased to discuss our comments in further detail with you or members of your staff.

If you need any additional information or have any questions, please do not hesitate to contact me. My contact information (including business address, telephone number, and email address) appears on the letterhead above.

Sincerely,

Katherine H. Yehl
Katherine H. Yehl
Director of Government Affairs North America
Volvo Car Corporation

Enclosures

Volvo Car Corporation
January 25, 2012

Volvo Car Corporation (VCC) would like to provide its comments on California Air Resources Board's (CARB) proposed Advanced Clean Cars program. VCC supports the Advanced Clean Cars program but would like to draw attention to certain critically important issues relating to the proposed changes within LEVIII, ZEV and proposed changes in certification fuel.

VCC would like to emphasize that we appreciate the openness and transparency that has characterized CARB's development of the proposed regulations, and that this openness has been a key enabler for an intermediate manufacturer, such as VCC, to be able to make a reasonable estimation of what the future requirements may include. Similarly, we would also like to acknowledge that CARB's staff has regularly met with intermediate manufacturers regarding issues unique to this group. 1 cont'd

VCC wants to be very clear that the proposed regulations are, and will be very challenging. One of the challenges is the pace of introduction of Advanced Technology Vehicles (ATV) to the market. CARB has been clear on what environmental needs are driving the aggressive introduction of ATVs, culminating in extraordinarily challenging requirements for Volvo as an intermediate manufacturer. We all need to recognize, however, that there is only limited ability to identify the mechanisms that will motivate tomorrow's consumers to actually purchase these highly advanced vehicles in requisite numbers, both to achieve the desired environmental impact and to provide economies of scale for smaller manufacturers.

As an intermediate manufacturer, VCC wishes to highlight some areas that are important to us.

1. GHG LEV III & National Program 2017-2025

–*Harmonization*

In the early 2000's, CARB addressed climate change in its own greenhouse gas initiative.

Then, under the direction of the Obama administration, a national plan was initiated to require EPA and NHTSA, in cooperation with CARB and other states, to develop standards for greenhouse gas and fuel consumption for the period 2012-2016 in or to achieve requirements that could coexist.

VCC's conclusion is that the agencies successfully achieved this for the 2012-2016 timeframe. For VCC, as an intermediate manufacturer, this is of great importance and we want to be clear that we value this pursuit of efficiency. It supported the critical need of smaller manufacturers to reduce administrative costs. 2

–*Alignment with the Federal Program*

VCC is sympathetic to the myriad environmental challenges that weigh on the agencies in trying to reach their varied goals. However, it is of *utmost importance* that all agencies, as far as possible, collaborate to achieve common understanding wherever possible. Section 1961.3 provides a good example of how CARB can achieve a common approach to technical proposals that EPA and NHTSA have identified in their pending regulatory proposal. But such commonality is clearly lacking in other areas. Here are areas of particular concern.

- Reciprocal Recognition: The current draft does not make it clear that CARB intends to allow reciprocal recognition of the national greenhouse gas program, as was the case for model years 2012 to 2016. Technical alignment and efficiency are of utmost importance to VCC. Although CARB's actions may be somewhat constrained by the fact that a federal 2017-2025 program is not finalized, CARB's draft does not express even an optimistic intent to allow reciprocal recognition as a best-case scenario.

- At this stage of drafting, only minor differences remain between the CARB and federal proposals. CARB should acknowledge that, barring unforeseen changes, it intends to recognize the federal program as meeting CARB's own requirements.

- VCC seeks confirmation that CARB intends to make this commitment for model years 2017 through 2025.

2 cont'd

– ***Mid-term evaluation***

Mid-term evaluation will allow manufacturers and the agencies to consider whether the regulation is reasonable and on track in its assumptions. VCC supports a mid-term evaluation because it is very difficult to predict fifteen years into the future without making a vast number of assumptions. Customer acceptance, affordability (especially in light of the phase-out of many of the federal and state incentives), safety, convenience and utility should be examined in the mid-term evaluation.

It is therefore imperative that the industry and the agencies review and consider the outcomes of our work in 2012 in relation to the joint plan at the midpoint.

–***AC leakage determination***

VCC continuously develops its climate systems in order to reduce refrigerant leakage and to improve durability. VCC is convinced that physical measurements better reflect real vehicle emissions and also result in development of more robust air conditioning systems than calculations of theoretical estimates and allowances.

VCC strongly supports the Agency's intent to allow, as expressed in the draft's Appendix D, paragraph 2.5.6.3,[1] physical measurements of refrigerant leakage as an alternative to the latest version of SAE J2727.

[1] Appendix D "CALIFORNIA 2015 AND SUBSEQUENT………"
2.5.6.3 The calculation of A/C Direct Emissions Credit…. (page E-42)
Note: Initial leak rate is the rate of refrigerant leakage from a newly manufactured A/C system in grams of refrigerant per year. The Executive Officer may allow a manufacturer to use an updated version of the August 2008 version of SAE J2727 or an alternate method if s/he determines that the updated SAE J2727 or the alternate method provides more accurate estimates of the initial leak rate of A/C systems than the August 2008 version of SAE J2727 does.

2. Criteria Emissions

–*Harmonization with federal proposed Tier 3*

VCC has actively worked with CARB toward development of the next generation of criteria pollutant regulations (LEV III). VCC values the open and interactive dialog that staff has had with the industry.

During 2010, EPA revealed its views about its next generation of regulations for criteria emissions (Tier 3). There is a clear indication that EPA and CARB intend to work together in order to harmonize their common targets in some areas, but there remain several critical issues and opportunities for reduced administrative burdens on both industry and CARB.

It is of utmost importance to VCC, as an intermediate manufacturer, that the agencies achieve harmonization to the greatest possible extent. The recent economic crisis, which resulted in an unprecedented contraction of the automotive market, was extremely challenging for all automakers and downright dire for many. This difficult period demonstrated that the requisite economic wherewithal for manufacturers to invest in new and reliable industrial development processes can evaporate almost overnight. This is important to note because investment in long-term development and testing procedures and facilities will form the critical foundation for meeting future technical requirements. 3
Challenges like the financial crisis of 2008-2009 can result in manufacturers being forced to take drastic streamlining measures.

–*PM*

CARB has chosen to broadly seek to harmonize with the EPA's upcoming Tier 3 requirements to control particulate matter (PM) from gasoline-powered vehicles. However, there remain many discrepancies between the agencies' regulatory requirements that affect manufacturers' ability to meet these very stringent particulate requirements.

Among the most important of these discrepancies are the test methods that will be selected to measure the particles now and in the future. The other critical discrepancy is that CARB and EPA have different requirements for reference fuels.

In its Tier 3 plan, EPA has proposed test methods for particulate matter based on its experience developing methods for heavy duty vehicles, Part 1065. VCC has been actively involved in addressing these issues directly with EPA and through the Alliance of Automobile Manufacturers (Alliance) on the proposal that was presented by EPA in November 2011. Through such dialogue, we have requested that EPA work closely with industry to minimize the requirements that lead to substantial investments while developing procedures that still achieve a high level of accuracy.

One very critical aspect of the requirements that are now proposed is a 3 mg/mile PM measurement standard. 3 mg/mile is on the edge of accurate and repeatable measurement capability using available techniques today. This challenge is likely to remain for the next 5 years.

It is therefore critical that these regulations do not set standards at levels that cannot be measured and that cannot be achieved with known technology. VCC recognizes that the agencies may tighten the requirements in the future, but VCC emphasizes that this should be accomplished through continuous dialog between government and industry.

FTP LEV III PM Standard 1 mg/mile in 2025

Based on VCC knowledge of particulate matter measurement technology, it is not currently feasible to measure compliance with the 1 mg/mile standard proposed for model year 2025. VCC does not believe that setting an unattainable standard so far out in the future (2025) is realistic.

VCC supports a thorough, formal, review of PM standards, vehicle emission control technologies, test methods of today and alternative test methods for the future, but only as part of future rulemaking. After this review is complete, we would recommend CARB develop and promulgate standards for 2025.

–LEV III Phase-In Requirement

The phase-in plan for LEV III (FTP and SFTP 150K durability and E10 certification fuel) was unclear in the ISOR and in the regulatory wording. It is VCC's understanding that all PZEVs can be carried over until MY2018 and that CARB intends to require all vehicles that certify to ULEV70 and below to meet the LEV III requirements from the beginning of model year 2015. 3 cont'd

VCC requests confirmation of CARB's intent.

–Interim In-Use Standards

For FTP, SFTP NMOG + NOx, and SFTP PM, interim in-use standards apply only through model year 2019. All of these interim in-use standards should apply through model year 2020. For interim in-use FTP PM, VCC supports CARB's planned phase-in through model year 2020.

Inconsistent phase-in periods and overly stringent ramp-ups place unwarranted burdens on intermediate manufacturers. For such manufacturers, the required ZEV volumes and the introduction of new technologies already pose disproportionate challenges. (§1961.2(a)(8), page A-48)

–Early Model Year 2014 Compliance

In the introductory paragraph and the corresponding regulatory text, there is a need for CARB to clarify its plan to allow compliance with LEV III prior to model year 2015. The regulation lacks LEV III FTP and SFTP composite fleet averages for model years 2013 and 2014. The LEV III regulations appear to require LEV II vehicles to continue to meet separate NMOG and NOx standards. (§1961.2, Page A-35)

VCC requests clarification.

–Early Phase-in for Zero EVAP

The proposed regulation for LEV III evaporative emissions allows manufacturers the option to certify to the zero evaporative vehicle standards using the Bleed Emissions Test Procedure instead of a "rig" test. 3 cont'd

Manufacturers should be allowed early (model year 2014) compliance with the new evaporative emission standards consistent with the plan to allow early compliance for LEV III exhaust. (§1976(b)(1)(G), page A-131)

–EVAP Testing During Exhaust DF Tests

Development of deterioration factors (DF) is already an extremely resource-intensive process. The prescribed intervals (5,000, 40,000, 70,000, and 100,000 miles) also make EVAP tests very costly. Eliminating the evaporative tests would result in a significant relief to VCC. (Appendix F, Part II.A.(2.4), page II-2)

3. ZEV Mandate

VCC recommends that CARB align the following areas in the ZEV regulation with the LEV III criteria emission regulations.

- PZEV carryover from 2014 and prior model years: As written, the regulations would require manufacturers to recertify all Partial Zero Emission Vehicles (PZEVs) using the LEV III (or federal Tier 3) certification fuel and to the new SFTP emission standards. 4

  VCC requests a revision to the model year 2009 – 2017 ZEV Regulation §1962.1(c)(2) to allow manufacturers to carry over PZEV certification data to model year 2015 and beyond.

- Similar to VCC's abovementioned request concerning early certification to LEV III EVAP, VCC requests that equivalent changes be made to §1962.1(c)(2) to allow early certification of PZEVs to LEV III.

4. Test Procedure

VCC has put considerable time and effort into maintaining a high degree of accuracy by having well-developed arrangements to monitor calibrations, checks, and all critical processes in our emission laboratory. We work continuously to monitor and improve the correlation and repeatability of our test rooms. Thus, VCC realizes that test procedures, calibrations, and instrumentation must be regularly reviewed and renewed to meet new challenges. 5

In the fall of 2011 EPA proposed, under TIER 3, to consolidate all test procedure requirements of Parts 86 into Part 1066 in order to improve their organization. In doing so, some test procedures will remain as they are, some will evolve, and new ones will be introduced.

Along with the industry, VCC pointed out that close industry-EPA cooperation is critical to ensuring that test procedures are relevant to their intended purpose, adequate, and meet the objective standards of reproducibility and repeatability. The initial EPA proposal would have required enormous investment from VCC, but based on current discussions there appears to be an understanding that there are other possible ways to address measurement.

VCC has therefore been actively involved in addressing issues directly with the EPA and through the Alliance on the proposal that was presented by EPA in November 2011.

Based on VCC's ongoing analysis of Part 1066, VCC believes that these proposed processes would benefit from thorough revision, in cooperation with the industry, to minimize the risk of creating processes that will add very little value to the goals they are meant to achieve: good repeatability and accuracy. EPA has recognized industry's challenges and therefore continues to work with industry on this issue.

VCC would welcome CARB's participation in that dialog. 5 cont'd

Currently there are crucial differences between CARB and EPA advanced technology vehicle test procedures that would benefit from harmonization.

Hybrid Test Procedures

The hybrid test procedures need to be updated to reflect a common approach between EPA and CARB. EPA extensively refers to SAE J1711 test procedures. The J1711 test procedures are the result of many years of cooperative work between industry and government, which includes EPA and CARB. If this harmonization does not occur, there will be unnecessary additional test burdens on the industry as a result of duplication of testing and uncertainty concerning the certification requirements.

Nitrous Oxide - N2O

The LEV III regulations require this N_2O measurement for the 2015 MY. Currently there is no equipment on the market that can measure N_2O with a relevant repeatability. During 2012-2013, new technology will be introduced to the market, but this technology is still in the research stage, and it would be premature to commit to its use as a certification tool at this juncture. VCC is concerned about technology readiness, instrument availability, measurement accuracy, and implementation lead time, including verifying that the instrument is robust enough for certification testing.

VCC and the Alliance addressed the same concern to EPA, which has pushed implement date of its requirement to model year 2017.

5. Fuel

−*Certification Gasoline and Harmonization*

VCC agrees that there is a need to move the reference fuel to a blend of 10% ethanol, consistent with the current and foreseeable future U.S. market. This is also consistent with fuel developments in Europe and Asia.

VCC supports a single certification fuel for EPA and CARB. It is expensive and inefficient to develop and store several different fuels to meet two nearly identical regulations.

When EPA and CARB require different fuels, it effectively doubles the amount of testing manufacturers are required to perform, while yielding limited, if any, additional environmental benefit. Even though it appears that 10% ethanol is likely to be the most common fuel on the U.S. market for the foreseeable future, it appears likely that EPA will require E15.

The consequence of this would be that CARB and EPA will have different certification gasoline requirements. To eliminate unnecessary duplicative testing, VCC is requesting that CARB accept certification using the EPA proposed fuel from MY2017.

VCC requests that CARB allow manufacturers to use the federal Tier 3 gasoline for certification to CARB standards for exhaust and evaporative emissions testing. For EVAP testing, the use of EPA temperature profiles is a necessity that must be part of this allowance.

−*Sulfur* 6

The same criteria that govern the need for new test procedures to measure extremely low emissions adequately and correctly also dictate the need for low-sulfur fuel. It is essential to avoid sacrificing environmental gains achieved by use of advanced technology by failing to recognize the effect of higher quality fuel or the impact of sulfur on catalyst efficiency over time. Lower sulfur in fuel will also result in environmental gains for the existing fleet since the catalyst deactivation and the need to regenerate the catalyst will be minimized.

VCC would prefer a flat 10 ppm cap instead of using the currently proposed range of 8.0-11.0. This would align with international standards, such as the current requirement in Europe.

−*RVP*

EPA's proposed Reid Vapor Pressure of 9 psi offers an opportunity to act on an achievable environmental opportunity that would positively influence on the vehicle EVAP systems. To that end, VCC would encourage EPA's harmonization with CARB's 7 psi. This is an environmental opportunity that would positively influence all vehicles nationwide.

VCC supports CARB's decision to remain at a more environmentally beneficial level of 6.9-7.2 psi.

– ***Octane number***

Higher octane fuel would enable manufacturers to pursue strategies that better support development and introduction of advance vehicle technologies, and a consequent reduction in greenhouse gases and criteria emissions.

To optimize engine fuel efficiency and minimize emissions, transitioning to higher octane regular and premium grade market gasoline may be necessary.

VCC would support establishment of a minimum blend stock octane. In this way, adding ethanol would raise fuel octane without risk that blenders would make corresponding reductions in base blend stock octane, thereby undoing the octane benefit of ethanol addition.

We recommend the Board direct staff to assess the environmental benefits of higher octane gasoline.

6
cont'd

LEV III – L38 Response

38-1 The commenter expresses that "Higher octane fuel would enable manufacturers to pursue strategies that better support development and introduction of advance vehicle technologies, and a consequent reduction in greenhouse gases and criteria emissions. To optimize engine fuel efficiency and minimize emissions, transitioning to higher octane regular and premium grade market gasoline may be necessary. VCC would support establishment of a minimum blend stock octane. In this way, adding ethanol would raise fuel octane without risk that blenders would make corresponding reductions in base blend stock octane, thereby undoing the octane benefit of ethanol addition. We recommend the Board direct staff to assess the environmental benefits of higher octane gasoline."

Although this comment does not directly relate to the adequacy of the EA prepared for the proposed ACC Program, and therefore, no written response is required in accordance with ARB's certified regulatory program at CCR section 60007, subdivision (a), this comment is responded to in this document because it mentions potential environmental benefits. Staff designed the certification fuel to be reflective of the current in-use fuel. According to the EIA , in California, among the total 5.4 million gallons per day of gasoline sold to end users in May 2011, 4.2 million gallons per day of gasoline (77%) were regular (87 AKI), 500 thousand gallons per day of gasoline (9%) were mid-grade (89 AKI), and 800 thousand gallons per day of gasoline (14%) were premium (91 AKI). Therefore, the certification fuel is designed around an 87 AKI and for those vehicles that have a warranty that requires 91 AKI, ARB allows for the vehicle to be tested using the certification fuel at 91 AKI.

The Department of Measurement Standards regulates octane level for in-use fuels. Octane is considered a consumer protection issue to prevent knocking and poor vehicle performance. ARB does not and has not regulated octane in gasoline because there is no evidence to suggest that octane affects emissions in and of itself. Staff is unaware of any studies that have been designed to isolate octane as an independent effect. It is very difficult to isolate octane at the same composition and volatility levels.

Increasing octane would; however, provide a CO_2 benefit if the vehicle was designed to take advantage of it; but it may not have an accompanied criteria pollutant benefit. Since the vehicle modeling supporting the proposed ACC Program was conducted on octane levels of current commercial gasoline, increased octane fuel is not needed to meet the proposed standards. In addition, because commercial gasoline specifications were not part of the regulatory package, the commenter's proposal is out of the scope of this rulemaking.

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Comment Log Display

BELOW IS THE COMMENT YOU SELECTED TO DISPLAY.
COMMENT 2 FOR ZERO EMISSION VEHICLE REGULATION (ZEV2012) - 45 DAY.

First Name: dan
Last Name: Mars
Email Address: dmsail@gmail.com
Affiliation:

Subject: ZEV
Comment:
I am very much in favor of feebates to encourage the use of plug-in hybrid, and all-electric vehicles. Charge a fee for inefficient vehicles and use that money to give rebates to buyers of clean vehicles that plug-in. There are many advantages for the individuals as well as society as a whole. 1

Attachment:

Original File Name:

Date and Time Comment Was Submitted: 2011-12-19 15:12:32

If you have any questions or comments please contact Clerk of the Board at (916) 322-5594.

ZEV – L2 Response

2-1 The commenter expresses that "I am very much in favor of feebates to encourage the use of plug-in hybrid, and all-electric vehicles. Charge a fee for inefficient vehicles and use that money to give rebates to buyers of clean vehicles that plug-in. There are many advantages for the individuals as well as society as a whole."

This comment and a response is included in this document because the commenter advocates a feebate program as an alternative. The EA prepared for the proposed ACC Program analyzed a feebate regulation as a potential alternative. Although it was considered, it was rejected as infeasible (see page 196 of Appendix B). A feebate is a new car pricing scheme where consumers who purchase high-emitting vehicles would pay an extra fee that would be used to fund rebates to consumers who purchase low-emitting vehicles. ARB sponsored research on the potential benefits of a feebate program for new vehicles and eliminated it as an option for a number of reasons. First, given the aggressive performance standards proposed for new vehicles, the additional reductions that could result from a feebate program are likely to be minimal. Manufacturers would already need to install all available, cost-effective emission-reducing technology, as well as adopt their own internal pricing strategies to comply with the standards. A feebate program would replace this internal pricing strategy and would only induce substantial, additional emission reductions if fees and rebates were very high, leading to greater impacts on consumers. Furthermore, a California-only program within a national market could result in more higher emitting vehicles being sold out of state and negating any in-state emission reductions. In terms of implementation, maintaining a revenue-neutral regulation would likely be a significant challenge given that vehicle purchase behavior would vary based on current economic conditions, but fee and rebate levels would need to be set in advance. More importantly, ARB may not have the legal authority to pursue feebates and could face challenges similar to pursuing a carbon fee or tax. In addition to legal opposition, there may be public opposition because some consumers would have to pay more for new vehicles. The administration of a feebate program would require ARB to collect revenues and then disperse funds. ARB may need additional authority from the Legislature to both disperse funds and collect feebate revenues. Consequently, in light of the legal and administrative challenges for minimal emissions reductions, ARB did not pursue the further evaluation of this alternative.

Of note, the ARB's Clean Vehicle Rebate Project (CVRP), funded through the AB 118 Air Quality Improvement Program, provides funding for consumer rebates of up to $2500 for zero-emission and plug-in hybrid light-duty vehicles. As of January 2012, the CVRP has provided rebates for over 4700 vehicles totaling about $17 million. More information on the CVRP may be found on ARB's website at http://www.arb.ca.gov/msprog/aqip/cvrp.htm.

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Comment Log Display

BELOW IS THE COMMENT YOU SELECTED TO DISPLAY.
COMMENT 74 FOR ZERO EMISSION VEHICLE REGULATION (ZEV2012) - 45 DAY.

First Name: Loren
Last Name: Marz
Email Address: lmarz@charter.net
Affiliation:

Subject: Comments on LEV III Proposed Regulation
Comment:

While fully supporting the spirit of the proposed LEV III Regulation, it doesn't appear that the impacts of a significant shift to "ZEV" technology such as electric vehicles (EV) have been fully considered. 1

According to a National Academies report (National Academies, "Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use.")...

"...Electric vehicles and grid-dependent (plug-in) hybrid vehicles showed somewhat higher nonclimate damages than many other technologies for both 2005 and 2030. Operating these vehicles produces few or no emissions, but producing the electricity to power them currently relies heavily on fossil fuels; also, energy used in creating the battery and electric motor adds up to 20 percent to the manufacturing part of life-cycle damages...."

This is supported by the latest version of Argonne National Laboratory's GREET model (GREET1_2011 - http://greet.es.anl.gov/) which shows that WTW emissions of particulate matter (PM) in California are higher for EV technology than current "clean diesel" technology. Based on the default "mid-sized" vehicle assumed in GREET for the year 2020... 1 cont'd

WTW PM10 (diesel) = 0.004 (Feedstock) + 0.009 (Fuel) + 0.030 (Vehicle Operation) = 0.043 g/mi
WTW PM10 (EV) = 0.060 (Feedstock) + 0.006 (Fuel) + 0.021 (Vehicle Operations) = 0.087 g/mi

WTW PM2.5 (diesel) = 0.003 (Feedstock) + 0.005 (Fuel) + 0.016 (Vehicle Operations) = 0.024 g/mi
WTW PM2.5 (EV) = 0.015 (Feedstock) + 0.004 (Fuel) + 0.007 (Vehicle Operations) = 0.026 g/mi

All of these values are based on the California electric generation mix assumed in GREET in 2020.

Exhaust PM from the diesel vehicle assumed in GREET = 0.009 g/mi (PM10); 0.0084 g/mi (PM2.5).

Furthermore, based on certified emissions of the 2003 VW Jetta TDI (example of an "old tech" diesel vehicle), exhaust PM emissions = 0.05 g/mi
(http://www.arb.ca.gov/msprog/onroad/cert/pcldtmdv/2003/volkswagen_pc_a00702

0.05 - 0.009 = 0.041 g/mi more exhaust PM for the "old tech" diesel than that assumed for "clean diesel" in GREET. 1 cont'd

0.043 g/mi + 0.041 g/mi = 0.084 g/mi WTW PM10 for the "old tech" diesel car, actually less than the 0.087 g/mi WTW PM10 calculated by GREET for EV in California for 2020.

"Old tech" diesel vehicles have been effectively banned for many years under LEV II regulations, to the Air Resources Board's credit, yet mandates are being proposed for vehicle technology (e.g., EV) which may actually increase PM emissions from a WTW perspective above "old tech" diesel engine technology. EPA acknowledges in the Draft RIA for the Proposed Rule to Extend the National Program to Reduce Greenhouse Gases and Improve Fuel Economy for Cars and Trucks - Docket ID No. EPA-HQ-OAR-2010-0799, that all PM2.5 is treated as equally potent in causing premature mortality regardless of source (page 6-35 of the Draft RIA), even specifically mentioning PM2.5 from diesel engine sources. So there appears to be no valid reason from a public health perspective to displace the reduction in PM2.5 emissions from diesel engines with increased PM2.5 emissions from power plants to support EV/PHEV technology. The regulatory push for these "advanced technologies" defies logic from an emissions perspective.

A massive shift to EV/PHEV technology would potentially offset gains made from diesel PM emission reduction mandates. It appears superfluous to propose significant reductions in PM emissions from gasoline/diesel vehicles under LEV III to trivial levels (which I support) yet essentially mandate technology which not only doesn't decrease WTW PM emissions from current technology, it increases WTW PM emissions with respect to pre-2004 (Tier 1) diesel vehicles.

I would like to state unequivocally that I support EV/PHEV technology for certain niches (e.g., urban commuter travel), but upstream emissions of this technology really need to be taken into account. 1 cont'd

As a disclaimer, I am in no way associated with the auto industry or any support industries to the auto industry, including diesel engine manufacturers.

Thank you for your consideration of these comments.

Respectfully submitted,

Loren Carl Marz, Certified Consulting Meteorologist (#591) 1 cont'd

Attachment:

Original File Name:

Date and Time Comment Was Submitted: 2012-01-23 11:01:37

If you have any questions or comments please contact Clerk of the Board at (916) 322-5594.

ZEV – L74 Response

74-1 The commenter expresses that "While fully supporting the spirit of the proposed LEV III Regulation, it doesn't appear that the impacts of a significant shift to "ZEV" technology such as electric vehicles (EV) have been fully considered." According to a National Academies report (National Academies, "Hidden Costs of Energy: Unpriced Consequences of Energy Production and Use.")...

"...Electric vehicles and grid-dependent (plug-in) hybrid vehicles showed somewhat higher nonclimate damages than many other technologies for both 2005 and 2030. Operating these vehicles produces few or no emissions, but producing the electricity to power them currently relies heavily on fossil fuels; also, energy used in creating the battery and electric motor adds up to 20 percent to the manufacturing part of life-cycle damages...."

Please refer to response for LEV III - L9-1.

VALERO

January 24, 2012

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

Sent by electronic transmission via ARB webpage

Re: **2012 Proposed Amendments to the Clean Fuels Outlet Regulation Comments of Valero Refining Company—California, Ultramar Inc, Valero Marketing and Supply Company, and Valero Renewable Fuels**

Board Members:

Valero Refining Company – California and Ultramar Inc, together with Valero Marketing and Supply Company and Valero Renewable Fuels (collectively "Valero"), appreciate this opportunity to provide comments regarding the California Air Resources Board ("ARB") 2012 Proposed Amendments to the Clean Fuel Outlet (CFO) Regulation. Valero's refining entities in California own and operate two refineries in the state of California, with a combined throughput capacity of over 305,000 barrels per day. Valero is also one of the largest ethanol producers in the U.S, and is investing in renewable diesel and cellulosic ethanol projects at various locations.

Valero agrees with the comments offered by the Western States Petroleum Association (WSPA) regarding the CFO regulation and incorporates those comments as its own. Additionally, Valero is providing the following comments for your consideration. 1

1. **<u>Refiners and importers should not be the regulated party under the Clean Fuels Outlet regulation.</u>**

In the December 16, 2011 draft revisions to the rule proposed to be renamed as the "Clean Fuels Outlet" regulation, ARB proposes to change the emphasis of the former "Clean Fuels Program" from facilitating market availability of various types of alternative fuels to focusing exclusively on zero-emission vehicles fueled by hydrogen and perhaps electricity. Further, ARB proposes to significantly shift the burden of the regulation by changing the "regulated party" under the regulation from the owners and operators of retail stations to refiners and importers of petroleum fuels. The effect of the proposed redefinition is to force refiners and importers to finance installation of infrastructure that will directly compete with

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Post Office Box 696000 • San Antonio, Texas 78269-6000 • Telephone (210) 345-2000

their own core business and, if market saturation is as successful as ARB hopes it will be, eventually erode that business. As the nation's largest independent refiner and the second-largest producer of corn ethanol, Valero objects to being forced to fund its own demise, and would note in particular the following issues:

- ARB's staff report on the Initial Statement of Reasons (ISOR) for the 2012 Proposed Amendments to the Clean Fuels Program Regulation does not consider making the parties who will benefit from installation of CFOs—the auto manufacturers and the hydrogen suppliers—the "regulated parties." With this change, ARB proposes to make the parties that will bear the brunt of the economic impact of declining gasoline demand fund the CFOs. The rationale offered in support of making refiners/importers regulated parties is that "This amendment will ensure that those refiner/importers that have the largest stake in supplying gasoline to the California market have a commensurate role in developing the state's hydrogen infrastructure." The logic supporting this statement is not apparent, unless one takes the punitive view that having supplied gasoline to the California market is a misdeed that now must be remedied. It makes more sense for those who potentially stand to profit from the proliferation of ZEVs to be responsible for developing the infrastructure to fuel them, yet the ISOR does not even identify this approach as an alternative.

- Transfer of funds from the refining industry based on each participant's market share in that industry for the benefit of stimulating a competitive business amounts to exaction of funds from the refining/importing industry. In order to impose a new tax, ARB must first seek approval of two-thirds of the California Legislature, as provided by Proposition 26. In order to impose a new fee, ARB must show a nexus between the fee and the use of the fee. 1 cont'd

- The economic impact discussion in the ISOR acknowledges that return on investment (ROI) is important in assessing the economic impact of the regulation. Leaving aside for the moment the adequacy of ARB's ROI projections, the ISOR does not explain the basis for the assumption that refiners/importers will be in a position to recoup any return at all if they are forced to pay for installation of equipment on property they neither own nor control. The ISOR assumes that branded dealers lease the real estate and equipment on which their stations operate from refiners. This is simply not the reality today. Nearly all branded dealers own their own property and equipment and are simply parties to branding and supply agreements. In fact, out of over seven hundred Valero-branded, wholesale-supplied retail outlets in California (which number does not include sites operated by a Valero affiliate), Valero has a real estate interest in only 19 of them, and fee title to only 10. To the extent Valero is compelled to fund installation of CFOs at branded stations that it does not own based on ARB's market-share formula for identifying the number of stations a particular refiner/importer must finance, coupled with ARB's ability to dictate the location of CFO outlets, Valero will not be making an "investment" in its own property at all. In that circumstance, Valero will receive no benefit whatsoever. Instead, Valero will be harmed to the extent CFOs result in reduced sales of the products provided under those supply agreements.

- Refiner/importers such as Valero that do not own the property upon which the CFOs will be located will have no direct control over how the CFOs are to be operated. Valero-affiliated entities that own operate petroleum refineries in California do not even have indirect relationships through contractual arrangements with wholesalers, much less retailers. Thus, the extraordinarily detailed requirements in Section 2309(b) of the proposed regulation prescribing exactly where on the property the CFOs are to be installed and how they are to be operated (sufficient fuel storage, signage, how customers are to pay, lighting, daily maintenance of equipment, etc.) and the breakdown/repair provisions in Section 2311 are not only unreasonably prescriptive, but they are completely inappropriate to impose as requirements on refiner/importers. The only way refiner/importers will be able to have any influence at all over compliance with these provisions is indirectly, through entering agreements with retailers for "constructive allocation" of stations or through persuading affiliated corporate entities to request modification of their contractual relationships with branded retailers to have the retailers promise to fulfill these provisions. Independent retailers may be reluctant accept the increased liability associated with storing and dispensing hydrogen onsite, or refuse to agree to the intrusive operational provisions mandated by the proposed revisions to the regulation. Even if some retailers ultimately agree to allow their site to be used for CFOs, if they do not fulfill their contractual obligations, refiner/importers will be left vulnerable to enforcement under the regulation with no direct ability to comply.

2. **<u>The proposed enforcement remedies in the ISOR are inequitable and without sound legal basis</u>.**

1 cont'd

The proposed revisions would make refiner/importers' willful failure to timely install CFOs subject to the penalty provisions of California Health and Safety Code (H&SC) Sections 43027 and 43208, and thus would provide penalties of up to a quarter-million dollars per day. This proposal raises several issues of equitable regulation and of legal sufficiency:

The proposed penalties for regulated parties and auto manufacturers are grossly inequitable. Under the proposed revisions, if vehicle manufacturers fail to meet their projections for production of hydrogen vehicles, the consequence to refiners and importers is that they will have been required to spend tens or hundreds of millions in sunk costs on installation of fuel outlets for which the demand turns out to be insufficient. Under the proposed revisions, the penalty for the vehicle manufacturers in this instance is a one-time fine of up to $35,000. In contrast, the proposed revisions would make a refiner/importer's "willful" failure to timely build a single fuel outlet subject to a penalty of up to $250,000 *per day*. The proposed revisions exceed the authority granted to ARB under H&SC Section 43027(a) based on the plain language of the statute, which does not reference imposition of daily penalties. Even if ARB recognizes that a penalty under Section 43027 should be a one-time occurrence, the quarter-million-dollar potential penalty for failure to install a single CFO on ARB's timetable represents a penalty over seven times that proposed for an auto manufacturer's penalty for misleading ARB and the public, as well as refiners and importers.

- The order-of-magnitude disparity noted above is particularly troubling given the vagueness of what constitutes a "willful" failure to install outlets timely. Under the proposed revision, the regulated party obligated to provide for installation of fuel outlets may have little or no direct control over where, when, and how the outlets are to be installed. If a regulated party has no option but to negotiate with a third party to install outlets to satisfy the refiner/importer's obligation, the third party is likely to leverage the fact that the regulated party is under the compulsion of a regulatory requirement, coupled with time pressure and a significant potential penalty, to demand commercially unreasonable terms. Based on the discussion in the ISOR and the language of the proposed regulation, it appears that ARB could regard the regulated party as willfully violating the regulation if it does not agree to this type of extortion.

- Although the draft rule indicates that Health and Safety Code Section 43027(a) will be cited as the basis for any violation of the requirement to install CFOs, ARB cannot unilaterally expand its statutory authority through regulatory interpretation. H&SC Section 43025 states that "It is the intent of the Legislature in the enactment of this chapter to update the penalty provisions for *violations of fuel regulations* to ensure that the appropriate tools are available to effectively and fairly enforce state law." Further, the plain language of H&SC Section 43027 indicates that it applies to violations for sales of fuel that does not comply with applicable specifications. Subsection (a) reads as follows (emphasis added): 1 cont'd

> *Any person who willfully and intentionally violates any provision of this part, or any rule, regulation, permit, variance, or order of the state board, pertaining to* ***fuel requirements and standards****, is liable for a civil penalty of not more than two hundred fifty thousand dollars($250,000),* ***and the prosecuting agency shall include a claim for an additional penalty in the amount of any economic gain that otherwise would not have been realized from the sale of the fuel determined to be in noncompliance.***

The language above makes it clear that the California Legislature intended Section 43027 to apply to violations of applicable regulations related to fuel quality. Requiring Valero to fund installation of CFOs is a way to fund installation of infrastructure to provide a regulated fuel, but these new requirements have nothing to do with meeting the requirements of ARB's fuel regulations. The California Legislature has not empowered ARB to impose a penalty of this magnitude for a violation of a requirement that is fundamentally different in nature than anything that existed when this provision was adopted.

3. **<u>The economic impact assessment in the ISOR does not adequately address impact on retailers or on refiner/importers.</u>**

- The ISOR does not address the potential consequences to retailers of displacing gasoline availability with CFO stations or on-site steam methane reformers. Most retail gasoline stations have little or no undeveloped surface available. During the peak hours before and after work and at lunchtime, the fueling positions at most retail stations are fully occupied and the limited parking spaces are full. If the hydrogen refueling equipment uses existing parking spaces, then in-store sales will decline. If the hydrogen dispenser replaces a gasoline dispenser, then not only will gasoline sales decline, but in-store sales will also decline, as there will be fewer hydrogen customers then gasoline customers. If the hydrogen dispenser is added to a fuel island, a car using it will prevent another car from using the gasoline pump next to the hydrogen dispenser. If an on-site steam methane reformer must be installed, this equipment would completely displace any space that could be occupied by an in-store retail customer. Thus, in any of these scenarios, gasoline and retail sales will decline, and retail service station owners will lose sales, revenue and profit. The economic impact of the proposed rule cannot be understood without quantifying these impacts.

- The economic analysis presented in the ISOR is based on numerous unfounded and unduly optimistic assumptions. For example, ARB assumes that technology advancements will result in a drop in the price of supplied hydrogen, although there is no basis for concluding what those advancements might be or why they would result in cheaper hydrogen. ARB assumes counterintuitively that station operators will be able to sell hydrogen at a higher price in later years to recoup their initial losses even though ARB also assumes that the number of stations will increase in subsequent years. If ARB's assumptions about the eventual profitability of hydrogen fueling outlets were correct, it would not be necessary to forcibly conscript participants in this market. 1 cont'd

4. **<u>The prescriptive requirements pertaining to CFO operation are overly burdensome and unrealistic.</u>**

Sections 2309 and 2311 of the proposed regulation include numerous requirements that are overly burdensome and unrealistic, even if station operators remain the regulated party. For example, the requirement to notify ARB within four hours of dispensing equipment malfunction is unnecessarily burdensome and serves no purpose. Station operators' time would be better spent calling the repair company to service the equipment. The requirement to repair broken equipment within one month overlooks the fact that until market saturation is reached, equipment and contractors are not likely to be widely available, and therefore it is arbitrary to mandate an unreasonably short time for equipment to be ordered, fabricated, delivered, and installed. The detailed requirements pertaining to amenities, lighting, signage, and so forth are stunningly intrusive. Most or all of these requirements exceed ARB's statutory authority to protect air quality in California.

5. **<u>The ISOR overlooks the environmental and safety impacts associated with hydrogen fuel manufacture and supply.</u>**

The proposed CFO revisions will just raise cost to all California consumers with little or no benefit. There are still emissions when hydrogen is produced and electricity is generated, they just are not at the tailpipe. Further, the ISOR is dismissive of the risks associated with onsite hydrogen storage, fueling, and perhaps manufacture.

For the reasons discussed above and in the comments submitted by WSPA, Valero strongly urges ARB to refrain from moving forward with the proposed amendments to the Clean Fuel Outlet regulations. If you have any questions, please contact me at (210) 345-2922. 1 cont'd

Sincerely,

John R. Braeutigam

John R. Braeutigam
V.P. Strategic & Regulatory Development

CFO – L8 Response

8-1 The commenter expresses that "The ISOR overlooks the environmental and safety impacts associated with hydrogen fuel manufacture and supply. The proposed CFO revisions will just raise cost to all California consumers with little or no benefit. There are still emissions when hydrogen is produced and electricity generated, they are just not at the tailpipe. Further, the ISOR is dismissive of the risks associated with onsite hydrogen storage, fueling and perhaps manufacture."

ARB disagrees. Contrary to the commenter's concerns, the EA for the proposed ACC Program (Appendix B), which ARB prepared in accordance with CEQA and its certified regulatory program, both evaluates environmental and safety impacts that may be associated with hydrogen fuel manufacturing, supply, storage, and fueling.

The EA analyses potential environmental impacts associated with the reasonably foreseeable compliance responses of the regulated community. Chapter 3 of the EA provides a discussion of the existing physical conditions and the regulatory framework relevant to each environmental resource area potentially affected by the proposed ACC Program. The chapter includes a section pertaining to hazards. This section describes characteristics of hazardous materials as toxic (causes human health effects), ignitable (has ability to burn, such as hydrogen), corrosive (causes severe burns or damage to material and reactive (causes explosions or generates toxic gases). California's hazardous waste regulations provide the means to determine whether or not a waste is hazardous. The section also provides a table of applicable federal and state laws and regulations governing hazards and hazardous materials.

Chapter 4 of the EA describes the foreseeable regulated community compliance responses, and includes discussions related to hydrogen supply and the potential for modification of hydrogen production plants. This section discloses that modification of existing hydrogen production plants may be necessary to accommodate an increase in demand. The EA indicates that using the fast-rate scenario for FCVs entering the vehicle fleet, the total hydrogen demand when the 10,0000 FCV trigger is activated in the South Coast Air Basin could represent 1.1 percent of the hydrogen supply in that area. Under the same fast-entry scenario, total statewide demand in 2020 would represent 3.9 percent of the merchant hydrogen supply, and in 2024, it could represent 9.2 percent. The EA also indicates that once the statewide demand for hydrogen reaches 3.5 million kilograms per year, the California standards for hydrogen will be in place, which require that 33 percent of the hydrogen that is produced for transportation be made from eligible renewable resources (CPUC Code Section 399.12) This requirement will eventually present a business case for the construction of new hydrogen plants that produce hydrogen from renewable resources.

Chapter 5 of the EA provides a programmatic impact and mitigation analysis, using the CEQA Checklist as a tool for determining whether an impact may result. It describes potential impacts associated with the entire ACC program and includes a discussion of construction of new facilities or modification of existing facilities, which may include hydrogen production plants. Such actions would be subject to site-specific analysis under CEQA. As for emissions related to hydrogen production, those emissions would be regulated by the local air district.

H. Daniel Sinks
Fuels Issues Advisor

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January 24, 2012

Clerk of the Board, Air Resources Board
1001 I Street
Sacramento, CA 95814

Via electronic submittal to: http://www.arb.ca.gov/lispub/comm/bclist.php

Re: **Notice of Public Hearing to Consider Adoption of the 2012 Amendments to the Clean Fuels Outlet (CFO) Regulation – ConocoPhillips Company Comments**

Dear Clerk of the Board,

ConocoPhillips Company (ConocoPhillips) appreciates the opportunity to provide these comments. ConocoPhillips will be directly impacted by this amended rule because we own and operate two refineries in the State of California and will be a "Major refiner/importer of gasoline" as defined in the proposed amendments. In addition, we have pipeline and terminal assets in the State that distribute fuels produced at our refineries.

ConocoPhillips also is a member of the Western States Petroleum Association (WSPA) and supports the comments submitted by WSPA for this hearing and rulemaking. Rather than repeat WSPA's detailed comments here, we incorporate them by reference into this letter. ConocoPhillips specifically opposes the proposed modifications to the CFO regulation that shifts the burden of motor fuel hydrogen infrastructure on to major refiner/importers of gasoline for the following reasons. 1

Legal Authority
As described in detail by WSPA in its comments, if amended as proposed the CFO regulation will violate several laws and/or legal authorities:

- the U.S. Constitution (both the Takings Clause of the Fifth Amendment as applied to the states via the Fourteenth Amendment and the Commerce Clause);
- the requirement of an administrative agency to remain within the scope of its statutory authority and not promulgate rules *ultra vires*;
- Proposition 26; and
- CEQA.

Bad Public Policy
We believe the proposed regulatory changes are bad public policy in that CARB is effectively picking "winners and losers" and placing the burden for those outlets on producers and importers of gasoline. The proposed amendments would require our company to install hydrogen fueling stations at sites that we do not own or operate. In fact, ConocoPhillips does not own or operate any retail outlets in California. In addition, the selection of those sites would be at locations prescribed by CARB. Further, the number of stations and the required investment would be based upon forecasts and

projections from vehicle manufacturers that may never materialize based upon consumer choice and actual vehicle sales.

We urge the Board to reject the staff proposed provision identified above. If the Government wants to mandate hydrogen fueling outlets, the burden of the mandate should not be borne by the petroleum based fuel suppliers. Thank you for considering ConocoPhillips' comments. Please feel free to contact me if you have questions regarding our comments. 1 cont'd

Sincerely,

<H. Daniel Sinks>

CFO – L15 Response

15-1 The commenter expresses that "ConocoPhillips also is a member of the Western States Petroleum Association (WSPA) and supports the comments submitted by WSPA for this hearing and rulemaking. Rather than repeat WSPA's detailed comments here, we incorporate them by reference into this letter. ConocoPhillips specifically opposes the proposed modifications to the CFO regulation that shifts the burden of motor fuel hydrogen infrastructure on to major refiner/importers of gasoline for the following reasons.

Legal Authority

As described in detail by WSPA in its comments, if amended as proposed the CFO regulation will violate several laws and/or legal authorities:

- the U.S. Constitution (both the Takings Clause of the Fifth Amendment as applied to the states via the Fourteenth Amendment and the Commerce Clause);
- the requirement of an administrative agency to remain within the scope of its statutory authority and not promulgate rules ultra vires;
- Proposition 26; and
- CEQA."

Please refer to responses CFO – L26. Regarding the statement that the CFO Regulation violates CEQA, ARB disagrees. ARB prepared an EA for the proposed ACC Program (Appendix B) in accordance with CEQA and its certified regulatory program. The EA analyses potential environmental impacts associated with the reasonably foreseeable compliance responses of the regulated community, identified mitigation where impacts were identified, and analyzed a reasonable range of alternatives. CEQA does not preclude ARB from pursuing a regulation that improves air quality in California or determining an appropriate regulated community. See also responses to this comment provided in the FSOR prepared for CFO regulation.

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Western States Petroleum Association

Credible Solutions • Responsive Service • Since 1907

Catherine H. Reheis-Boyd

President

January 25, 2012

Clerk of the Board
Air Resources Board
1001 I St
Sacramento, CA 95814
Via e-mail to http://www.arb.ca.gov/lispub/comm/bclist.php

Re. **Western States Petroleum Association's Comments on CARB Board Hearing Agenda Item # 12-1-2 – Public Hearing to Consider Amendments to the Clean Fuels Outlet Regulation**

Dear Clerk of the Board:

The Western States Petroleum Association (WSPA), is a non-profit trade association representing twenty-six companies that explore for, produce, refine, transport and market petroleum, petroleum products, natural gas and other energy supplies in California and five other western states.

WSPA has actively participated in the California Air Resources Board's (ARB's) Clean Fuels Outlet (CFO) regulatory amendment workshops and meetings over the past two years. During the July 13th, 2011workshop, WSPA and WSPA members expressed strong policy, technical, economic, environmental and legal concerns with staff's outline of proposed revisions to the CFO regulation; most notably the fact that CARB is proposing to target "gasoline producers and importers" as the regulated party responsible for creating a hydrogen retail infrastructure.

WSPA also has been an active and productive participant in the Hydrogen Infrastructure Collaborative Workgroup ("workgroup") composed of, but not limited to, the California Fuel Cell Partnership, auto manufacturers, hydrogen fuel providers including equipment suppliers, environmental organizations, the California Energy Commission, South Coast Air Quality Management District, representatives of the University of California Davis and Irvine, the International Clean Cars & Transportation and ARB. Over the past few months, the workgroup has diligently worked together in understanding the technology, equipment, and most

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importantly funding challenges and costs necessary to make an effective business case for hydrogen (H2) infrastructure deployment.

At our recent workgroup meetings, WSPA was both encouraged that the workgroup was working toward developing a funding strategy based on utilizing/expanding existing state hydrogen programs such as the AB 118 program, and was supportive of this approach. Thus, we continue to question why ARB feels there is a need for continued pursuit of the CFO regulatory amendment rulemaking.

WSPA urges ARB to withdraw the CFO regulation and continue to support the collaborative efforts and goals of the workgroup. WSPA continues to oppose ARB's proposed CFO regulatory mandate and submits the attached comments and supporting documents to express our opposition as well as identify the deficiencies with staff's proposed regulatory amendment package.

A mandate as proposed in the regulation will provide none of the certainty in infrastructure development that the Board and automakers are seeking. Forcing infrastructure investments from non-interested parties will likely result in certain legal challenges.

For that reason, WSPA strongly urges the ARB Board to deny approval of the proposed Clean Fuel Outlet amendments, and instead pledge to work within the Hydrogen Collaborative framework to progress the installation of hydrogen infrastructure in the state – commensurate with the level of fuel cell vehicles sold in the state in the most cost-effective manner to meet consumer needs.

If you have any questions, please contact me at (916) 498-7752.

Sincerely,

Catherine H. Reheis-Boyd

c.c. Nancy McFadden, Executive Secretary, Office of the Governor
Cliff Rechshaffen, Senior Advisor, Office of the Governor
Matt Rodriquez, Secretary, California Environmental Protection Agency
Mary Nichols, Chairwoman, California Air Resources Board
James Goldstene, Executive Officer, California Air Resources Board
CARB Board

ARB ADVANCED CLEAN CARS PROGRAM

2012 PROPOSED AMENDMENTS TO THE CLEAN FUELS OUTLET REGULATION

Western States Petroleum Association Comments on ARB January 26 Board Hearing Agenda Item #12-1-2 – Public Hearing to Consider the 2012 Amendments to the Clean Fuels Outlet Regulation

Comments on Legal Issues Raised by the Proposed CFO Amendments

Comments on Appendix F: Legal Authority

ARB Does Not Have Statutory Authority to Adopt the Proposed CFO Amendments

A regulation must be "(1) within the scope of authority conferred and (2) . . . reasonably necessary to effectuate the purpose of the statute." *Culligan Water Conditioning v. State Bd. Of Equalization*, 17 Cal.3d 86, 93 (1976). Administrative agencies have only the authority that is granted them by statute. *State Bd. Of Equalization v. Bd of Supervisors*, 105 Cal. App.3d 813, 818-820 (1980).

Nothing in the Health and Safety Code provides ARB with statutory authority to mandate that petroleum refiners/importers (or anyone else) establish retail outlets for the distribution of "designated clean fuels," including hydrogen. Indeed, ARB does not appear to even have the authority to mandate the use of a particular substance or form of energy (i.e., hydrogen or electricity) as a motor vehicle fuel. If ARB can require that fuel suppliers install or pay for hydrogen CFO stations throughout California, where is the limit of what ARB can mandate? With a stroke of the same regulatory brush, ARB could require the same fuel suppliers to provide retail facilities for sale of every kind of alternative fuel that might ever propel a vehicle of any kind. ARB could direct solar power generators to install equipment to generate renewable hydrogen to assure that the SB 1505 renewable hydrogen mandates are met. ARB could reach out to impose similar mandates on big-box retailers, cities and counties, utilities, and any "indirect source" that attracts vehicles (like amusement parks and sport complexes and universities). We do not believe the general "enabling clause" in Health and Safety Code section 43018[1] could ever reach this far, and that the proposed hydrogen mandates in the proposed CFO amendments cross the line of ARB's authority under state law.

In the Initial Statement of Reasons for the 2012 Proposed Amendments to the Clean Fuels Outlet Regulation ("ISOR"), ARB concedes that "Health and Safety Code section 43018 is the primary source of ARB's legal authority to adopt the proposed regulation." ISOR, p. 66. ARB also references a July 31, 1990 memorandum from Senior Staff Counsel W. Thomas Jennings to

[1] All statutory references are to sections of the Health and Safety Code unless indicated otherwise.

Peter Venturini ("1990 Memo"). That memorandum explains ARB's view that section 43018, enacted as part of the California Clean Air Act of 1988, "provides the ARB with broad regulatory motor vehicle and fuel authority not otherwise granted in the Health and Safety Code." 1990 Memo, p. 6.

As relevant here, section 43018 reads as follows:

> 43018. (a) The state board shall endeavor to achieve the maximum degree of emission reduction possible from vehicular and other mobile sources in order to accomplish the attainment of the state standards at the earliest practicable date.
> (b) Not later than January 1, 1992, the state board shall take whatever actions are necessary, cost-effective, and technologically feasible in order to achieve, not later than December 31, 2000, a reduction in the actual emissions of reactive organic gases of at least 55 percent, a reduction in emissions of oxides of nitrogen of at least 15 percent from motor vehicles. These reductions in emissions shall be calculated with respect to the 1987 baseline year. The state board also shall take action to achieve the maximum feasible reductions in particulates, carbon monoxide, and toxic air contaminants from vehicular sources.
> (c) In carrying out this section, the state board shall adopt standards and regulations which will result in the most cost-effective combination of control measures on all classes of motor vehicles and motor vehicle fuel, including, but not limited to, all of the following:
> (1) Reductions in motor vehicle exhaust and evaporative emissions.
> (2) Reductions in emissions from in-use emissions from motor vehicles through improvements in emission system durability and performance.
> (3) Requiring the purchase of low-emission vehicles by state fleet operators.
> (4) Specification of vehicular fuel composition.

According to ARB, section 43018 "does not limit the Board's authority to adopting 'specifications' of fuels. Rather, it authorizes the Board to adopt whatever control measures pertaining to fuels that are technologically feasible, cost-effective, and necessary to attain the state ambient air quality standards by the earliest practicable date." ISOR, p. 66. ARB further argues that section 43018 "expanded the Board's previous authority to regulate and control the sale of motor vehicle fuels." 1990 Memo, p. 5.

ARB's interpretation overstates the scope of authority granted by section 43018. Nothing in section 43018 grants ARB authority to mandate the use of a particular fuel (i.e., hydrogen or electricity) in motor vehicles. Even "specification of vehicular fuel composition" under section 43018(c)(3) provides no more authority than does section 43013(a): "'specification of vehicular fuel composition' in section 43018(c)(4) correlates to 'motor vehicle fuel specifications'" under section 43013. 1990 Memo, p. 7. That authority allows ARB to establish standards and specify characteristics for vehicle fuels, but not to mandate what fuel is used.

ARB asserts in the 1990 Memo that the legislature's use of the phrase "including, but not limited to" in section 43018(c) expanded ARB's authority beyond the measures specified. However, even if the list of measures in section 43018(c) is non-exclusive, measures adopted pursuant to that authority must be consistent with the statutory scheme. See *Copley Press, Inc. v. Superior Court*, 39 Cal. 4th 1272, 1288-89 (2006); *California Sch. Boards Assn. v. State Bd. of Educ.*, 191 Cal. App. 4th 530, 572 (2010) (holding that regulations adopted by the School Board must be consistent with authority under statutory scheme, despite express authority to "*adopt, regulations implementing this subdivision, including but not limited to* defining the terms 'average daily classroom attendance,' 'conditions reasonably equivalent,' 'in-district students,' 'facilities costs…."). As discussed above, neither the text of section 43018 nor the regulatory scheme suggests that ARB has authority to mandate the use of a particular fuel. None of the measures listed in section 43018(c) comes close to mandating the use of a particular fuel, so such a requirement cannot be considered to be within the scope of ARB's authority under section 43018.

ARB claims that the legislative history of section 43018 supports its interpretation, because at various points in the legislative process the list of measures in what eventually became section 43018(c) included "requiring the use of clean burning fuels," and "requiring the manufacture of vehicles capable of using cleaner-burning fuels." "It therefore follows that each of the specifically itemized categories listed in the intermediate versions of the bill fell within the broader range of control measures the Board was authorized to adopt." 1990 Memo, pp. 7, 8. In fact, the legislature's later deletion of that language from the final enacted legislation establishes the opposite – that such measures are <u>not</u> included within the authority granted to ARB under Section 43018. The scope of an agency's authority may not be enlarged by the "insertion of language that the Legislature has overtly left out." *Traverso v. People ex rel. Dept. of Transportation*, 46 Cal.App.4th 1197 (1996); *see also Cooper v. Swoap*, 11 Cal. 3d 856, 863-64 (1974) (holding that an agency did not have authority to adopt a regulation using the same language as a proposed amendment to the enabling statute that had been rejected by the Legislature).

"The evolution of a proposed statute after its original introduction in the Senate or Assembly can offer considerable enlightenment as to legislative intent.... Generally the Legislature's rejection of a specific provision which appeared in the original version of an act supports the conclusion that the act should not be construed to include the omitted provision." *People v. Goodloe* (1995) 37 Cal.App.4th 485. Here, the Legislature amended the earlier-proposed versions of section 43018(c) to eliminate all references to "clean burning fuels" and "clean fuel vehicles." Because the Legislature expressly deleted any grant of authority to implement measures relating to "clean burning fuels" and "clean fuel vehicles," ARB may not infer the inclusion of such authority in the statute. See *Traverso*, 46 Cal.App.4th at 1207; see also *People v. Hunt*, 74 Cal. App. 4th 939, 947-48 (1999) (holding that "the Legislature's rejection of a specific provision which appeared in the original version of an act supports the conclusion that the act should not be construed to include the omitted provision").

Even assuming that ARB had authority to mandate the use of particular substances or energy sources as motor vehicle fuels, it does not have authority to require that any particular person or entity construct and operate facilities to sell a particular fuel. The language used in sections 43013 and 43018 consistently refers to "motor vehicle emission standards," "motor vehicle fuel specifications," "the most cost-effective combination of control measures on all classes of motor vehicles and motor vehicle fuel" and similar language Nowhere is there even a mention of fuel providers or retail outlets, much less a grant of authority to require that existing fuel providers establish retail outlets to sell a completely different fuel, and the terms used in the statute cannot be read that expansively. Contrary to ARB's assertion in the ISOR, the 1990 memo doesn't address this issue. Notwithstanding its title, the 1990 Memo addresses ARB authority to adopt clean fuels regulations only generally, not with respect to a requirement to establish retail outlets. *Western Oil and Gas Ass'n v. Orange County APCD*, 14 Cal. 3d 411 (1975), discussed in the l990 Memo, also does not address the issue of ARB's authority to require establishment of retail outlets for specific fuels, and it does not provide any such authority.

The Legislature's enactment of SB 1505 (Lowenthal) in 2006 (Stats. 2006, Ch. 877) further undercuts ARB's position. Section 43869(a), enacted by SB 1505, expressly authorizes ARB to "adopt hydrogen fuel regulations" to accomplish specified objectives in a manner consistent with criteria established by the Legislature. SB 1505 illustrates the maxim that the Legislature knows how to say what it means, and that the plain meaning of the statutory language controls. *Murphy v. Kenneth Cole Productions, Inc.*, 40 Cal. 4th 1094, 1103 (2007) ("[W]e presume the Legislature meant what it said and the plain meaning of the statute governs"). This extensive and detailed legislation regarding hydrogen as a vehicle fuel (enacted after section 43018) does not authorize ARB to mandate the establishment of retail facilities for the sale of hydrogen fuels. Accordingly, ARB cannot read such an authorization into section 43018.

Finally, a substantial element of ARB's rationale for adopting the proposed CFO amendments (as part of the Advanced Clean Cars package) is reducing greenhouse gas emissions. For example, "Beyond 2025, the driving force for lower emissions will primarily be climate change." ISOR, p. i. Nothing in sections 43013 and 43018, or indeed in any of the Health and Safety Code provisions cited in the Proposed Regulation Order as authority for the CFO amendments, grants ARB any authority whatsoever with regard to greenhouse gas emissions or climate change. For example, section 43018(a) states: "The state board shall endeavor to achieve the maximum degree of emission reduction possible from vehicular and other mobile sources in order to accomplish the attainment of the state standards at the earliest practicable date." The "state standards" do not include climate or greenhouse gas emissions. 17 Cal. Code Regs. § 70200. Since ARB has cited no authority for the GHG-related aspects of the proposed CFO amendments, any anticipated GHG impacts and emission reductions cannot be considered in connection with this measure.

<u>The Proposed CFO Amendments are not Cost-Effective, and ARB has not Prepared the Required Cost-Effectiveness Analysis</u>

ARB has characterized the proposed CFO amendments as a motor vehicle fuel standard. Prior to adoption, ARB must determine that motor vehicle fuel standards are, among other things, "necessary and cost effective." Sections 43013(a), 43018(c). Cost effectiveness is typically presented in terms of the cost per ton of emissions reduced. *See, e.g.*, Table VII-B-5, "Estimates of Cost Effectiveness for Advanced Clean Cars Reductions of Criteria Pollutants and Greenhouse Gases (2009 Dollars)," Initial Statement Of Reasons For Proposed Rulemaking, Public Hearing To Consider The "LEV III" Amendments To The California Greenhouse Gas And Criteria Pollutant Exhaust And Evaporative Emission Standards And Test Procedures And To The On-Board Diagnostic System Requirements For Passenger Cars, Light-Duty Trucks, And

Medium-Duty Vehicles, And To The Evaporative Emission Requirements For Heavy-Duty Vehicles ("LEV III ISOR"), p. 196. None of the rulemaking documents for the CFO amendments include such an analysis, nor do they identify any emission reductions attributable to the proposed CFO amendments. In the absence of any identified emission reductions attributable to the proposed CFO amendments, the cost-effectiveness of the proposal is infinite and the proposed amendments cannot be considered to be cost-effective.

Consistent with the lack of analysis in the current rulemaking package, in its Final Statement of Reasons for the 1999 amendments to the CFO, ARB stated that the CFO program has no emissions benefits or identified cost-effectiveness:

> While the commenter is correct to note that there are no specific emission benefits associated with the regulations, the regulations are an important part of the California LEV Program. When the LEV Program was first adopted in 1990, the Clean Fuels Regulations were also adopted to ensure that clean alternative fuels used to certify LEVs would be publicly available. In order for automakers to confidently produce clean fuel LEVs, a degree of certainty must be present that there will be fuel available for those vehicles. Therefore, while the regulations themselves do not provide any specific emission benefits, they assist automakers in implementing the LEV Program.
>
> The commenter is correct to note that the regulations by themselves have no associated cost-effectiveness. However, during the adoption of the LEV/Clean Fuels Regulations in 1990, the estimated overall cost-effectiveness of the LEV Program included the costs associated with the clean fuels portion of that rulemaking. Therefore, the cost-effectiveness of the LEV Program has already considered the costs associated with the clean fuels provisions. In addition, staff believes that the amendments provide an overall cost-savings to affected parties compared to the original regulations.
>
> Final Statement of Reasons for Rulemaking Including Summary of Comments and Agency Responses; Hearing to Consider Amendments to the Clean Fuels Regulations Regarding Clean Fuel Outlets, pp. 4, 5.

Since ARB has previously admitted that the CFO rule has no emissions benefits and no associated cost-effectiveness and has not provided any information to the contrary in the current CFO amendment rulemaking materials, the ARB Board cannot find that the proposed CFO amendments are necessary or cost-effective.

<u>The Proposed CFO Mandate Would Result in an Unconstitutional Taking of Private Property.</u>

The proposed amendments include a CFO mandate that requires major refiners/importers to establish CFOs without just compensation. That would result in an unconstitutional taking of private property. The Legislature has not, and could not, mandate such a taking without providing compensation. Neither can the ARB.

The ARB can only take private property with express authority from the Legislature. The Legislature has never authorized the ARB to exercise the state's power of eminent domain, and it has not done so to allow ARB to take private property to establish CFOs.

Requiring major refiners/importers to establish CFOs, particularly where no mechanism has been included to assure an adequate return on the required investment, constitutes a taking of property without just compensation and violates the Fifth Amendment to the U.S. Constitution. *See Penn Central Transp. Co. v. New York City*, 438 U.S. 104, 124 (1978) (interference with investment-backed expectations); *Loretto v. Teleprompter Manhattan CATV Corp.*, 458 U.S. 419 (1982) (permanent physical occupation of property).

Plainly, the proposed amendments interfere with the investment-backed expectations of refiners. Over the course of many years, refiners have invested substantial capital to enable themselves to produce the gasoline needed by vehicles in California. While refiners might expect state agencies to impose reasonable regulations on their refinery operations, no one could reasonably expect that a state agency would require refiners to establish retail outlets for hydrogen, a fuel that competes with gasoline. For the ARB to require refiners to establish outlets for a product that directly competes with the refiners' own gasoline is an unconstitutional interference with investment-backed expectations and would result in an unconstitutional taking of property.

<u>The Proposed CFO Mandate Violates the Commerce Clause</u>

The proposed amendments contemplate that most CFOs would be established at existing service stations. That has a discriminatory effect against importers of gasoline from outside California--those importers are unlikely to have contractual relationships with existing service stations and will be at a disadvantage in attempting to establish CFOs at existing service stations.

The Commerce Clause of the U.S. Constitution "directly limits the power of the States to discriminate against interstate commerce." *New Energy Co. of Indiana v. Limbach*, 486 U.S. 269, 273 (1988). "A finding that state legislation constitutes 'economic protectionism' may be made on the basis of either discriminatory purpose . . . , or discriminatory effect." *Bacchus Imports, Ltd. v. Dias*, 468 U.S. 263, 270 (1984). The discrimination barred by the Commerce Clause "takes various forms." *Hunt v. Washington State Apple Advertising Commission*, 432 U.S. 333, 350 (1977). A statute may be unconstitutional "[d]espite the statute's facial neutrality." *Hunt*, 432 U.S. at 351. For example, a statute may have "a leveling effect which insidiously operates to the advantage of local . . . producers." *Hunt*, 432 U.S. at 351.

Applying these Commerce Clause principles, the U.S. District Court for the Eastern District of California recently enjoined the enforcement of California's Low Carbon Fuel Standard ("LCFS"), holding that it impermissibly discriminated against out-of-state sources. *Rocky Mountain Farmers Union v. Goldstein*, E.D.Cal., Dec. 29, 2011. In one portion of his decision, District Judge O'Neill of the Eastern District of California found "that the LCFS discriminates against out-of-state and foreign crude oil while giving an economic advantage to in-state crude oil." Order on NPRA Plaintiffs Summary Adjudication Motion, p. 2. Judge O'Neill noted that the "practical effect of the LCFS" is to favor California crude oil and discriminate against out-of-state and foreign crude sources. *Id.*, p. 19. That violates the Commerce Clause "even though the distinctions drawn appears to be neutral." *Id.*

Similarly here, the proposed amendments would give an economic advantage to in-state refiners that have contractual relationships with existing service stations—the practical effect is to favor California refiners and discriminate against importers. That violates the Commerce Clause even if the proposed amendments appear to be neutral.

<u>Proposition 26 and the Due Process Clause Limit the ARB's Authority to Impose any Levy, Charge or Exaction</u>

Proposition 26 amended Article 13A, Section 3 of the California Constitution expands the definition of "tax" and requires a two-thirds supermajority vote in each house of the Legislature for "any change in state statute which results in any taxpayer paying a higher tax." Proposition 26 defines a "tax" as "any levy, charge, or exaction of any kind imposed by the State." Excepted from the definition is a fine, penalty, or other monetary charge imposed by the judicial branch of government or the State, as a result of a violation of law.

Here, the ARB's proposed amendments provide that violations of the CFO mandate would subject a refiner/importer to penalties under sections 43027 and 43028 of the Health and Safety Code. Other than providing that each day of violation at a specific outlet shall be deemed a separate violation, no other explanation is given in the proposed amendments. Without further information showing that the penalties in the proposed amendment are truly fines imposed by the state, the limits that Proposition 26 imposes may apply.

The CFO mandate itself is contrary to Proposition 26. The stated purpose of Proposition 26 was to restrict the adoption of levies, charges, or exactions "simply imposed to raise revenue for a new program"--such levies, charges or exactions "should be subject to the limitations applicable to the imposition of taxes," even if they are "couched as 'regulatory.'" *See* Proposition 26, Section 1(e) (Findings and Declarations of Purpose). The proposed amendments effectively impose an in-kind exaction on refiners and importers, requiring them to establish CFO outlets. By imposing that mandate, the ARB is establishing a new program of hydrogen fuel outlets--accomplished by requiring in-kind exactions. While circuitous, the CFO mandate is nonetheless subject to the requirement of a two-thirds vote of the Legislature. *See Dolan v. City of Tigard*, 512 U.S. 374, 386, 114 S. Ct. 2309, 2317, 129 L. Ed. 2d 304 (1994) (holding that forced dedication of easement was a non-monetary exaction).

Moreover, the Due Process Clauses of the U.S. Constitution and the California Constitution limit the authority of the ARB and other agencies to impose penalties. *Hale v. Morgan*, 22 Cal.3d 388, 398-399 (1978). The California Supreme Court has held that oppressive or unreasonable penalty schemes may be invalidated as violating due process. *Id.* "Uniformly," the California Supreme Court has "looked with disfavor on ever-mounting penalties and ha[s] narrowly construed statutes which either require or permit them." *Id.* at 401.

Yet, here, the ARB's proposed amendments specifically provide that each day that a refiner/importer violates the CFO regulation at a clean fuel outlet is a separate violation subject to a penalty under sections 43027 and 43028 of the Health and Safety Code. And, the ARB staff report notes that under those sections a willful violation could result in a penalty of $250,000 per station per day, and a negligent violation could result in a penalty of $50,000 per station per day. That is precisely the type of “ever-mounting penalties” that the California Supreme Court has disapproved in *Hale v. Morgan.*

<u>ARB Failed to Properly Comply with CEQA.</u>

As ARB recognizes, the California Environmental Quality Act (CEQA)[2] requires a study of environmental impacts before adopting regulations such as the proposed amendments to the Clean Fuels Outlet (CFO) regulation. It is well-settled that, even when an agency adopts a rule to protect or improve the environment, any adverse side-effects must be evaluated under CEQA.[3] ARB has adopted its own procedures for CEQA compliance under its certified regulatory program, but still must satisfy the fundamentals of the statute. Thus, ARB must identify potentially significant impacts, consider mitigation measures and a reasonable range of alternatives to avoid or reduce such impacts, and consider and respond to comments from the 1
public and other agencies. Finally, ARB must adopt mitigation measures or alternatives unless they are infeasible and overriding benefits justify adopting the regulation despite its significant and unavoidable impacts.[4]

To comply with CEQA, ARB’s Initial Statement of Reasons (ISOR) for the CFO amendments includes Appendix B, a draft Environmental Analysis (EA) prepared as the functional equivalent of an Environmental Impact Report. The air quality evaluation in the EA is supported by ISOR Appendix D, an Emission Impact Analysis (EIA). However, the EA and EIA are seriously flawed and cannot be relied on to satisfy ARB’s CEQA obligations.[5]

Failure to Fully Disclose Programmatic Impacts. Throughout the EA, ARB finds that local authorities will conduct future project-level CEQA review when approving and issuing permits for individual hydrogen fueling station projects. Through project-level review, the local agencies will be responsible for implementing ARB’s recommended mitigation measures and others that they may identify and incorporate in permit conditions. While expecting that local authorities will do so, ARB cannot be certain that mitigation which is beyond its control will be implemented successfully. Accordingly, the EA finds such impacts to be potentially “significant and unavoidable”, though justified by the benefits of the CFO rule. Although in general this “programmatic” or “tiered” approach is authorized for CEQA review at the rulemaking stage, the 2
EA takes the tiered approach too far.

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[2] Pub. Res. Code § 21000 *et seq*.

[3] *Save the Plastic Bag Coalition v. City of Manhattan Beach*, 52 Cal. 4th 155 (2011); *County Sanitation District No. 2 of Los Angeles County v. County of Kern*, 127 Cal. App. 4th 1544 (2005).

[4] Pub. Res. Code § 21081, 14 Cal. Code Regs. (CEQA Guidelines) § 15093.

[5] In addition to the legal issues raised in this portion of WSPA’s comments, the technical flaws in Appendices B and D, as described in other sections of our comments, further undercut ARB’s reliance on these analyses for CEQA purposes. All technical and other comments on Appendices B and D, elsewhere in WSPA’s comments, are incorporated by reference herein and should be considered as part of our CEQA comments.

Even impacts that are significant and unavoidable at the programmatic stage must be fully disclosed, to provide a meaningful opportunity for the public to comment and to propose further feasible mitigation measures. Such issues also must be fully disclosed to enable informed decision-making, a central objective of CEQA. The ARB Board is responsible for considering and balancing benefits and adverse side-effects in deciding whether to adopt the CFO amendments. For each significant and unavoidable impact, ARB must find "overriding considerations", i.e., that specific benefits outweigh each adverse side-effect. But overriding considerations cannot be legally or factually supportable if the decision-makers have insufficient information to understand the extent of the side-effects they are deciding to accept. Weighing benefits and impacts is impossible when the impact side of the balance is insufficiently disclosed. In short, programmatic "significant and unavoidable" determinations are not a shield for the casual narrative evaluations and conclusions throughout the EA. 2 cont'd

Over-Reliance on Future Project-Level CEQA Review. Moreover, in following the programmatic approach, the EA relies heavily on project-level CEQA review that supposedly will be conducted by local agencies undertaking or permitting individual hydrogen fueling facility projects. However, it is quite likely that many local agencies will conduct no CEQA review at all. On an individual basis – especially if ARB is correct in assuming that most new hydrogen fueling station projects will be located at existing gas stations – many of these small projects will be exempt from CEQA, under the categorical exemption for minor alterations to existing facilities[6] or other exemptions. Yet ISOR Table IV-2b (p. 50) projects that over 450 new stations will be required under the CFO rule. Of course, capturing impacts that are insignificant for each project considered separately, but significant when nearly five hundred projects are considered together, is the purpose of cumulative impacts analysis under CEQA.

The EA does acknowledge impacts to be addressed by local agencies as significant and unavoidable:

> Because the authority to determine project-level impacts and require project-level mitigation lies with the land use and/or permitting agency for individual projects, and programmatic analysis does not allow project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts. Consequently, this EA takes the conservative approach in its post-mitigation significance conclusions (i.e., tending to overstate impacts) and, for CEQA compliance purposes, discloses that potentially significant impacts related to the development of fueling stations and new or modified manufacturing facilities may be significant and unavoidable. 3

ISOR App. B, p. 8. Nevertheless, the EA reassures the public and decision-makers that:

> ARB expects, however, that as the proposed ACC Program is carried out, these significant impacts can and should be resolved and reduced to insignificance by other

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[6] CEQA Guidelines § 15301; see, e.g., Attachment A, Notice of Exemption for University of California, Irvine, North Campus hydrogen fueling station expansion ; and Attachment B, Notice of Exemption for Alameda County Transit District (AC Transit) Hydrogen Energy Station, May 25, 2011. The AC Transit Notice, p. 2, indicates that a prior hydrogen fueling project in 2004 was also found to be exempt from CEQA.

> government agencies, in accordance with their authorities and project review procedures."

Id. This reassurance is hollow, however, since the EA does *not* disclose to the public and decision-makers the extent to which local agencies can be expected to rely on categorical exemptions and not consider CEQA mitigation in the first place. Thus, rather than being conservative, the EA hides the true magnitude of anticipated significant and unavoidable impacts. If unmitigated through project-level review due to CEQA exemptions, the adverse impacts will be greater than the EA admits.[7] This error also further undercuts the basis for overriding considerations, since the adverse impacts side of the balance is understated by assuming more project-level mitigation than can reasonably be expected. 3 cont'd

Failure to Consider Available Information on Foreseeable Project-Level Impacts. Even at the programmatic or first-tier level, CEQA requires evaluation of all issues that are ripe for review, where feasible and where information is available. Yet, while claiming that extensive analysis must be deferred to the project level, the EA ignores CEQA documents for hydrogen fueling projects that are already in place. Although some existing hydrogen facilities were approved based on CEQA exemptions, CEQA review documents do exist for other projects. Such documents provide concrete, readily available information on matters as to which the EA merely speculates.

For example, the City of Burbank prepared a Mitigated Negative Declaration for its Hydrogen Fueling Station Project, attached.[8] It is true that some impact analyses in Burbank's Negative Declaration are based on project-specific details (e.g., visual impacts of the facility's profile in the specific setting) not appropriate for evaluation at the programmatic stage. Nevertheless, some impact analyses in the Negative Declaration provide valuable information on issues inherent to hydrogen fueling facilities – in particular, on the hazards of hydrogen itself (see comment on hazards below). Other impacts likely to be common to hydrogen facilities wherever they are located include air emissions, noise, public services (including fire protection), and transportation and traffic, from both facility construction and operation.[9]

It is also true that the City of Burbank, after full analysis and disclosure, found that all potential impacts could be mitigated to less than significant – but only for that individual project. Findings of insignificance are by no means assured when scaling up the impacts identified in the Burbank Negative Declaration to over 450 new hydrogen stations anticipated as a result of the CFO amendments. Yet the EA could have analyzed reasonably foreseeable means of 4

[7] For example, the EA (pp. 141-142) states: "All projects, no matter their size or type would be required to seek local land use approvals prior to their implementation. Part of the land use entitlement process requires that each of these projects undergo environmental review consistent with California environmental review requirements (e.g., CEQA) and other applicable local requirements (e.g., local air district rules and regulations). This environmental review process would assess whether project implementation would result in short-term construction air quality impacts." This is simply not true of "each of these projects" if a substantial number can reasonably be expected to be categorical exempt, while air district rules would not reach the range of impacts addressed by CEQA.

[8] Attachment C, Burbank Hydrogen Fueling Station Project, Initial Study/Negative Declaration/Environmental Assessment (August 2008).

[9] See Attachment C, Burbank Hydrogen Fueling Station Negative Declaration, pp. 2-12 – 17, 2-36 – 44.

compliance by considering available information from CEQA documents for existing hydrogen fueling facilities. It was ARB's responsibility to identify and consider such available information, but not one such project-level CEQA document is cited in the EA references. 4 cont'd

Failure to Analyze CFO, ZEV and LEV III Actions As Separate "Projects." Three separate regulatory actions are before ARB: amendments to the CFO regulations and also to the Zero Emission Vehicle (ZEV) and Low Emission Vehicle (LEVI III) regulations. These three actions are collectively referred to as the Advanced Clean Cars (ACC) Program. They are also collectively analyzed in the EA for environmental impacts, as though they were a single "project" for purposes of CEQA. See EA, p. 35. However, the EA's characterization of the single "project" is inconsistent with ARB's Notice of Public Hearing to Consider Amendments to the Clean Fuels Outlet Regulation (Nov. 29, 2011), which does not propose a single ACC project. Instead, the proposed regulatory action in the Notice is a stand-alone action on the CFO amendments. The Notice, p. 3, merely notes in passing that the CFO project is "part of the Advanced Clean Cars regulatory proposals" – note that "proposals" is plural – that are to be heard on the same day. Similarly, ARB's website at http://www.arb.ca.gov/regact/2012/cfo2012/cfo2012.htm lists the CFO amendments as a stand-alone proposed regulatory action, and the January 26-27, 2012 meeting agenda lists three separate, albeit consecutive, public hearings rather than one hearing covering three subjects; see http://www.arb.ca.gov/board/ma/2012/ma012612.htm. 5

Certainly, it was appropriate for the EA to consider the cumulative impacts of the three separate CFO, ZEV and LEV III projects. Cumulative impact analysis is the correct means of evaluating the effects of past, present and reasonably foreseeable future projects that overlap in time and may combine to exacerbate their respective impacts. However, nothing in the Notice or the EA states that ARB will *only* adopt the CFO amendments if it also simultaneously adopts the ZEV and LEV III changes. Nor does the EA inform the public and decision-makers of the potential environmental consequences should ARB choose to separately adopt the CFO amendments. Accordingly, the EA does not provide a basis for action on the CEQA "project" that is actually proposed.

Lack of Clarity on Numbers of New Hydrogen Fueling Stations. A CEQA document must contain a clear, stable and complete project description, in order to provide the essential basis for review of the project's impacts. The EA project description, pp. 33-35, describes the CFO regulation changes themselves but does not describe the reasonably foreseeable means of compliance; i.e., the numbers and locations of new hydrogen fueling stations. Not until pp. 131-133 of the EA is the "compliance response" discussed. Even here, an example for the South Coast is provided, followed by a statement that "Starting in 2016 in the Upper Bound [i.e., fast entry of fuel cell vehicles into the California market] Scenario, the number of vehicles statewide would exceed the 20,000 statewide trigger requiring the construction of 39 additional stations." But that figure is for a single year, without stating the total effect of the rule provided. The reader must hunt for that information in the ISOR, Table IV-2 on p.50. 6

However, even there it is not even clear exactly how many new hydrogen fueling stations ARB attributes to the CFO amendments. ISOR Table IV-2b, p. 50, includes a column for Total Stations and a column for Total New Stations Installed Per CFO under the fast-entry Upper

Bound FCV Scenario. In the Total New Stations column, 31 stations are indicated prior to the rule and 488 stations by 2024, the difference representing 457 new stations attributable to the rule. However, the sum of the Total New Stations Installed Per CFO, adding the numbers for each year from 2015 to 2024, is 461. This discrepancy is not explained in the document. 6 cont'd

The total number of new fueling stations is one of the main drivers of the magnitude of CEQA impacts. The failure to clearly disclose the total number of stations within the EA does not comport with CEQA's informational purposes.

Unsupported Assumptions Regarding Locations of New Hydrogen Fueling Stations. The other main driver of the magnitude of impacts is the location of the fueling stations. The EA downplays location-based impacts, assuming that "new individual hydrogen fueling facilities would be constructed at existing public retail gasoline service stations that are already managed by the retail branches of the respective refiners/importers of gasoline. These locations would also likely be in urban areas where they are positioned to serve the most drivers. Thus, it is unlikely that new hydrogen fuel outlets would be located at greenfield sites (land not previously developed), and that they would be built in locations consistent with local zoning."[10] EA, p. 133. Nothing in the proposed CFO amendments requires this result and the EA cites no evidence to support these assumptions.[11] Instead, since the existing CFO regulations would have directly required gas station owners and operators to locate facilities on their property, ARB simply assumes that the same thing will occur despite shifting the obligation to refiners and importers. This unsupported speculation is the critical basis for conclusions of limited impacts throughout the EA.[12]

In fact, there is reason to doubt the EA's assumptions. Even today, gas stations are the sites of only a small proportion of CFO facilities. The attached spreadsheet identifies 27 hydrogen fueling facilities which currently operate in California and another 15 that are planned.[13] Of the total of 42, only 12 are located in gas service stations. The other 30 are not, including facilities operated by transit agencies, municipalities (for city vehicles) and universities, many not open to the general public.[14] 7

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[10] Presumably the word "consistent" is a typographical error and the EA intended to state that it was unlikely that new outlets would be in locations inconsistent with local zoning.

[11] As the California Fuel Cell Partnership has noted: "Not all of the hydrogen stations need to be traditional retail fueling sites. Some may be built at grocery or big box stores. Fueling dispensers may also be co-located at other hydrogen sites such as with transit stations, forklift fueling or with renewable power generation." California Fuel Cell Partnership, *Hydrogen Fuel Cell Vehicle and Station Deployment Plan: A Strategy for Meeting the Challenge Ahead* (February 2009), pp. 14-15.

[12] As discussed above, even where the EA concludes that an impact is significant and unavoidable, it cannot unreasonably downplay the impact's magnitude and thereby tilt the balance in favor of overriding considerations. Accordingly, even for impacts that are significant and unavoidable (because outside ARB's regulatory control at the project level), the assumption of location on existing service station sites (tending to reduce impacts compared to new sites) must be supported by evidence. In other words, the significant and unavoidable findings do not shield the EA where it relies on unsupported assumptions.

[13] Attachment D, Hydrogen Fueling in California.

[14] This spreadsheet was developed from information from the following sources: California Fuel Cell Partnership, http://cafcp.org/stationmap; US Department of Energy list of Hydrogen Fueling Stations in California, http://www.afdc.energy.gov/afdc/progs/ind_state.php/CA/HY; "Program Overview - Hydrogen Fueling Infrastructure" presentation by Larry Watkins to the Clean Fuels Winter Advisory Group Winter Retreat

Moreover, just as ARB does not control the behavior of local governments, the refiners and importers do not control the behavior of station owner/operators. The overwhelming majority of service stations in California are now owned by independent operators who only have a supply contract with a refiner or distributor. There are few remaining lessee dealers who lease service stations owned by refiners. Except in those few cases, a refiner has no ability to require station owner/operators to install equipment to dispense hydrogen. The expense would likely be considerable, both to pay for the equipment and to induce station owner/operator to cooperate and surrender its property for a new line of business without a track record of profitability.[15] Moreover, refiners and importers will be reluctant to install costly equipment at locations where they have no control but may be subject to liability in the event of accidents. Accordingly, refiners may be more likely to contract with other parties, such as the existing providers who are already in the hydrogen business and with whom refiners already have business relationships, to establish new outlets specializing in hydrogen. At this point, that prospect too may be speculative, but it appears to make economic sense. But those new outlets are unlikely to be sited at existing retail service stations. At the least, ARB has provided no justification for assuming that the development of outlets in new locations will *not* occur. 7 cont'd

In sum, the facts suggest that it is reasonable to expect a significant number of CFO facilities may be located outside existing retail service stations, contrary to the assumption in the EA. As a result, there is no substantial evidence to support the EA's conclusions that are predicated on the restriction of CFO facilities to existing stations, in order to avoid impacts in new locations.

Improper Use of "Hypothetical Future Conditions" Baseline. ARB assumes that the existing conditions or "baseline" for purposes of determining impacts of the CFO amendments (as well as the ZEV and LEV III provisions addressed in the EA and EIA) consists of:

> existing vehicle and related fuel emissions programs, policies, and regulations. The existing regulatory condition includes the existing LEV regulation (LEV II), including the GHG requirements that are part of LEV II (known as the Pavley regulations), the EPL regulation, and the existing ZEV regulation, as well as other relevant, previous California rulemakings, such as the LCFS and all comparable federal regulations. . . . In the context of regulatory programs, impacts on the physical environment are the result of compliance responses to regulations. Compliance responses to the existing LEV II, ZEV, and CFO regulations are already in place and underway. The environmental effects of proposed amendments to regulations that reduce CAP and/or GHG emissions from light- 8

(February 2, 2011), http://www.aqmd.gov/tao/ConferencesWorkshops/Retreats/2-2011_Watkins.pdf; Berkeley Transportation Letter, "Filling the Tank with Hydrogen" (Winter 2011), http://its.berkeley.edu/btl/2011/winter/hydrogen; Los Angeles Times, "Torrance Shell station adds hydrogen fuel pump" (May 11, 2011), http://latimesblogs.latimes.com/greenspace/2011/05/hydrogen-torrance.html; and review of Google Maps for the locations identified in these sources.

[15] Elsewhere in these comments, WSPA provides an analysis questioning the economic analysis in ISOR Appendix E, which appears to underestimate capital costs, interest rates and hydrogen costs, and overestimate station utilization rates. Applying more realistic assumptions, ARB's projected $150 to $531 million in cumulative economic benefit becomes an estimated $210 to $775 million cumulative loss.

> and medium-duty vehicles would build upon the compliance responses to these existing regulations.

ISOR Appendix B, pp. 24-26. On the contrary, the CEQA baseline consists only of the physical environmental conditions that actually exist.[16] Hypothetical conditions that do not physically exist are not properly included in the CEQA baseline, no matter how reasonable the expectation that those conditions will come to pass.[17] Similarly, anticipated future conditions that will exist on completion of plans, rules and compliance responses cited by the EA cannot be included in the baseline here.[18] Instead, impacts of the CFO amendments must be determined by comparison to the physical environment that now exists. By improperly including regulatory developments which are still in progress in the baseline, the EA obscures the actual impacts required to be disclosed under CEQA, by understating changes compared to conditions that exist today. 8 cont'd

Failure to Correctly Analyze Air Emissions. Even if ARB were justified in considering the future conditions resulting from compliance with the pre-amendment regulatory regime as the CEQA "baseline", it failed to correctly implement this approach. The Emissions Impact Analysis, ISOR Appendix D, compares scenarios of fast and slow fuel cell vehicle (FCV) deployment to gasoline vehicles only. However, compliance with the existing regulatory regime, including existing ZEV regulations, should result in the deployment of battery electric vehicles (BEVs) instead. Accordingly, the CFO amendments, fostering the development of the FCV market by ensuring the availability of hydrogen fuel, would be expected to result in the replacement of BEVs with FCVs. Therefore, the EIA should have focused on the differences in air emissions between BEVs and FCVs, the emissions associated with the generation and distribution of electricity and hydrogen, and any secondary issues associated with the use of conventional vehicles for long-distance travel by owners of both BEVs (which require frequent battery charging) and FCVs (which require proximity to hydrogen fueling stations). In particular, utilizing the EA's claimed baseline, the EIA should have compared hydrogen production to electricity generation emissions, rather than to those of gasoline production.[19] 9

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[16] CEQA Guidelines § 15125(a); *Communities for a Better Environment v. South Coast Air Quality Management District*, 48 Cal.4th 310 (2010).

[17] See, e.g., *Sunnyvale West Neighborhood Assn. v. City of Sunnyvale*, 190 Cal.App.4th 1351 (2010) (baseline for traffic congestion relief project was the existing environment, not projected traffic conditions based on expected growth under adopted plans).

[18] CEQA Guidelines § 15125(a) defines the environmental setting as a "description of the physical environmental conditions in the vicinity of the project at the time the notice of preparation is published, or if no notice of preparation is published, at the time the environmental analysis is commenced, from both a local and a regional perspective. This environmental setting will normally constitute the baseline physical conditions by which a Lead Agency determines whether an impact is significant." Courts have interpreted the word "normally" to allow some latitude; e.g., if the environmental analysis commenced during a flood or drought, an average of *past* conditions over time may be preferred to an instantaneous but unrepresentative "snapshot." However, as explained in *City of Sunnyvale*, hypothetical conditions based on *future* expectations cannot be included in the CEQA baseline

[19] Moreover, even if the CFO amendments led to displacement of gasoline rather than electricity production, there is no basis for the EIA's assumption that emissions associated with gasoline production in California would decline. Refiners are more likely to continue producing gasoline (and emissions) and ship the product outside the state, than to forego production and reduce emissions.

These comparisons not only affect the claim of overriding benefits to justify significant and unavoidable impacts, but also have implications for the analysis of adverse impacts. Hydrogen generation, whether at central facilities or at fueling stations, generally can be expected to occur in developed areas, which are more likely to be in non-attainment of ambient air quality standards. By contrast, electricity in California is often generated outside urban and developed areas and in some cases outside the state. Emission increases associated with hydrogen thus may be more likely to cause significant air quality impacts. 9 cont'd

Failure to Analyze and Disclose Air Quality and GHG Impacts from Construction of New Hydrogen Fueling Stations. The EA air quality section, p. 142, states: "Based on typical emission rates and default parameters for above mentioned equipment and activities, construction activities could result in hundreds of pounds of daily NOx and PM, which may exceed general mass emissions limits depending on the exact location of generation." The short-term construction impact (which is not so "short term" when considering construction of over 450 fueling stations) is considered potentially significant, and mitigation is left to the local permitting authorities during project-level CEQA review. However, the EA does not say what those casual references to "typical emission rates" and "default parameters" may mean, nor explain the "general mass emissions limits" which may apply. Neither the EA nor the EIA (ISOR Appendix D, the emissions impact technical analysis) provides any quantitative estimates of air pollutant emissions beyond the vague acknowledgment of "hundreds of pounds of daily NOx and PM."[20] Readers are given no information to understand or comment on whatever basis ARB may have for that order-of-magnitude figure. Moreover, other construction air quality impacts (e.g., toxic air contaminants) are not even described with order-of-magnitude estimates, and neither the EA nor the EIA even mentions greenhouse gas (GHG) emissions from fueling station construction. 10

As discussed above, the programmatic nature of the EA and the anticipated future project-level review (at least, for those projects not found exempt from CEQA) are not a shield from CEQA's disclosure obligations. Determining the readily identifiable magnitude of emission impacts was not properly left as an exercise for the reader.

Failure to Evaluate Construction and Operation Impacts of New Hydrogen Generating Capacity. The EA (pp. 134-145) acknowledges that compliance with the CFO requirements would require an increase of up to 9.2% in the state's currently projected supply of merchant hydrogen. The EA also notes that increased hydrogen purity may be required for merchant hydrogen to be suitable for use as fuel for FCVs. Accordingly, the EA explains: "For delivered gaseous hydrogen, modifications of the central plants may be necessary to further purify the hydrogen so that it meets the purity standards required for fuel cell vehicles" and goes on to rely on other agencies for mitigation as it does elsewhere, noting that "the construction work associated with these plant modifications would have to satisfy State and local requirements for permitting, hazardous materials, and other resource areas, which are typically handled by local agencies" (EA, p. 135). 11

[20] The EA and EIA could easily have provided reasonable quantitative estimates and an explanation for their basis, scaled up for approximately 450 stations from the individual project level; see, e.g., Attachment C, Burbank Hydrogen Fueling Station Negative Declaration, p. 2-13.

However, the EA fails to indicate what percentage of currently available or forecast merchant hydrogen complies with existing specifications for hydrogen as an alternative vehicle fuel. More important, it does not provide any justification for assuming adding up to 9.2% of higher purity hydrogen to the existing supply can be accomplished merely be "modifications" to existing hydrogen generating plants. In fact, in every reference to impacts associated with meeting hydrogen demand, the EA is careful to assert that the demand will be met with "modifications" of existing plants. See, e.g., EA pp. 139, 141, 148, 151, 152, 155, 158, 161-163, 167-169, 171 (each asserting that "New hydrogen fueling stations could also be constructed and operated along with modifications to existing hydrogen production plants").

By assuming only modifications to existing facilities, the EA can avoid any impacts from construction and operation of new hydrogen generating capacity, which can be substantial. New merchant scale hydrogen plants are major industrial facilities whose construction and operation, like that of other industrial plants, can have significant environmental impacts requiring evaluation under CEQA. (Among other things, hydrogen generation itself produces GHG emissions, which must be mitigated or offset.) However, the EA provides no basis for the assumption. In fact, it seems unreasonable that so great an increase in supply can be accomplished without new facilities. Moreover, as the EA also notes, pursuant to SB 1505, once statewide demand for hydrogen as a transportation fuel reaches certain levels, state law requires that 33.3 percent of this hydrogen be made from renewable resources. There is no estimate of the amount of hydrogen available from existing sources that meets both this requirement and vehicle fuel specifications. Yet under these circumstances, it seems inevitable that there will be more than a modification of existing facilities. 11 cont'd

Just as the EA's unrealistic assumption that all fueling facilities will be located on existing retail service stations serves to understate impacts from new facilities, so does the assumption that only modifications of existing generating capacity are needed. However, given the far larger footprint and environmental effects of new hydrogen generating capacity, the omission has greater consequences for the inadequacy of the EA.

Failure to Analyze Hydrogen Hazards. The EA, p. 158, summarily dismisses impacts related to hazardous materials transport and use, asserting that "New hydrogen fueling stations [and] . . . modifications to existing hydrogen production plants. . . . would likely occur within existing footprints or in areas with consistent zoning." As discussed above, there is reason to doubt these speculative and unsupported assumptions. The EA (pp. 158-159) goes on to address explosion risk from electric vehicle batteries (for the ZEV portion of the ACC initiative) but, remarkably, omits any mention of explosion risk from hydrogen transport and use. Still more remarkably, the only risk of spills the EA discusses is minor diesel spills from fueling construction equipment. No potential impacts (not even insignificant impacts) are recognized for hydrogen transport to fueling stations and operations at stations. No mitigation measures are provided for hydrogen hazards, not even recommended measures to be implemented by local authorities in project-level CEQA review for permitting or approvals. 12

The failure to discuss hazards or the impacts of hazard mitigation strategies in relation to hydrogen transport and refueling facility operation is a significant omission in the EA. The California Energy Commission (CEC) evaluated potential failure modes and the effects of those failures at hydrogen refueling stations, which include failure modes associated with hydrogen delivery vehicles and on-site generation.[21] The U.S. Department of Energy developed an on-line tool for hydrogen hazard and risk analysis.[22] As indicated in these references, the outcomes of many potential failure modes are explosion and fire. Some of the analyzed scenarios have low or moderate frequency but, if they do occur, would have severe consequences." Both of these references also address potential mitigation measures that are not addressed at all in the EA which might address hazards but could create other potential environmental impacts not to mention impact refueling facility design, throughput, cost, and other important factors.

The CEC report (p. 6-3) concludes that: 12 cont'd

> hydrogen is relatively leak prone, particularly considering the fact that it is usually stored at high pressures, flammable mixtures are easily ignited, and it is difficult to detect. These characteristics may make hydrogen less safe than other fuels in some accident scenarios. While hydrogen's industrial-use safety record is good, this application does not include all vehicle fuel and lay person issues. Fortunately, safety research is underway and codes and standards are being developed to address hydrogen vehicle fuel applications.

However, neither the Existing Conditions section (pp. 79-83) nor the Hazards and Hazardous Materials section (pp. 158-160) of the EA describes any such codes and standards, either as part of the regulatory setting or as a source of mitigation measures.[23] Moreover, as recognized in the CEC's allusion to "lay person issues", customers at hydrogen fueling stations cannot be expected to observe safety procedures as rigorously as trained personnel.

Failure to Consider Fire Protection/Public Service Impacts. As in the Hazards and Hazardous Materials section, the EA's Public Services section contains no discussion of hydrogen risks. Given that the impacts of failure modes at hydrogen refueling facilities are frequently fire, explosion, or both, the EA's conclusion (p. 168) of a less than significant impact on fire protection public services is untenable.

As shown in the ISOR, Table I-1 (p. 10), there are only ten public hydrogen refueling stations currently open in California. The largest of those ten stations has a capacity of 100 kg/day of hydrogen. Given the lack of existing stations, most fire departments would not be expected to be familiar with nor trained to deal with emergencies at hydrogen refueling stations. These departments could be faced with the need to purchase new equipment, engage in additional training or add additional fire fighters. Moreover, ARB assumes that hydrogen stations attributable to the CFO amendments will be designed for throughputs of 400 kg/day, or four 13

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[21] Attachment E, California Energy Commission, *Failure Modes and Effects Analysis for Hydrogen Fueling Options* (November 2004).

[22] http://www.hydrogen.energy.gov/permitting/risk_analysis.cfm

[23] The Negative Declaration for the Burbank hydrogen fueling station examined hydrogen hazards and safety and accident prevention procedures for facility design and operation. Attachment C, pp. 2-26 – 30. Operational risks including accidental spills from delivery vehicles, hydrogen leaks, breaks in hydrogen lines and fires were examined. After thorough analysis, the Negative Declaration found the impact less than significant, for that individual project. Again, the EA should have provided such analysis for over 450 stations, rather than remaining entirely silent on the subject of hydrogen risk.

times the capacity of the largest existing station. Even fire departments that are familiar with and trained to deal with emergencies at existing hydrogen stations will be faced with much larger potential fires and explosions at facilities with larger volumes of stored hydrogen and/or the increased number of hydrogen delivery vehicle trips. Finally, the increase in hydrogen transport vehicles on the state's roadway network would introduce increased risks, necessitating training and, potentially, new equipment for fire departments in locations that do not have fueling stations, as well as those that do. 13 cont'd

If the EA were to follow its usual pattern, relying on the authority of local agencies to address increased demands on local fire protection service, then the impact should be found significant and unavoidable, not less than significant. At the least, the impact must be acknowledged and recommended mitigation measures provided.[24] The EA should also recognize that agencies responsible for disaster response (e.g., in the event of earthquake), as well as local fire departments, likely would be affected by the risks associated with over 450 new hydrogen outlets and the delivery trucks necessary to service them.

Failure to Analyze Population and Housing and Related Impacts. Typical impacts in several areas – e.g., population and housing, land use, recreation, utilities, public services in addition to fire protection, and growth-inducing impacts – relate to the numbers of workers involved in construction and operation of hydrogen facilities. The EA makes broad, unsupported assertions that worker numbers will be low and impacts related to worker numbers accordingly insignificant (see, e.g., EA p. 168). Again, the reader has no basis to know how well-founded such assertions are and it was ARB's responsibility to provide support for public review and comment. 14

Failure to Consider a Reasonable Range of Feasible Alternatives. Alternatives analysis is a central aspect of the CEQA review process. A lead agency must consider and evaluate a range of potentially feasible alternatives that will foster informed decision-making and public participation. To accomplish this, the CEQA document must develop and evaluate a range of reasonable alternatives that would feasibly attain most of the basic objectives of the project, but "would avoid or substantially lessen any of the significant effects of the project."[25] However, with respect to the CFO amendments, the EA fails to meet even the "reasonable range" standard.

Other than the statutorily required no project alternative, the sole alternative to the CFO amendments considered is the Memorandum of Agreement (MOA) with major gasoline refiners and importers to carry out the exactly same objectives provided in the CFO amendments.[26] 15

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[24] Moreover, ARB should consider mitigation measures at the state level to address this issue, rather than leaving it entirely to local fire departments and other local responders. For example, the California Fuel Cell Partnership suggested that resources should be provided "to the state fire marshal to integrate hydrogen training into the state fire curriculum", as one of the key "education outreach needs" for hydrogen fueling. The Fuel Cell Partnership also recommended educational efforts aimed at "emergency responders, building and code officials, and state and federal elected officials as well as the general public in communities that have or will have hydrogen stations." California Fuel Cell Partnership, *Hydrogen Fuel Cell Vehicle and Station Deployment Plan: A Strategy for Meeting the Challenge Ahead* (2009), pp. 26-27.

[25] CEQA Guidelines § 15126.6(a).

[26] The EA also considers alternatives involving more and less stringent LEV and ZEV standards than those proposed, but these are not alternatives to the proposed CFO amendments.

Accordingly, the EA concludes (pp. 195-196) that its impacts would be the same or less than those of the proposed project, since potentially "varying levels of commitment" by MOA participants could lead to fewer hydrogen fueling stations being constructed.

WSPA strongly disagrees with the implication that MOA participants would breach the agreement. ARB has no grounds to impugn the intent of MOA participants to fully comply with requirements to which they have committed. Moreover, intent aside, compliance would not be optional. As the EA (p. 195) states, the "MOA would have the binding power of a contract and be legally enforceable."

The unsupported presumption of inadequate MOA compliance also has an important consequence for the CEQA review of alternatives. The MOA alternative is designed to and can be expected to achieve the same results as the CFO amendments. Accordingly, the EA fails to consider *any* CFO alternative that is designed to "avoid or substantially lessen any of the significant effects of the project" as required by CEQA. Not every feasible alternative that an agency (or a commenter) can conceive of need be considered. Nevertheless, ARB is obligated to revise the EA to contain, and must then fully and fairly consider, some other alternatives that reasonably can be expected to accomplish actual reductions in significant impacts.

While it is ARB's obligation to develop a reasonable range of alternatives that can avoid or less impacts, at least two potential alternatives appear feasible.

First, as discussed above, the EA analysis assumes that hydrogen fueling facilities will be constructed at existing gasoline service stations. However, ARB could accomplish the same objective, promoting the availability of hydrogen fuel and so encouraging the manufacturing and purchase of FCVs, without assuming that hydrogen fueling will only occur at public fueling stations. Deployment of FCVs could also create a market for in-home hydrogen fueling. In-home fueling for natural gas vehicles already exists.[27] Hydrogen fueling could be accomplished through exchange of canisters, such as is already being tested on light electric vehicles with fuel cells (such as scooters) in Taiwan.[28] FCV fueling by this method could occur at some public fueling stations, but canisters also could be purchased at retail outlets and installed at home. Under this alternative, far fewer than the 450 public hydrogen dispensing facilities assumed by the EA would be necessary, and associated impacts would be reduced.

15 cont'd

Second, refiners and importers could be provided the option of meeting CFO obligations through hydrogen dispensing or electric vehicle charging facilities. Electricity is also a clean fuel that could satisfy CFO requirements. The regulatory language in proposed 13 Cal. Code Regs. section 2300(a)(2) defines "clean alternative fuel" as "any fuel used as the certification fuel in a zero-emission vehicle" which includes both electricity and hydrogen.[29] Since this alternative

[27] *See* Honda Home Energy Station at http://automobiles.honda.com/fcx-clarity/home-energy-station.aspx. *Also see* "Convenient Home Refueling Appliances Now Available for Natural Gas Vehicles" at: http://www.honda.com/newsandviews/article.aspx?id=200707092524.

[28] See http://www.hydrogencarsnow.com/blog2/index.php/hydrogen-fueling-stations/first-hydrogen-canister-exchange-station-set-up-in-taiwan/.

[29] Proposed 13 Cal. Code Regs. section 2300(a)(5) defines "designated clean fuel" – that is, fuels subject to the CFO requirements – as any clean alternative fuel, except that "Designated clean fuel does not include electricity unless

would have the effect of promoting a mixed fleet of FCVs and BEVs, the CEQA evaluation would include consideration of impacts associated with BEV batteries. Nevertheless, BEVs are a more mature technology with which consumers are more familiar than FCVs. At the least, hazard impacts and firefighting public service impacts associated with the use of explosive hydrogen fuel could be reduced. In particular, hydrogen handling by "lay persons" as opposed to trained personnel was recognized as an issue by the CEC (see above). Accordingly, this alternative merits consideration by ARB in a revised EA. 15 cont'd

Revision and Recirculation of the EA. Correcting the deficiencies discussed above require extensive revisions to the EA. Substantial changes (including the addition of feasible new alternatives that clearly would lessen significant impacts) must be made available for public review and comment.[30] Accordingly, the EA should be revised and recirculated for additional public comment before ARB takes action on the proposed CFO amendments. 16

<u>Comments on Initial Statement of Reasons (ISOR)</u>

Listed below, WSPA has several concerns with the ISOR for the CFO regulatory amendments. Specifically, there are many technical, policy and legal concerns WSPA has relative to what ARB is using as the basis and assumptions to justify the regulation.

I (B)(1)(e) <u>Hydrogen Vehicle Deployment Plans</u>
In Table 1-2 of the ISOR, ARB staff presents data that are purported to be the results of a 2010 CARB/CEC survey of automakers to ascertain their plans regarding FCV placement in California over the period from 2012 to 2017. According to ARB, the manufacturer responses were predicated on the assumptions that:

1. Adequate hydrogen fueling infrastructure will indeed be in place in the communities ahead of vehicle deployments; and
2. Customers will lease or buy these vehicles.

With these assumptions in place, ARB reports that very few FCVs will be in place prior to the 2015-2017 period, but that manufacturers expect a rapid increase in FCV deployment during that period. These survey results are used as not only the basis for the FCV projections of the "Upper Bound" scenario but also to justify the need for modifications to the CFO regulation to be made now rather than waiting until later to see if FCV demand and the need for hydrogen refueling facilities really materialize.

What ARB staff does not report in the ISOR is that auto manufacturers were asked to characterize their FCV projections with one of three levels of confidence. The survey instructions in this regard were as follows:

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the Board concludes, based on the analysis conducted pursuant to section 2302(c), that public charging infrastructure for electric vehicles should be incorporated into this regulation." The alternative proposed here would require ARB to so determine.

[30] CEQA Guidelines § 15088.5.

Please fill in the green shaded areas for all time periods to represent the confidence level regarding the locations of these reported FCEVs, using the descriptions below.

10% - interest in area/deployment discussions
50% - concept plan
90% - delivery plan

The actual survey results for 2015 to 2017 indicated California statewide placement of 57,490 FCVs. However, only 6,130 (10.6% of the total) were designated with the 90% confidence level, while 11,830 (20.6% of the total) and 39,530 (68.8% of the total) were designated with the 50% and 10% confidence levels, respectively.

The fact that almost 70% of the FCVs projected for 2015 to 2017 were at the 10% confidence level and that almost 90% were at the 50% or lower level, even after manufacturers thought there would be both customer interest and refueling infrastructure, seems to dramatically highlight the continuing level of uncertainly regarding the commercial viability of FCVs. It also suggests that actual FCV placement levels prior to 2017 will be much lower than those associated with the Upper Bound scenario which in turn has significant ramifications regarding both the need for the CFO regulation as well as the reasonableness of the associated Emission Impact and Environmental Analyses.

II (A)(9) – Tools for Evaluating Proposed Outlet Locations
ARB references various models such as the STREET model, developed by U.C. Irvine that may be used to identify potential CFO location placement in various regions of interest. While such models may be helpful, WSPA is concerned that these often cannot simulate actual market conditions. Additionally, such models cannot take into consideration other factors like retailer interest, community acceptance, land and space availability, and agency permitting requirements including compliance costs. To date, there is no real-world evidence or peer review that supports the accuracy and appropriateness of the use of this academic tool as proposed.

WSPA recommends ARB update this section to clarify that the final siting decision for the clean fuel outlets shall be made by the regulated party, regardless of any modeling tools or other sources of information and data used by either ARB or any local, state or federal regulatory agency.

II (A)(10) – Extending the Timeline for Compliance
The compliance timeline should include more checks/balances and "look backs" to validate that additional stations are needed. Please see comments under Regulation Section 2304.

II (A)(11) – Compliance Requirements
While WSPA understands that some manufacturers are pursuing 5,000 psi and others are pursuing 10,000 psi fueling pressure levels, to our knowledge there has been no industry consensus developed or agreed to by the automobile manufacturers on the appropriate fueling pressure for hydrogen fuel cell vehicles. In that regard, rather than require all clean fuel outlets to be equipped with both 5,000 and 10,000 psi pressure dispensers, an analysis should be conducted that would assess the number of FCVs that are equipped with different pressures and

an assessment of the number of stations needed to provide the appropriate pressure dispenser levels.

An alternative approach would be for ARB to require industry to standardize the pressure at a single level. If done now, well ahead of construction of the vehicles and the fueling sites – it would greatly simplify fueling and fueling availability for this fuel. It will certainly cut down on customer frustration if they pull into a site only to find the pressure does not match their vehicle.

WSPA recommends that as part of its annual survey, ARB should request the number of vehicles and deployment geographies, separately, for vehicles at each fueling pressure. ARB should also drive the industry to establish a fueling pressure standard for FCVs. Further, the regulated parties should only be required to install the fueling pressure identified in the industry-wide standard for the vehicles projected to be deployed within a given geography.

II (A)(12) – **Violations**
WSPA does not support the proposed level of violations that could be assessed to the regulated party (up to $250,000/day), while the penalty that could be assessed to an auto manufacturer would not exceed $35,000, which is clearly not equitable given the regulated parties compliance obligations are based on auto manufacturer FCV projections. Since the auto manufacturers' annual projections trigger the CFO regulation and subject the regulated parties to substantial investment on fueling infrastructure in advance of actual vehicle deployment, to have regulatory compliance parity, the penalties assessed to the auto manufacturers should be commensurate with those assessed to the regulated parties for noncompliance.

WSPA recommends ARB reduce the penalties for violations imposed on major producers or importers of gasoline to a level commensurate with the penalties imposed on automotive manufacturers. Alternatively, auto manufacturer penalties ($35,000) should be increased to be commensurate with fueling infrastructure penalties because auto manufacturer projections trigger significant investment by infrastructure providers.

II (A)(13) – **Breakdown of Dispensing Equipment-Release from Liability**
WSPA is very concerned with ARB's proposal to reduce the time for equipment repairs from 6 months to 1 month. Any new technology, particularly in regards to dispensing and operating equipment associated with hydrogen, as well as a limited vendor base, most likely will result in delays associated with repairs and replacements of such equipment and technology. Given hydrogen fueling station technology is not yet mature; the vendor base is limited; a robust, skilled workforce capable of performing repairs does not yet exist; and some of the equipment providers are not based in the U.S., these factors could all result in lead times for repair work that could easily exceed one month.

WSPA recommends ARB retain the six month allowable repair timeline.

II (A)(14) – **Sunset Provisions**
While ARB's proposal to reduce the sunset provisions from 10% to 5% is a step in the right direction, nonetheless a 5% sunset provision is higher than the number needed to "bridge the gap" to commercialization. In fact, according to the California Fuel Cell Partnership's Action

Plan, it identifies 50-100 hydrogen stations are needed for early commercialization (see Attachment F).

WSPA recommends ARB reduce the sunset provisions to 50-100 hydrogen stations.

IV (A)(2)(a) – **Capital Costs**
In its economic analysis, ARB provided capital cost ranges. However, in its calculations, ARB used the lower end of those ranges when determining the economic impacts of the regulation. WSPA believes these capital cost estimates are unrealistic since a 400 kg/day hydrogen station has not yet been installed or operated in the field. The capital cost of a 400 kg/day hydrogen station with compressed gas deliveries is estimated by ARB at $1.5MM in the early years, $1.4MM in the later years and $1.8MM for liquid deliveries. These estimates have not been substantiated nor demonstrated in the field. Further they conflict with previous hydrogen station estimates as presented by ARB staff during the July 13 workshop and recent CEC AB118 awards of $2.3MM for compressed gas and $2.7MM for liquid deliveries.

The need for the CEC to provide cost share for hydrogen fueling projects up to 75% in its AB 118 awards illustrates that the economic barriers to this technology are very significant.[31]

The U.S. Department of Energy launched its Hydrogen Analysis (H2A) initiative in February 2003 to utilize industry-wide expertise in the development of a standardized approach and set of assumptions for estimating the lifecycle costs of hydrogen and the cost of hydrogen fuel.[32] Based upon publicly available data from the AB 118 grant awards (i.e. capital costs and station size) and utilizing the DOE H2A tool with standard assumptions, the cost per gallon equivalent of hydrogen is estimated to exceed $28/kg (H2A inputs and assumptions are provided in Attachment G). Mandating such a high-cost transportation fuel will likely have significant adverse economic impacts on those who participate in that market.

WSPA recommends modifying the capital cost estimates to align with the July 13 workshop amounts of $2.3MM for compressed gas and $2.7MM for liquid deliveries since it is the most current data representing the actual capital costs for hydrogen fueling stations.

IV (A)(2)(b) – **Delivered H2 Cost**

The delivered hydrogen cost appears to be extremely low ($2.70 - $2.85/kg). The reference for the delivered hydrogen cost of $2.70 for liquid hydrogen and $2.85 for compressed gas, that ARB cites is: "US DOE, 2011b. United States Department of Energy. Satyapal, Sunita. US DOE Fuel Cell Technologies Program. "Overview of Hydrogen and Fuel Cells." March 3, 2011. This reference is inaccurate.

The title of the slides containing this reference is "Infrastructure (Station with Liquid Truck Delivery) — Progress: Cost" and "Infrastructure (Station with Tube Trailer Delivery) — Progress: Cost." In reviewing the detail on these slides, it is apparent that the $2.85 and $2.70 estimates are not the delivered hydrogen cost at all. They are the cost of the infrastructure associated with the delivery of hydrogen assessed on a per kilogram basis. Using compressed gas as an example, the $2.85 includes compression, storage, terminal fees, cooling, tube trailer

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[31] http://www.energy.ca.gov/contracts/PON-09-608_Revised_NOPA.pdf

[32] http://www.hydrogen.energy.gov/h2a_analysis.html#h2a_project

and other station costs - not the cost of hydrogen molecules as ARB has indicated in its economic analysis.

Further, the reference notes that the costs are for "high-volume" hydrogen stations. DOE defines "high-volume" as hydrogen stations capable of dispensing 1,000 kg/day. Scaling these costs down to a station size of 400 kg/day is not appropriate as they will not realize the benefits of economy of scale that were assumed for the "high-volume" scenario.

WSPA recommends modifying the cost of hydrogen in the economic assessment. ARB could consider the estimates from the MOA or an alternative reference.

Operating Cost

Additionally, ARB has not provided a transparent dataset that offers estimated operating costs for hydrogen fueling stations. These costs include: actual costs for hydrogen (the molecule), delivery of hydrogen from the production facility to the station, and the cost to operate and maintain the equipment at the station capable of compressing, storing and dispensing the hydrogen, repairs, maintenance, replacement and decommissioning.

Integrating hydrogen into an existing retail gasoline station is not without technical and logistical challenges. Analysis is needed to fully understand how such challenges can be addressed and the impacts that the hydrogen equipment will have on the existing retail business. Further, as we commented in our November 4, 2011 letter, the Collaborative Workgroup identified an estimated negative cash flow of $175,000 or more per year for at least 4 years, or possibly longer. In fact, the operator may never realize a profit.

Thus, it is clear that early hydrogen station operators would be faced with operating a business that does not make economic sense and a business case cannot be made without recognizing the need for financial support.

WSPA recommends making the operating cost data available for review by the regulated parties. The reference ARB provided is UCD, 2011, University of California, Davis. Ogden, Joan et al. UCD Institute of Transportation Studies. "Analysis of a "Cluster" Strategy for Introducing Hydrogen Fuel Cell Vehicles and Infrastructure in Southern California." Sept. 16, 2011. Revised Oct. 5, 2011. This version could not be found in the public domain. WSPA requests ARB provide a copy so that WSPA can review and provide additional comments as necessary.

SB 1505 Premium

ARB has assessed a $0.70/kg additional cost for the SB 1505 requirements. There is significant competition for renewable energy in the marketplace due to requirements in the Renewable Portfolio Standard. Has ARB conducted an analysis to confirm that the renewable energy required for compliance with SB 1505 will be available? Further, in its worst case scenario, why is ARB using biogas as the renewable energy source? Solar electrolysis is currently the high-cost hydrogen production pathway, so the worst case analysis should include the highest cost technology.

WSPA recommends performing a more thorough analysis of: (1) the availability of renewable energy that could be utilized in the production of hydrogen; and (2) the impact of competition for renewable energy on cost. Additionally, WSPA recommends ARB consider a true worst case scenario that includes the high cost alternative for producing hydrogen – solar electrolysis.

IV (A)(3) – **Station Utilization and Payback Assumptions**
WSPA does not agree with ARB's position that hydrogen stations will operate at 100% utilization. Utilization rates are typically <100% to ensure that fuel is available when customers need it – even for gasoline stations. Hydrogen fueling stations new technology, so equipment downtime should be expected and planned for. It will also be difficult to predict when customers actually need fuel.

WSPA recommends ARB modify the economic analysis with a utilization rate of 70% to account for demand spikes and equipment downtime.

IV (B)(5) – **Summary of Economic Analysis Results**
ARB estimates that a retailer will be able to recover costs and begin making a profit within 3 years. As mentioned in Section IV (A)(2)(b) – Delivered H2 Cost, WSPA stated in our November 4, 2011 letter, the Collaborative Workgroup identified an estimated negative cash flow of $175,000 or more per year for at least 4 years, or possibly longer, and in fact the operator may never recognize a profit.

Interest Rate for Commercial Loans
ARB does not provide a reference for using a 6% interest rate on business loans. Interest rates for commercial/business loans are typically higher, especially for unproven technology in a new market.

WSPA recommends ARB provide information to support a 6% interest rate. In the absence of such information, WSPA recommends ARB update the economic analysis with a more reasonable number based upon actual commercial interest rates.

Comments on Appendix A: Proposed Regulation Order

§2300 - Definitions
(14) Importer – Definition should be consistent with the CaRFG3 regulation and/or LCFS regulation.

§2302(b)(1) – Retail Outlet Requirements
The requirement to provide "upon request" fueling capability for both 5,000 and 10,000 psi vehicle storage tanks is problematic. See II (A)(11) comments above.

§2302(c)
The regulatory package indicates ARB will conduct an analysis on the feasibility and need for EV charging and EV charging may be added to the CFO regulation following the conclusion of the analysis. WSPA feels strongly that there is no need to include provisions for a study in this regulation and that sufficient electric vehicle recharging infrastructure efforts are well under way in the state. Further, it is WSPA's position that the same legal concerns associated with

mandating hydrogen fueling infrastructure exist with electric charging infrastructure. It is apparent that ARB believes the regulation can be modified to accommodate different fuels, so the agency could again opt for pursuit of modifications to the CFO to include electric charging infrastructure when the need is imminent.

WSPA strongly recommends the EV charging study be excluded from the proposed regulatory amendments and ARB conduct a study outside of the regulation to determine if any further EV charging infrastructure will be needed and, if so, options for achieving the funding requirements in consultation with utilities and other involved stakeholders.

§2303(b)

There appears to be a problem with the reference cited in 2303(b) for the reporting of FCV sales projections. Specifically, reference is made to "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles" as incorporated by reference in Title 13, California Code of Regulations, section 1961. This reference only requires reporting of model-year TLEVs, LEVs, ULEVs, and SULEVs not certified exclusively on gasoline or diesel.

WSPA recommends revising the reference as appropriate, presumably such that it aligns with that used in §2303(a).

§2303(b)(2)

In the ISOR, ARB extrapolates vehicle projection data. In the regulation, it is unclear if the methodology for triggering the CFO will be similar.

WSPA recommends all survey data be made publicly available, especially to the regulated entities. Additionally, ARB has indicated that it is collecting and analyzing data to determine whether auto manufacturers are on track to manufacture FCVs within a given timeframe. Such information should also be made publicly available to ensure the regulated parties have full knowledge and information given they are required to expend capital to comply with the requirements of the regulation.

Additionally, WSPA recommends in the regulatory language, that ARB should explicitly state that the trigger can only be calculated by the summation of actual responses received. Projections should only include actual, auditable responses from each individual auto manufacturer. Extrapolation of data (as referenced in the ISOR) should not be allowed. If an auto manufacturer does not respond or project vehicles, their response shall be recorded as zero and also be made part of the public record.

§2303.5(a)(1)

ARB has added a regional trigger of 10,000 vehicles in an air basin, where CFOs would then be required to be installed.

WSPA recommends ARB remove the regional trigger of 10,000 within the boundaries of an air basin. Alternatively, the regulation should explicitly state that if ARB does not remove the regional trigger of 10,000, then CFOs will only be required within that region.

§ 2304(a)(1)
ARB's calculation for the number of CFOs required, are based upon 146,000 kg/yr. It is unclear if ARB expects that compliance is based upon this minimum capacity.

WSPA recommends that regulated parties must have the flexibility to install station types and scale appropriately for each location. The calculation assumes 146,000 kg/year (400 kg/day), but this should not be a requirement. The flexibility to install smaller and/or larger stations should be allowed and determined by the regulated party.

§2304(a)(2)(C) – Determination of the Number of CFO's
It is unclear if the CFO can be redacted if projections fall below the 10,000 or 20,000 vehicle threshold. There is no robust look-back mechanism to validate that additional CFOs are needed.

WSPA recommends new sections (3 and 4) as shown in *red italicized* underlined language below.

(C) Reducing the number of required retail clean fuel outlets to reflect certain preexisting outlets *and based on the actual demand for the designated clean fuel.*

1. For each year, the Executive Officer shall determine for each designated clean fuel the number of retail clean fuel outlets that [i] are owned or leased by persons who are non refiner/importers of gasoline, [ii] have a design capacity as set forth in section 2302(b) where applicable, [iii] satisfy the provisions of section 2309 (b), and [iv] certify that they will operate throughout the compliance year for which the determination is being made.

2. For each year, the Executive Officer shall reduce the total number of required clean fuel outlets required for each designated clean fuel, as determined pursuant to sections 2304(a)(1), and (a)(2)(B) by the number of retail clean fuel outlets determined in accordance with section 2304(a)(2)(C)1. The Executive Officer shall notify the refiner/importer responsible for each retail clean fuel outlet included in the determinations made pursuant to this section 2304(a)(2), and no such outlet may be constructively allocated pursuant to section 2308.

3. *At the end of each year, the Executive Officer shall conduct a needs assessment to validate the total number of clean fuel outlets required for each designated clean fuel before increasing the number of required clean fuel outlets for the next year. The needs assessment shall include analysis of the vehicle manufacturers' projections pursuant to section 2303(b)(2), the number of vehicles deployed in the State of California compared with the vehicle manufacturers' projections, and the available supply of versus demand for the designated clean fuel. Based upon the findings in*

the needs assessment, the Executive Officer shall reduce the number of clean fuel outlets required if:

a. *The vehicle manufacturers' projections pursuant to section 2303(b)(2) exceed the actual number of vehicles deployed in the State of California for that year, resulting in an excess supply of the designated clean fuel as projected by the TPMV calculations set forth in section 2303(c).*

b. *The state-wide fueling capacity of the designated clean fuel exceeds the state-wide demand for that designated clean fuel by greater than 20%*

4. *In the event that the vehicle manufacturers' projections pursuant to section 2303(b)(2) decline below the trigger level requirement during the twelve months prior to the start of the year described in section 2303.5, the Executive Officer shall delay the requirement to install clean fuel outlets until the trigger level requirement is again reached. The Executive Officer shall notify the parties of this delay within 4 months of receipt of the vehicle manufacturers' projections.*

§Section 2308 – Constructive Allocation of Retail Clean Fuel Outlets
Section 2308(a) seems to disallow constructive allocation of a retail clean fuel outlet if the outlet is also a retail gasoline outlet.

WSPA recommends ARB strike the words "which is not a retail gasoline outlet" in line 2. We believe that dual purpose or multi-purpose fuelling facilities may be more attractive to owners, operators and customers and should be allowed.

§2309(b)(2)
ARB requires that the regulated party, "store a commercially reasonable quantity of the designated clean fuel at the outlet." This requirement is technology limiting and favors hydrogen deliveries over onsite production.

WSPA recommends ARB consider modifying the requirement to "make a commercially reasonable quantity of the designated clean fuel at the outlet available", as opposed to requiring a minimum amount of hydrogen to be stored on site.

§2309(d)(2)
ARB's provisions for reporting operational details of clean fuel outlets at facilities not owned by the regulated party are problematic. WSPA does not support the regulated parties being responsible for reporting operational requirements, such as the manner of how fuel will be supplied at outlets that our members do not own and operate.

WSPA recommends modifying or excluding the detailed operational reporting requirements for outlets that are not owned and operated by the regulated parties from this section.

§2311(a)(1)- Breakdowns

WSPA does not support the limited time to provide notification in the event of CFO equipment malfunction. In terms of a "major breakdown," for example, the requirement to notify the Executive Officer within 4 hours is burdensome and onerous. As stated in section §2309(d)(2), WSPA does not support regulated parties being held accountable for operational requirements, which includes requirements to report breakdowns at outlets that they do not own and operate.

WSPA recommends deleting the definition of "minor breakdown" and removing all requirements regarding "minor breakdowns". In terms of a major breakdown we recommend a notification period of 72 hours. We also support the original regulatory language that allows for a repair time of six months.

§2312 - Reporting
WSPA recommends this section be deleted. Since the regulation is being changed to regulate producers and importers, the requested information is unnecessary.

§ 2315(d) – Violations of Section 2303 (b)(2)
As stated above in the ISOR section, we believe false vehicle projection penalties should be equivalent to the CFO non-compliance penalties. If an auto manufacturer decides not to deploy the number of vehicles it already projected at the last minute due to lack of consumer interest/sales, the manufacturer would likely take the ARB penalty of $35,000 over a choice of continuing to build cars for which a market does not exist. However, the regulated party to the CFO regulation will have already invested substantial capital to comply with the regulatory requirements. An investment that would ultimately be a stranded liability with sunk costs. Given this potential realistic scenario, it is critical that the penalty to auto manufacturers be comparable for both the CFO regulated parties and the auto manufacturers. Further, it ensures that OEM projections are accurate, particularly during the second year of the three year survey analysis.

WSPA recommends the false vehicle projection data penalty be equivalent to the CFO non-compliance penalties. It is currently significantly lower. Additionally, the vehicle projection data penalty is slated to remain with the government. ARB should utilize the vehicle projection data penalty revenues to reimburse the CFO regulated parties for stranded investment as a result of inaccurate OEM projections.

Comments on Appendix B: Environmental Analysis

Environmental Analysis Related to Hazards, Hazardous Materials, and Public Services

WSPA recommends ARB staff review the deficiencies and issues identified below and augment/correct them in the final regulatory documents. 17

As part of the ARB's Environmental Analysis for the Advanced Clean Cars Program (Appendix B to the Initial Statement of Reasons (ISOR) for the 2012 Proposed Amendments to the Clean Fuel Outlet (CFO) Regulation), the potential impacts of the CFO regulation on Hazards, Hazardous Materials, and Public Services are analyzed along with means to mitigate potentially significant impacts.

Beginning with Hazards and Hazardous Materials ARB analyzed three issues. These are:

1. Routine Transport, Use, or Disposal of Hazardous Materials

2. Upset and Accident Conditions, and

3. Hazardous Emissions, Materials, or Substances Near Schools, Hazardous Material Site, Airport Land Use Plan, Private Airstrip, Emergency Response Plan or Emergency Evacuation Plan, and Wildland Fires.

With respect to Public Services ARB analyzed only the following issue:

4. Response Time for Fire Protection, Police Protection, Schools, Parks, and Other Facilities.

With respect to issues 1 and 4, ARB concluded that impacts would be less than significant.

With respect to issue 2, ARB identified only the potential of fuel spillage associated with the refueling of construction equipment as a potentially significant impact but went on to indicate that "…*this impact could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB."* No description of what the "mitigation" to which ARB refers is provided. What is clear is that impact has nothing to do with the delivery of hydrogen to refueling stations or the operation of those stations.

17 cont'd

With respect to issue 3, ARB indicates that "*impacts…may be significant and unavoidable"*.

It appears that ARB ignored germane factors that should have been included in the Environmental Analysis for issues 1, 2 and 4 that could have also lead to findings of significant impacts and unavoidable impacts. These factors are related to the potential failure modes and the effects of those failures at hydrogen refueling stations which include failure modes associated with hydrogen delivery vehicles and on-site generation. These factors have been studied extensively and documented, for example, in a report prepared for the California Energy Commission[33] and in an on-line tool for hazard and risk analysis available from the U.S. Department of Energy.[34] As indicate in these references, the outcome of many potential failure modes are "explosion and fire". This seems to directly contradict ARB's conclusion that risks with respect to issues 1 and 2 are not significant and do not require mitigation.

Given that the impacts of failure modes at hydrogen refueling facilities are frequently fire, explosion, or fire and explosion, it is difficult to understand how ARB arrived at the conclusion that there would not be significant impacts with regard to fire protection services which are

[33] Failure Modes and Effects Analysis for Hydrogen Fueling Options, California Energy Commission, CEC-600-2005-001, November 2004.

[34] The tool is available at http://www.hydrogen.energy.gov/permitting/risk_analysis.cfm

included in issue 4. As described below, it is clear that there will be significant impacts on fire protection services which will require either mitigation or which will have to be deemed to be significant and unavoidable.

As shown in Table I-1 of the CFO ISOR (page 10), there are only ten public hydrogen refueling stations currently open in California and of those ten stations, the highest capacity is 100 kg/day of hydrogen. This is important for at least two reasons. The first is that given the lack of existing stations, most fire departments would not be expected to be familiar with, nor trained, to deal with emergencies at hydrogen refueling stations. These departments could be faced with the need to purchase new equipment, engage in additional training or perhaps add more fire fighters. A similar issue could be raised by the introduction of hydrogen transport vehicles operating in their jurisdictions which could raise new threats necessitating new equipment and/or training.

The second reason is that ARB assumes that hydrogen stations created by the CFO will be designed for throughputs of 400 kg/day or four times the capacity of the largest existing station. Given this, even fire departments that are familiar with and trained to deal with emergencies at existing hydrogen stations will be faced with much larger potential fires and explosions owing to the larger volumes of stored hydrogen and/or the increased number of hydrogen delivery vehicle trips created by the operation of the station.

Another potential factor that could impact public services that was not identified or analyzed by ARB is the impact of hydrogen refueling stations on disaster response requirements. Given that their numbers are currently very small, the increases required under the CFO regulation could affect public agencies responsible for earthquake response requirements as well as responses required for prolonged outages of electric service potentially resulting from high wind events and other types of disasters. 17 cont'd

Returning to issue 3, where ARB did indicate that potentially significant and unavoidable impacts could exist, one way to mitigate the risk associated with a hydrogen refueling station could be for the local lead agencies (which ARB states will be responsible for approving construction of those stations) to simply reject applications for station construction submitted by refiners subject to the CFO regulation precluding their ability to comply with the CFO regulation.

As review of the CEC and DOE references cited above quickly indicates, there are different potential failure modes and hence risks associated with different hydrogen refueling station designs. Given this, another potential mitigation measure would be to dictate station design. Given that ARB's economic model presented in Appendix E to the CFO ISOR indicates significant differences in the cost of station construction as a function of their design, these local lead agency actions could have significant impacts on the costs of compliance with the CFO regulation that CARB staff has failed to take into account.

<u>CFO Environmental Analysis Related to Hydrogen Production</u>

<u>WSPA recommends ARB staff review the deficiencies and issues identified below and augment/correct them in the final regulatory documents.</u>

As part of ARB's Environmental Analysis for the Advanced Clean Cars Program (Appendix B to the Initial Statement of Reasons (ISOR) for the 2012 Proposed Amendments to the Clean Fuel Outlet (CFO) Regulation), the compliance response of increased hydrogen generation for fuel for fuel cell vehicles (FCVs) is recognized and discussed. The impacts associated with the compliance response are analyzed with respect to air quality but not with respect to greenhouse gas (GHG) emissions.

With respect to air quality, ARB concludes that compliance with CEQA would ensure that all impacts associated with the construction and operation of hydrogen production facilities are mitigated to a *"…less-than-significant level"*. However, it appears as discussed below that ARB ignored a number of factors in analyzing the air quality and GHG impacts associated with the required increase in hydrogen production for compliance with the CFO regulation.

ARB's discussion of hydrogen production is embedded on pages 134 and 135 of the EA. ARB notes that compliance with the CFO requirements would require increases in the supply of up to 9.2% in the state's currently projected supply of merchant hydrogen. The EA also notes that increased hydrogen purity may also be required for merchant hydrogen to be suitable for use as fuel for FCVs. However, ARB does not indicate what percentage of currently available or forecast merchant hydrogen complies with the agency's existing specifications for hydrogen used an alternative motor vehicle fuel[35] or what the environmental impacts associated with changes required at hydrogen production facilities to produce sufficiently pure hydrogen could be.

ARB also notes that pursuant to SB 1505, once statewide demand for hydrogen as a transportation fuel reaches certain levels, state law requires that 33.3 percent of this hydrogen be made from "eligible renewable resources as defined in subdivision (a) of section 399.12 of the Public Utilities Code." However, ARB provides no estimate of the current amount of hydrogen that is available that meets both this requirement as well as its motor vehicle fuel specifications and does not include any forecasted estimates. 17 cont'd

Finally, ARB assumes the required hydrogen will be available (and in its economic analysis, at prices equivalent to those associated with local production at centralized steam methane reforming facilities). However, no basis is provided for that assumption.

The first problem with the ARB analysis is the assumption that all potential air quality impacts will be mitigated to be non-significant as a result of the need for CEQA compliance, and the simultaneous assumption that all of the increase in hydrogen production capacity required for CFO compliance will occur in a timely fashion.

Looking first at central hydrogen production facilities producing local merchant hydrogen, ARB has provided no evidence that refiners either have direct control over these plants or that refiners can somehow compel the expansion of their capacity. Therefore, the decision with regard to whether or not to expand hydrogen production will likely be made based on economics by the

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[35] CARB's current hydrogen fuel composition regulation is found at §2292.7, Title 13, California Code of Regulations.

plant owner who will factor the costs of CEQA compliance into that analysis and may well conclude that expansion does not make economic sense, particularly in areas such as the South Coast Air Basin where necessary emissions offsets are difficult to obtain or expensive. If merchant hydrogen meeting ARB's hydrogen fuel specifications is in short supply, costs will likely rise and to the extent that supply is unable to satisfy FCV demand, FCV owners would have to turn to other modes of transportation, most likely conventional vehicles with the result being increases in emissions of both air pollutants as well as GHG emissions.

Similarly, existing merchant hydrogen plants are subject to the AB32 cap-and-trade regulation, which will likely require reductions in GHGs from those plants. Expansion of those plants would increase GHG emissions and force plant operators to purchase additional offsets. Again, this fact would be accounted for in the economic decision-making of hydrogen plant owners and tend to discourage decisions to increase capacity.

ARB also fails to identify the potential impacts of the need to increase hydrogen supply and the specific production methods used on hydrogen prices which in turn may have environmental impacts. As noted by the California Hydrogen Highway Network[36] (see Attachment H) and as CARB staff is aware, the cost of hydrogen produced by different methods varies dramatically, in this case ranging from $1.44 to more $7.00 per kilogram. As hydrogen fuel prices will be related to the marginal cost of the source of the last increment of hydrogen needed to satisfy demand, it is crucial that CARB identify the sources of supply it assumes will be added to satisfy the increased demand. The price of hydrogen will be critical to decisions made regarding supply increases and also to FCV purchase decisions made by consumers. 17 cont'd

In addition, because compliance with the ZEV regulation requires only that vehicle manufacturers deliver vehicles for sale in California and allows manufacturers to count FCVs sold in other states towards compliance with the ZEV regulation, the supply and price of hydrogen in California are going to be critical determinants in both the impacts of the ZEV regulation as well as the actual need for the CFO regulation.

<u>Appendix C: Status of Alternative Fuel Infrastructure for Non-ZEV Alternative Fuel Vehicles</u>
No comments.

<u>Comments on Appendix D: Emissions Impacts Analysis</u>

<u>WSPA recommends ARB staff review the deficiencies and issues identified below and augment/correct them in the final regulatory documents.</u>

ARB has incorrectly performed the analysis of fuel cell vehicles (FCVs) by comparing them only with gasoline vehicles. However, it would appear from a technical point of view that the correct baseline for assessment of the emission benefits of FCVs in general and the CFO regulations in

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[36] See presentation at http://www.arb.ca.gov/msprog/hydprod/SB_1505_workshop_feb2010.pdf

particular is with a scenario where battery electric vehicles (BEVs) are assumed to be produced instead of FCVs to comply with the "pure-ZEV" requirements of either the existing ZEV regulation or the modified ZEV regulation being proposed by ARB staff.

While this might not at first seem intuitive, the ZEV regulation requires vehicle manufacturers to produce and offer for sale a range of vehicles including ZEVs which as indicated in Table 1.1 of the ISOR for the ZEV regulation are either BEVs or FCVs. Manufacturers can elect to comply with the pure ZEV requirements using either BEVs or FCVs. Therefore, to the extent that ARB takes action to foster the development of one technology over the other – for example FCVs as is the case with the proposed modifications to the CFO regulations - then fewer BEVs will have to be produced and offered for sale.

Since the proposed modifications to the CFO regulations are intended to support the introduction of FCVs, one assumes that in the absence of the revised regulations manufacturers would be required to sell more BEVs instead. Therefore, the emissions impact analysis of the CFO regulation should focus only on the differences in emissions between BEVs and FCVs, the emissions associated with the generation and distribution of the "fuels" that power these vehicles, as well as any secondary issues associated with inability of both BEVs and FCVs to fully account for the travel demands of their owners who may be forced to used conventional vehicles for long distance travel or travel away from hydrogen refueling stations. ARB staff has failed to perform this analysis.

While any real EIA would have to include a complete comparison of emissions impacts for BEV and FCV compliance under the ZEV mandate that includes not only emissions associated with fuel production, but also emissions associated with fuel transportation and the need to use conventional vehicles for some portion of travel given the range and refueling infrastructure limitations that will affect BEVs and FCVs regardless of the CFO, it is easy to show that there will be differential impacts. The following table shows the CI values contained in the most recently modified version of ARB's LCFS "Lookup Table" for electricity and hydrogen production along with those same values divided by the energy efficiency ratios (EERs) of 3.4 and 2.5 that apply to BEVs and FCVs, respectively. As shown, in almost all cases the values for the carbon intensity divided by the EER associated with hydrogen and therefore FCV operation is higher indicating that ARB regulations like the CFO regulation that promote FCVs relative to BEVs are likely to have adverse impacts on CO_2 emissions which need to be identified and quantified in the EIA and considered under CEQA.

Fuel	Source	CI gCO2 eq/MJ	CI/EER
ELEC	California average electricity mix	124.10	36.50
ELEC	California marginal electricity mix of natural gas and renewable energy sources	104.71	30.80
H2	Compressed H2 from central reforming of NG (includes liquefaction and re-gasification steps)	142.20	56.88
H2	Liquid H2 from central reforming of NG	133.00	53.20

H2	Compressed H2 from central reforming of NG (no liquefaction and re-gasification steps)	98.80	39.52
H2	Compressed H2 from on-site reforming of NG	98.30	39.32
H2	Compressed H2 from on-site reforming with renewable feedstocks	76.10	30.44

The EIA does not contain any estimate of emissions associated with the construction of hydrogen refueling facilities required under the modified CFO regulations. Although this deficiency should be noted, it is unlikely that these construction emissions will be substantial.

Different scenarios are evaluated in the EIA with respect to criteria pollutant and GHG emission impacts. Again, this finding is correct and should be noted as a deficiency in the EIA which should use the same scenarios throughout the analysis. However, the impact of this deficiency is not likely to be substantial.

In addition, there are a number of additional issues that should be raised with respect to the EIA. The first issue deals with the analysis of criteria pollutant impacts associated with hydrogen production presented on pages D18 to D23 of the EIA.

The first problem with this analysis is that ARB staff claims on page D-18 that is was performed "using GREET". While California has created a version of GREET for use in estimating life-cycle greenhouse gas emissions associated with different fuel pathways that is incorporated into the LCFS regulation, this model is not used to develop emission inventories of criteria pollutants for use in the development of State Implementation Plans (SIPs) and the reasons for its use here, instead of the official methods for inventory development, are not explained.

Further, the GREET-based numbers in Table D-6 do not track in any way the numbers from the South Coast Inventory shown in Table D-7. For example, the ratio of NOx to VOC for gasoline in Table D-6 is about 2 while it is less than 1 for petroleum refining in Table D-7. Similarly, the ratios of NOx to VOC for all four hydrogen production processes shown in Table D-6 are all greater than 1 while the ratio for Industrial chemical processes in Table D-7 is less than 0.01 or more than 100 times different than the GREET-based ratios shown in Table D-6. Notwithstanding the other issues identified with the so called "analysis" of criteria pollutants, impacts must be based on ARB approved emission inventory procedures, must be performed specifically for gasoline and hydrogen production occurring in California, and must be documented such that the public can properly comment on it (e.g. understand and reproduce the reported values).

The second problem is that hydrogen production is compared to gasoline production rather than properly compared to electricity generation. Issues associated with the proper comparison of criteria pollutant emissions associated with hydrogen production versus electricity generation include where the emissions occur. With hydrogen generation those emissions are likely to occur in the urban areas where FCVs are operated and where non-attainment with ambient air quality standards is likely. As a result, increases in emissions associated with increased hydrogen production may exacerbate air quality problems. In contrast, electrical generation in California often takes place away from urban areas and in some cases outside the state of California. In this case, increases in electrical generation may not have any impact on air quality within any California non-attainment area. Again, the EIA must both recognize and address these issues.

Further, even if FCV use was displacing the use of gasoline rather than electricity, there is no basis to assume that emissions associated with gasoline production in California would decline. In order for that to happen refiners would have to either reduce throughput at California refineries (which may or may not reduce criteria pollutant emissions) or shut down refineries. It is unlikely that changes in local gasoline consumption are likely to cause refiners to operate their refineries differently as they would still have the option of producing gasoline in California but shipping it elsewhere for consumption – without any change in refinery emissions.

Similarly, even a refinery shutdown would not necessarily reduce emissions because those emissions are subject to local stationary source regulations and the shutdowns would generate emission reduction credits (ERCs) which could be used to offset emissions from new sources that could not otherwise be constructed in the area where the refineries were located. Again, the failure of the EIA to even raise this issue highlights the fact that it is fatally flawed and cannot be relied upon by the Board in making a decision to adopt the proposed modifications to the CFO regulation.

<u>The third issue</u> is the relation between the so called travel provisions of proposed section 1962.2(d)(5) (E) Title 13 California Code of Regulations (CCR) which allow FCVs sold in some states other than California to be counted towards compliance with the requirements of the ZEV mandate and the hydrogen-fueled vehicle reporting requirements associated with the CFO regulations in Section 2303(b)(2) Title 13 (CCR). Under the travel provisions, vehicle manufacturers receive credit with respect to compliance with the both the California ZEV regulation for the sale through the 2017 model-year of most BEVs and all FCVs in states other than California that have adopted the California vehicle regulations as well as the ZEV regulation in place in the state where the vehicle was actually sold. For FCVs, but not BEVs, these provisions continue to apply without sunset from the 2018 model-year. In contrast, the CFO regulation requires manufacturers to report the number of FCVs they plan to offer for sale in specific air basins of California.

Based on the above, it is not clear that the FCV sales projections shown in Figure D-1 of the EIA represent estimates of FCVs in operation in California or nationwide. To the extent that the estimates reflect the nationwide sales of FCVs upon which compliance with the ZEV regulation would be evaluated, the California hydrogen demand estimates and all California specific corrections in the EIA are incorrect. ARB must include estimates of the fraction of FCVs that are expected to be sold in states other than California under the ZEV regulation and account for the fact that many FCVs required under the ZEV regulation may not even operate in California in the EIA.

In addition, the calculations shown in the EIA were reviewed. While the methodology used in the analysis and the basis for a number of the assumptions are not well documented, there were no substantial issues identified.

Lastly, ARB should have analyzed the potential emissions impacts from truck deliveries of hydrogen in the case where on-site generation of hydrogen is not used. Liquid H2 trucks carry approximately 4,000 kg and gaseous carry 400 kg. Assuming an 8000 gallon gasoline volume and an EER of 2.5, there are 25% less tanker trips to support a fleet of similar vehicles than with gasoline. But for gaseous, there would be 8 times as many tanker trips required. Also, one would expect H2 tanker travel distances to be longer as you cannot pipe it to distribution facilities like gasoline. Like construction emissions, we don't think truck emissions are a major emissions impact but the issue should have been considered in the emissions and CEQA analyses.

Comments on Appendix E: Economic Model

WSPA recommends ARB staff review the deficiencies and issues identified below and augment/correct them in the final regulatory documents.

WSPA does not support placing the cost of hydrogen refueling infrastructure or electrical chargers on refiners and importers. These costs should be borne by those electing to produce the vehicles or produce the alternative fuel (the car manufacturers, the hydrogen producers and the electricity providers). Forcing a party to engage in a business that is in direct competition with their primary product makes no sense from any standpoint. Forcing a party to fund infrastructure that will exist on property owned by another party is also unfair. This proposed regulation does not treat all parties equally and is clearly an anti-petroleum fuel measure that will raises with little or no benefit. There are still emissions when hydrogen is produced and electricity is generated - they just are not at the tailpipe.

The proposed regulation is not treating all parties equally. The potential penalty for vehicle manufacturer's providing high estimates of future production of hydrogen vehicles are significantly lower than the penalty for refiners not building enough clean fuel outlets, let alone the cost of funding the hydrogen dispensing equipment that is not needed. Clearly, the vehicle manufacturers should be the one providing the majority of the funds. After all, they are choosing to produce hydrogen vehicles, a vehicle that uses a fuel without a current distribution system or infrastructure. ARB's stated reason for changing the regulated party to major producer/importers of gasoline is because it "evenly spreads the requirement to build CFO's among the parties that continue to benefit financially from California's use of gasoline" is flawed as it is the refiners who will suffer economically as demand for their product declines due to this regulation. ARB is making the party that carry's the major brunt of the economic impact of declining gasoline demand fund the CFO's. The section of the ISOR on "Regulated Party" just identifies the ownership of retail outlets and production of gasoline. It provides no justification for making refiner/importers the regulated party.

This regulation will cost the retail service station owners lost sales, revenue and profit.

Retail gasoline stations have little or no spare land. Installing hydrogen refueling infrastructure will result in lost sales, revenue and profits. Gasoline stations have three busy times of the day, before work, lunch time and after work. During these times the fueling positions are normally fully occupied and the limited parking spaces are full.

a. If the hydrogen refueling equipment uses existing parking spaces then in-store sales will decline as people need to either be fueling their car or park their car in order to go into the store.
b. If the hydrogen dispenser replaces a gasoline dispenser then gasoline sales will decline and in-store sales will also as there will be less hydrogen customers then gasoline customers.
c. If the hydrogen dispenser is added to a fuel island, a car using it will prevent another car from using the gasoline pump next to the hydrogen dispenser. Thus gasoline sales will likely decline.
d. If the hydrogen refueling equipment displaces a car wash or other revenue generating asset, the sales from these assets would likely be eliminated completely.

The Initial Statement of Reasons (ISOR) for the 2012 Proposed Amendments to the Clean Fuel Outlet (CFO) Regulation), includes an economic analysis of the impacts associated with the regulation (pages 47 to 65). This analysis is generally based on an "economic model" for hydrogen refueling facilities that is presented in Appendix E of the ISOR. These documents are supplemented by two spreadsheets posted on the ARB website. [37] This memorandum documents the results of a critical review of the ARB economic analysis for the CFO regulation.

The CFO economic analysis begins with projections of fuel cell vehicle (FCV) populations operating in California during the period from 2014 to 2028 under two scenarios referred to as the "Upper Bound" and the "Lower Bound". These FCV populations are then used to estimate the number of hydrogen refueling outlets that would be required under the proposed CFO regulations from which the economic impacts are assessed using the "economic model".

The fuel cell vehicle populations for the Upper Bound case are described as being based on automaker projections of FCV that are expected to be sold in specific areas of California through 2017 and then assuming that manufacturers elect to comply with the requirements of ARB's Zero Emission Vehicle (ZEV) regulations using only FCVs. The Lower Bound population of FCVs is reported to represent ARB's "most likely compliance scenario" for the ZEV mandate. The numbers of FCVs estimated to be in operation in California under both scenarios are presented in Figure III-1 of the ISOR.

However, it should be noted that FCVs sold in states other than California that have adopted the California ZEV regulation pursuant to section 177 of the Clean Air Act also count towards compliance with the ZEV regulation in California. It is not clear how many FCVs ARB staff estimates will be sold in other states or how, if at all, those vehicles are accounted for in FCV population estimates presented in Figure III-1 and in the CFO economic analysis. It should be

[37] http://www.arb.ca.gov/msprog/clean_cars/clean_cars_ab1085/clean_cars_ab1085.htm

noted that vehicle manufacturers can elect to comply with the ZEV mandate using only battery electric vehicles (BEVs) without producing any FCVs.

Although the costs of FCVs are not a consideration in the economic analysis of the CFO, they will likely be a major factor in determining the number of FCVs that will actually operate in California. It should be noted that compliance with the ZEV regulation is based on the number of ZEVs "produced and delivered for sale in California" rather than the number of ZEVs actually sold. Therefore, manufacturers can comply with the ZEV mandate without the public having to purchase FCVs. ARB estimates of incremental costs for FCVs taken from Table 5-4 of the ZEV ISOR are presented in Table 1 for the 2016 and 2025 model-year for three different types of vehicles. On-board hydrogen storage capacities associated with cost estimates are also presented. As shown, ARB estimates for FCV costs in 2016 range from about $20,000 to $35,000 more than a conventional vehicle. By 2025, ARB assumes these incremental costs have dropped to about $7,500 to $13,500. These cost reductions are driven as explained in the ZEV ISOR mainly by assumed reductions in the cost of fuel cells expected as the result of high volume production.

Although the costs shown in Table 1 do not necessarily reflect the prices that vehicle manufacturers will charge for FCVs and do not reflect the impact of any purchase incentives, or tax credits that may be offered, it is clear that FCVs will be expensive and are likely to cost more than comparable conventional vehicles making which may make them less attractive to consumers. Given, it is not clear that FCVs will be sold in California in the volumes assumed by ARB staff in the time frames assumed by ARB staff.

Overall, given the fact that vehicle manufacturer compliance with the ZEV mandate doesn't depend directly on selling vehicles, manufacturers can get credit in California for FCVs offered for sale in certain other states, and the costs of FCVs, it is possible that actual in-use FCV populations may be substantially lower than those used in computing the number of hydrogen refueling facilities mandated under the CFO regulation. This may lead to lower station utilization rates than would reasonably be estimated which lead to greater economic impacts.

Table 1
ARB Estimates of FCV Incremental Costs Relative to Conventional 2016 Model-Year Vehicles (2009 $)

Vehicle Type/(H2 storage)	2016	2025
Subcompact Car (3.3 kg)	19,060	7,513
Midsize Car (3.8 kg)	23,472	9,334
Large Car (4.3 kg)	33,238	13,406

Turning now to ARB's "economic model" for hydrogen refueling facilities, the model is based on capital cost estimates for construction costs and annual fixed costs associated with operation and maintenance, cost of hydrogen either delivered to or produced at the facility, and station utilization rates. The estimates used by ARB staff are taken from studies prepared by U.C. Davis and the U.S. Department of Energy.

ARB's capital cost estimates are based on U.C. Davis studies and assume that stations are designed to supply 400 kg of hydrogen per day to FCVs. These estimates apply to three different types of station design and include higher "early years" and lower "later years" values which range from $1.4 to $3.8 million. These values are used with an ARB-assumed interest rate of 6% and an assumed seven year cost recovery period. No supporting bases for these assumptions are provided by ARB, and ARB provides no assumption regarding the lifetime or replacement costs associated with hydrogen station equipment. Others, including a U.C. Davis study,[38] (see Attachment I) have used different assumptions including much higher capital costs even in the early years under "low cost" scenarios, a 12% real discount rate and a 15 year equipment replacement lifecycle all of which call into question the reasonableness of ARB's assumptions and lead to higher costs than CARB has estimated for hydrogen refueling stations.

ARB's assumed fixed costs for operation and maintenance are $100,000 per year regardless of station type.

Turning to the cost of hydrogen supplied to stations, ARB staff assumes relatively low costs for delivered gaseous and liquid hydrogen from central hydrogen plants and staff also assumes produced costs for hydrogen from on-site reformation of natural gas will be even lower than these costs. In addition, ARB assumes that compliance with the requirements of SB 1505 (which specifies once statewide demand for hydrogen as a transportation fuel reaches certain levels, that 33.3 percent of this hydrogen be made from eligible renewable resources) will add only $0.70 per kg to the cost of hydrogen.

These ARB assumptions lead to hydrogen production costs of $1.45 to $3.00 per kg before the addition of the SB 1505 surcharge. The costs are not assumed to change over time except with respect to the addition of the SB 1505 surcharge in later years. However, the ARB assumptions appear to be at odds even with the estimates that are reported in the reference[39] (see Attachment J) that ARB cites as their source, which range from a low of about $3 per kg to as much as $10 per kg and suggest an average of about $5 per kg based on a 2009 study before accounting for the cost impacts of SB 1505. The impact of higher hydrogen costs is of course that higher hydrogen prices will have to be charged in order to recover capital and recurring fixed costs which in turn will make the cost of operating FCVs higher relative to vehicles operating on other fuels, and the ownership of FCVs less economically desirable.

The next factor to be considered is station utilization rates. These are important because they establish the annual volume of hydrogen dispensed at a refueling facility over which capital costs and fixed annual maintenance and operating costs can be recovered. ARB assumes a four year ramp up (25, 50, 75 100%) to 100% utilization for all hydrogen refueling stations installed during the early program years and a two year ramp up (75%, 100%) for all hydrogen stations in the later years. There is no basis provided by ARB to support the assumed utilization rates,

[38] Nicholas M., and Ogden, J., "An Analysis of Near-Term Hydrogen Vehicle Rollout Scenarios for Southern California", Final Draft January 29, 2010.

[39] Satyapal, S., "Overview of Hydrogen and Fuel Cells", March 22, 2011.

which are again higher than maximums of 70 to 80% referenced in the U.C. Davis studies [40] (see Attachment K). Again, use of more reasonable utilization rates will raise the price of hydrogen that has to be charged to recover capital and operating costs.

In summary, our review of the ARB economic analysis of hydrogen fueling facilities indicates that relative to other sources, ARB:

1. Underestimated capital costs;
2. Underestimated interest rates;
3. Underestimated hydrogen costs; and
4. Overestimated station utilization rates.

All of which lead to an underestimation of the economic impacts of the CFO regulation.

Based on the assumptions used by ARB regarding FCV populations and operation; the assumptions described above related to the economic analysis; and two assumed retail hydrogen pricing scenarios the basis for which is not disclosed; ARB concludes that the operation of hydrogen stations required to be built based on the CFO mandate will yield cumulative profits of between about $150 and $531 million over the course of the regulations. This includes percentage ratios of annual profit to cost (e.g. the dollars of profit per dollar spent) running at of over 35% by the time the CFO regulations are assumed to sunset. Given the apparent profit potential of hydrogen refueling stations revealed by the ARB economic analysis, one has to question why a regulation forcing the development of the industry and retail outlets is required.

However, this question is easily answered by re-examining the ARB analysis using some of the more reasonable assumptions described above. For example, if one simply assumes that the cost of producing or procuring hydrogen is $5 per kg rather than the values assumed by ARB, and that the maximum average station utilization rate is 80% rather than 100% as ARB assumed, without changing any other ARB assumptions, the estimated $150 to $531 million in cumulative profits becomes instead an estimated $210 to $775 million dollars in cumulative ***losses***. Obviously the magnitude of the estimated losses would be increased by using the alternative assumptions regarding capital cost and interest rate described above that appear to be more reasonable than those ARB selected.

[40] Ogden, J., and Nicholas, M., "Analysis of a "Cluster" Strategy for Introducing Hydrogen Fuel Cell Vehicles and Infrastructure in Southern California", September 16, 2011.

CFO – L26 Response

26-1 The commenter expresses that "ARB Failed to Properly Comply with CEQA.

As ARB recognizes, the California Environmental Quality Act (CEQA) requires a study of environmental impacts before adopting regulations such as the proposed amendments to the Clean Fuels Outlet (CFO) regulation. It is well-settled that, even when an agency adopts a rule to protect or improve the environment, any adverse side-effects must be evaluated under CEQA.

ARB has adopted its own procedures for CEQA compliance under its certified regulatory program, but still must satisfy the fundamentals of the statute. Thus, ARB must identify potentially significant impacts, consider mitigation measures and a reasonable range of alternatives to avoid or reduce such impacts, and consider and respond to comments from the public and other agencies. Finally, ARB must adopt mitigation measures or alternatives unless they are infeasible and overriding benefits justify adopting the regulation despite its significant and unavoidable impacts.

To comply with CEQA, ARB's Initial Statement of Reasons (ISOR) for the CFO amendments includes Appendix B, a draft Environmental Analysis (EA) prepared as the functional equivalent of an Environmental Impact Report. The air quality evaluation in the EA is supported by ISOR Appendix D, an Emission Impact Analysis (EIA). However, the EA and EIA are seriously flawed and cannot be relied on to satisfy ARB's CEQA obligations."

This comment provides a general introduction to commenter's more specific comments that follow. ARB disagrees with the comment that ARB failed to properly comply with CEQA and with the commenter's statement that the EA and EIA cannot be relied upon to satisfy ARB's CEQA obligations. ARB prepared an EA for the proposed ACC Program (Appendix B) in accordance with CEQA and its certified regulatory program. The EA analyses potential environmental impacts associated with the reasonably foreseeable compliance responses of the regulated community. Chapter 3 of the EA provides discussion of existing conditions and the regulatory setting for each of the resource areas potentially affected by the proposed ACC Program. Chapter 5 of the EA provides a programmatic impact and mitigation analysis, using the CEQA Checklist as a tool for determining whether an impact may result. Please refer to the following L26 responses for specifics regarding CEQA compliance and the purported flaws in the EA.

26-2 The commenter expresses that there was "Failure to Fully Disclose Programmatic Impacts. Throughout the EA, ARB finds that local authorities will conduct future project-level CEQA review when approving and issuing permits for individual hydrogen fueling station projects. Through project-level review, the local agencies will be responsible for implementing ARB's recommended mitigation measures and others that they may identify and incorporate in permit conditions. While expecting that local authorities will do so, ARB cannot be certain that mitigation which is beyond its control will be implemented successfully. Accordingly, the EA finds such impacts to be potentially "significant and unavoidable", though justified by the benefits of the CFO rule. Although in general this "programmatic" or "tiered" approach is authorized for CEQA review at the rulemaking stage, the EA takes the tiered approach too far.

Even impacts that are significant and unavoidable at the programmatic stage must be fully disclosed, to provide a meaningful opportunity for the public to comment and to propose further feasible mitigation measures. Such issues also must be fully disclosed to enable informed decision-making, a central objective of CEQA. The ARB Board is responsible for considering and balancing benefits and adverse side-effects in deciding whether to adopt the CFO amendments. For each significant and unavoidable impact, ARB must find "overriding considerations", i.e., that specific benefits outweigh each adverse side-effect. But overriding considerations cannot be legally or factually supportable if the decision-makers have insufficient information to understand the extent of the side-effects they are deciding to accept. Weighing benefits and impacts is impossible when the impact side of the balance is insufficiently disclosed. In short, programmatic "significant and unavoidable" determinations are not a shield for the casual narrative evaluations and conclusions throughout the EA."

Appendix B is an environmental analysis prepared as in accordance with Public Resources Code section 21080.5, subdivision (d)(3) and ARB's regulations at CCR sections 60005 through 60007. The programmatic approach to the analysis is informed by CEQA Guidelines section 15168, which describes the parameters for a program EIR. Section 5 of Appendix B (Impact Analysis and Mitigation) discloses impacts to the resource areas identified on the CEQA checklist.

The commenter acknowledges that CEQA authorizes a programmatic approach and indicates that ARB takes the tiered approach "too far" but is not specific as to which resource area impacts are insufficiently disclosed. The EA discloses potential environment impacts related to the foreseeable compliance responses by the regulated community on a statewide level, and identifies mitigation. The level of specificity required in an environmental analysis depends on the degree of specificity of the activity under review. For example, an EIR for a construction project must be more specific and detailed than an EIR for a general plan or other general policy. An EIR for a policy or plan focuses on the indirect secondary effects of that plan or policy and cannot be as detailed as a subsequent EIR on the specific construction projects that are expected to follow. (See CEQA Guidelines section 15146, sub (b).) ARB's preparation of the EA for the ACC Program is similar to the approach for an EIR prepared for a plan or policy. In preparing the EA for the ACC Program, ARB cannot speculate about details that will be provided in any subsequent project specific environmental analyses.

ARB's programmatic approach to its analysis on the potential indirect impacts related to the regulated communities' foreseeable compliance responses is necessarily general, programmatic and qualitative in nature. A more detailed analysis is not reasonably feasible because it is unknown what specific future actions will be and any site-specific impacts cannot be known and assessed with any level of specificity at this time. Therefore, details of project level impacts are properly deferred to future project level review when those details can be known. This is an appropriate approach under CEQA. (See In re Bay-Delta Programmatic Environmental Impact Report Coordinated Proceedings (2008) 43 Cal.4th 1143.)

When potentially significant environmental impacts are identified in the EA, feasible mitigation measures have been presented to substantially reduce the effects. As stated in the EA, ARB does not possess the authority to require project-specific mitigation measures for facilities approved by other land use or permitting agencies if impacts are identified for those projects. Because the authority to determine project-level impacts and require project-level mitigation lies with the land use and/or permitting agency for individual projects, and project-specific details about the impacts and mitigation cannot be known at this stage, there is inherent uncertainty in the degree of impacts identified and mitigation ultimately implemented. Consequently, the EA took the conservative approach in its analysis of potential impacts and in its post-mitigation significance conclusions (i.e., tending to overstate impacts) and, for CEQA compliance purposes, discloses that potentially significant impacts related to the development of fueling stations and new or modified manufacturing facilities may be significant and unavoidable. ARB expects, however, that as the proposed ACC Program is carried out, these significant impacts can and should be resolved and reduced to insignificance by other government agencies, in accordance with their authorities and project review procedures

26-3 The commenter states that there is "Over-Reliance on Future Project-Level CEQA Review. Moreover, in following the programmatic approach, the EA relies heavily on project-level CEQA review that supposedly will be conducted by local agencies undertaking or permitting individual hydrogen fueling facility projects. However, it is quite likely that many local agencies will conduct no CEQA review at all. On an individual basis – especially if ARB is correct in assuming that most new hydrogen fueling station projects will be located at existing gas stations – many of these small projects will be exempt from CEQA, under the categorical exemption for minor alterations to existing facilities or other exemptions. Yet ISOR Table IV-2b (p. 50) projects that over 450 new stations will be required under the CFO rule. Of course, capturing impacts that are insignificant for each project considered separately, but significant when nearly five hundred projects are considered together, is the purpose of cumulative impacts analysis under CEQA."

Appendix B acknowledges that the proposed ACC Program could result in the construction and operation of over 100 new hydrogen fueling stations, along with modifications to existing hydrogen production plants. The EA found that these would likely occur within existing footprints or in areas with consistent zoning. The EA includes a Cumulative Impacts section in Chapter 6, which analyzes the potential for cumulative impacts for resource topics. These are disclosed in general qualitative terms as they pertain to reasonably foreseeable compliance responses because of the programmatic nature of the EA. See response to Comment 26-2. As with all of the environmental effects and issue areas, the precise nature and magnitude of impacts will depend on the types of projects associated with implementation of the proposed ACC Program, their locations, their aerial extent, and a variety of site-specific factors that are not known at this time but that would be addressed by environmental reviews at the project-level.

The commenter indicates, it is "...quite likely that many local agencies will conduct no CEQA review at all. On an individual basis new hydrogen fueling station projects that would be located at existing gas stations may be exempt from CEQA, under the categorical exemption for minor alterations to existing facilities or other exemptions." The commenter attached documents to demonstrate this point including two Notices of Exemption and a mitigated negative declaration. These submissions support finding that impacts from such projects are insignificant and do not contradict the conclusions in the EA even though the EA took a conservative approach to determining potential impacts at this programmatic level.

The commenter also expresses that "the EA does acknowledge impacts to be addressed by local agencies as significant and unavoidable:

> Because the authority to determine project-level impacts and require project-level mitigation lies with the land use and/or permitting agency for individual projects, and programmatic analysis does not allow project-specific details of mitigation, there is inherent uncertainty in the degree of mitigation ultimately implemented to reduce the potentially significant impacts. Consequently, this EA takes the conservative approach in its post-mitigation significance conclusions (i.e., tending to overstate impacts) and, for CEQA compliance purposes, discloses that potentially significant impacts related to the development of fueling stations and new or modified manufacturing facilities may be significant and unavoidable.

ISOR App. B, p. 8. Nevertheless, the EA reassures the public and decision-makers that:

> ARB expects, however, that as the proposed ACC Program is carried out, these significant impacts can and should be resolved and reduced to insignificance by other government agencies, in accordance with their authorities and project review procedures.

> Id. This reassurance is hollow, however, since the EA does not disclose to the public and decision-makers the extent to which local agencies can be expected to rely on categorical exemptions and not consider CEQA mitigation in the first place. Thus, rather than being conservative, the EA hides the true magnitude of anticipated significant and unavoidable impacts. If unmitigated through project-level review due to CEQA exemptions, the adverse impacts will be greater than the EA admits. This error also further undercuts the basis for overriding considerations, since the adverse impacts side of the balance is understated by assuming more project-level mitigation than can reasonably be expected."

The commenter asserts that the EA hides the true magnitude of anticipated significant and unavoidable impacts, apparently by not disclosing the extent to which local agencies can be expected to rely on categorical exemptions. The commenter states that local agencies can be expected to rely on CEQA categorical exemptions for particular fueling stations and that the reliance on categorical exemptions somehow results in impacts because no mitigation is considered when an exemption is used, and therefore, these projects will result in cumulative impacts. The commenter submitted several references during the 45-day public comment period, including copies of Notices of Exemptions and a Mitigated Negative Declaration for hydrogen fueling stations. The categorical exemptions submitted are under CEQA Guidelines sections 15301(e) and 15302 because the facilities were preexisting and the projects were considered ministerial under a public agency's statutes and ordinances. Public Resources Code 21083 and 21084 were also cited in the documents submitted.

Categorical exemptions (found at CEQA Guidelines sections 15300-15329) are classes of projects fully exempt from CEQA. These classes of projects are identified by the Secretary of Natural Resources as exempt from CEQA because the Secretary has found these projects have no significant effect on the environment. (See Public Resources Code section 21084, subdivision (a).) A project otherwise eligible for a categorical exemption may not claim the exemption if "the cumulative impact of successive projects of the same type in the same place over time is significant." (CEQA Guidelines section 15300.2, subd. (b).) Therefore, any new hydrogen fueling station projects that might otherwise fall under a categorical exemption may not use the categorical exemption if the cumulative impact of successive fueling station projects in the area is significant. The commenter's assertion that local agencies will use categorical exemptions suggests then there must be no cumulative impacts from such facilities or else the exemption is not available for these projects. Therefore, commenter's assertion, and the materials submitted, support a finding no cumulative impacts from the building of such facilities and not a finding of a greater magnitude of impacts as asserted by commenter. Therefore, the EA's conservative approach, which did not assume the use of categorical exemptions, does not mask the magnitude of potential impacts as the commenter asserts, but instead tends to overstate potential impacts.

The commenter's submitted information supports the analysis in the EA and does not require a revision to the EA, nor does it trigger the obligation to recirculate the EA under CEQA because it does not identify significant new information, as defined by CEQA.

26-4 The commenter expresses that there was "Failure to Consider Available Information on Foreseeable Project-Level Impacts. Even at the programmatic or first-tier level, CEQA requires evaluation of all issues that are ripe for review, where feasible and where information is available. Yet, while claiming that extensive analysis must be deferred to the project level, the EA ignores CEQA documents for hydrogen fueling projects that are already in place. Although some existing hydrogen facilities were approved based on CEQA exemptions, CEQA review documents do exist for other projects. Such documents provide concrete, readily available information on matters as to which the EA merely speculates.

For example, the City of Burbank prepared a Mitigated Negative Declaration for its Hydrogen Fueling Station Project, attached. It is true that some impact analyses in Burbank's Negative Declaration are based on project-specific details (e.g., visual impacts of the facility's profile in the specific setting) not appropriate for evaluation at the programmatic stage. Nevertheless, some impact analyses in the Negative Declaration provide valuable information on issues inherent to hydrogen fueling facilities – in particular, on the hazards of hydrogen itself (see comment on hazards below). Other impacts likely to be common to hydrogen facilities wherever they are located include air emissions, noise, public services (including fire protection), and transportation and traffic, from both facility construction and operation.

It is also true that the City of Burbank, after full analysis and disclosure, found that all potential impacts could be mitigated to less than significant – but only for that individual project. Findings of insignificance are by no means assured when scaling up the impacts identified in the Burbank Negative Declaration to over 450 new hydrogen stations anticipated as a result of the CFO amendments. Yet the EA could have analyzed reasonably foreseeable means of compliance by considering available information from CEQA documents for existing hydrogen fueling facilities. It was ARB's responsibility to identify and consider such available information, but not one such project-level CEQA document is cited in the EA references."

The commenter asserts that the EA is inadequate because ARB did not cite to CEQA review documents for other fuel station projects such as the City of Burbank document attached to the commenter's letter.

ARB is not required by its CRP or CEQA to cite other environmental document in the preparation of its EA. It may do so if such documents are helpful.

As noted by commenter, the impact analysis in Burbank's Negative Declaration is based on project-specific details. These details are not appropriate for ARB's programmatic level of analysis of the potential impacts of implementation of its regulations. As the commenter notes, impacts are specific to each facility and its setting. ARB's EA speaks generally to the general types of impacts that may occur (see response to Comment 26-2 for explanation of level of detail appropriate for the EA). The commenter asserts that some impacts discussed in the Burbank document are likely to be common to hydrogen facilities wherever they are located, such as air emissions, noise, public services (including fire protection), and transportation and traffic. Contrary to commenter's assertion, the whole focus of the EA analysis was to consider impacts that would be common to hydrogen facilities wherever they are located such as air emissions, noise, public services (including fire protection), and transportation and traffic (see EA Chapter 5 Impacts Analysis and Mitigation).

The Burbank document submitted by commenter does not provide any more specific or helpful information than what is already included in the EA about potential impacts that would be common to hydrogen facilities. For example, the EA analysis of potential air emissions provides a reasonable accounting of the types of air quality impacts that could occur with new hydrogen fueling stations or modifications to existing facilities (see EA at page 141-152). The EA discloses that during the construction phase, air pollutants could be generated, including site grading and excavation activities which could generate fugitive PM dust emissions and exhaust emissions from off-road construction equipment, material delivery trips, and construction worker-commute trips. As disclosed in the EA, actual emissions can vary as a function of parameters such as soil silt content and moisture, wind speed, acreage of disturbance area, and the intensity of activity performed with construction equipment. These parameters are specific to individual facilities and cannot be known at this time. The Burbank document submitted does not provide more detailed information, and is not specific to that particular project that could be used to revise the analysis or conclusions in the EA.

Furthermore, the documents provided by the commenter demonstrate that such projects tend to have less than significant impacts. However, the EA takes the conservative approach in its post-mitigation significance conclusions (i.e., tending to overstate impacts) and, for CEQA compliance purposes, discloses that potentially significant impacts related to the development of fueling stations and new or modified manufacturing facilities may be significant and unavoidable. ARB expects, however, that as the proposed ACC Program is carried out, these impacts can and should be resolved and reduced to insignificance by other government agencies, in accordance with their authorities and project review procedures. This information supports the analysis in the EA and does not require a revision to the EA nor does it trigger the obligation to recirculate the EA under CEQA, because it does not provide significant new information, as defined by CEQA.

26-5 The commenter expresses that there was "Failure to Analyze CFO, ZEV and LEV III Actions As Separate "Projects. Three separate regulatory actions are before ARB: amendments to the CFO regulations and also to the Zero Emission Vehicle (ZEV) and Low Emission Vehicle (LEVI III) regulations. These three actions are collectively referred to as the Advanced Clean Cars (ACC) Program. They are also collectively analyzed in the EA for environmental impacts, as though they were a single "project" for purposes of CEQA. See EA, p. 35. However, the EA's characterization of the single "project" is inconsistent with ARB's Notice of Public Hearing to Consider Amendments to the Clean Fuels Outlet Regulation (Nov. 29, 2011), which does not propose a single ACC project. Instead, the proposed regulatory action in the Notice is a stand-alone action on the CFO amendments. The Notice, p. 3, merely notes in passing that the CFO project is "part of the Advanced Clean Cars regulatory proposals" – note that "proposals" is plural – that are to be heard on the same day. Similarly, ARB's website at http://www.arb.ca.gov/regact/2012/cfo2012/cfo2012.htm lists the CFO amendments as a stand-alone proposed regulatory action, and the January 26-27, 2012 meeting agenda lists three separate, albeit consecutive, public hearings rather than one hearing covering three subjects; see http://www.arb.ca.gov/board/ma/2012/ma012612.htm."

ARB disagrees that the CFO regulation should have a stand-alone analysis. The CFO regulation is a complement to the ZEV program, and without it, the ZEV targets may not be met. Further, because the ZEV regulation would be flexible in that manufacturers could fulfill their requirements by marketing hydrogen FCVs, as well as other types of vehicles, it cannot be determined ahead of time exactly when the CFO regulation would be activated by the regional or statewide trigger levels. This is not a case where one regulation should preclude another. The proposed ACC Program will result in a fleet of vehicles with supporting infrastructure. One cannot occur without the other.

As for noticing, ARB posted a Notice of for the Staff Reports (Initial Statement of Reasons) prepared for the LEV III, ZEV and CFO amendments, which included notice of the coordinated analysis of the potential for environmental impacts and benefits presented in the Appendix B to each staff report. The EA assesses all impacts associated with the entire proposed ACC Program, which is the proposed project. The EA describes the project in Chapter 2 of the EA. The "project" is the collective and integrated set of proposed regulatory amendments that would affect manufacturer design of vehicles and the fueling of a segment thereof to meet these ARB regulations, while also meeting other regulatory requirements. The regulatory amendments are described in detail for CEQA purposes starting on page 33 of the EA. Separately or together, the impact analysis related to the CFO regulation would be the same.

The commenter also expresses that "Certainly, it was appropriate for the EA to consider the cumulative impacts of the three separate CFO, ZEV and LEV III projects. Cumulative impact analysis is the correct means of evaluating the effects of past, present and reasonably foreseeable future projects that overlap in time and may combine to exacerbate their respective impacts.

However, nothing in the Notice or the EA states that ARB will only adopt the CFO amendments if it also simultaneously adopts the ZEV and LEV III changes. Nor does the EA inform the public and decision-makers of the potential environmental consequences should ARB choose to separately adopt the CFO amendments. Accordingly, the EA does not provide a basis for action on the CEQA "project" that is actually proposed."

ARB agrees that it was appropriate for the EA to consider the cumulative impacts of all regulations in the ACC Program. The EA includes a cumulative assessment of impacts on the environment that could result from the incremental impacts of a proposed project when added to other past, present, and reasonably foreseeable future actions. Such impacts can result from individually minor, but collectively significant actions taking place over time.

The EA provides a detailed description of the project being proposed for approval, which includes the three regulatory actions. The project description should not be a smaller portion of the entire proposed project being considered for approval as the commenter suggests. The EA informs the decision makers of the potential environmental impacts associated with the CFO amendments while providing an integrated, coordinated impacts analysis of all the proposed ACC Program's amendments. ARB has the authority to define the proposed project. ARB disagrees that the EA does not provide a basis for action by the Board on the proposed ACC Program. The entire ACC has been fully analyzed and the Board has the discretion to approve the entire project or some portion thereof.

26-6 The commenter expresses that there was "Lack of Clarity on Numbers of New Hydrogen Fueling Stations. A CEQA document must contain a clear, stable and complete project description, in order to provide the essential basis for review of the project's impacts. The EA project description, pp. 33-35, describes the CFO regulation changes themselves but does not describe the reasonably foreseeable means of compliance; i.e., the numbers and locations of new hydrogen fueling stations. Not until pp. 131-133 of the EA is the "compliance response" discussed. Even here, an example for the South Coast is provided, followed by a statement that "Starting in 2016 in the Upper Bound [i.e., fast entry of fuel cell vehicles into the California market] Scenario, the number of vehicles statewide would exceed the 20,000 statewide trigger requiring the construction of 39 additional stations." But that figure is for a single year, without stating the total effect of the rule provided. The reader must hunt for that information in the ISOR, Table IV-2 on p.50.

However, even there it is not even clear exactly how many new hydrogen fueling stations ARB attributes to the CFO amendments. ISOR Table IV-2b, p. 50, includes a column for Total Stations and a column for Total New Stations

Installed Per CFO under the fast-entry Upper Bound FCV Scenario. In the Total New Stations column, 31 stations are indicated prior to the rule and 488 stations by 2024, the difference representing 457 new stations attributable to the rule. However, the sum of the Total New Stations Installed Per CFO, adding the numbers for each year from 2015 to 2024, is 461. This discrepancy is not explained in the document.

The total number of new fueling stations is one of the main drivers of the magnitude of CEQA impacts. The failure to clearly disclose the total number of stations within the EA does not comport with CEQA's informational purposes."

The scenario presented on Table IV-2b includes the assumption that four of the hydrogen fueling stations present in 2014 will be decommissioned in the 2015-2020 timeframe. For example, in the 2015 row on this table nine new stations are added bringing the 2015 total to 38, but the total stations in 2014 was 31. This indicates the assumption that two stations would have been decommissioned between 2014 and 2015. Staff made the assumption that some of the stations currently in operation today or under construction would close in this timeframe because of inability to meet increasing fueling demands in the future, and that these smaller capacity stations would be replaced by higher volume newer stations nearby.

As for the total number of new fueling stations being one of the main drivers of the magnitude of CEQA impacts, ARB disagrees with the commenter's statement that the failure to clearly disclose the total number of stations within the EA does not comport with CEQA's informational purposes,. The EA appropriately provides a programmatic level of analysis of the potential impacts that would be expected from implementation of the proposed regulation. The number of stations has little or no bearing on the impact analysis, as each station would be subject to local determination of whether there would be adverse environmental impacts, or whether the project would be exempt.

26-7 The commenters expresses that there was "Unsupported Assumptions Regarding Locations of New Hydrogen Fueling Stations. The other main driver of the magnitude of impacts is the location of the fueling stations. The EA downplays location-based impacts, assuming that "new individual hydrogen fueling facilities would be constructed at existing public retail gasoline service stations that are already managed by the retail branches of the respective refiners/importers of gasoline. These locations would also likely be in urban areas where they are positioned to serve the most drivers. Thus, it is unlikely that new hydrogen fuel outlets would be located at greenfield sites (land not previously developed), and that they would be built in locations consistent with local zoning.

EA, p. 133. Nothing in the proposed CFO amendments requires this result and the EA cites no evidence to support these assumptions. Instead, since the existing CFO regulations would have directly required gas station owners and operators to locate facilities on their property, ARB simply assumes that the same thing will occur despite shifting the obligation to refiners and importers. This unsupported speculation is the critical basis for conclusions of limited impacts throughout the EA.

In fact, there is reason to doubt the EA's assumptions. Even today, gas stations are the sites of only a small proportion of CFO facilities. The attached spreadsheet identifies 27 hydrogen fueling facilities which currently operate in California and another 15 that are planned. Of the total of 42, only 12 are located in gas service stations. The other 30 are not, including facilities operated by transit agencies, municipalities (for city vehicles) and universities, many not open to the general public.

Moreover, just as ARB does not control the behavior of local governments, the refiners and importers do not control the behavior of station owner/operators. The overwhelming majority of service stations in California are now owned by independent operators who only have a supply contract with a refiner or distributor. There are few remaining lessee dealers who lease service stations owned by refiners. Except in those few cases, a refiner has no ability to require station owner/operators to install equipment to dispense hydrogen. The expense would likely be considerable, both to pay for the equipment and to induce station owner/operator to cooperate and surrender its property for a new line of business without a track record of profitability. Moreover, refiners and importers will be reluctant to install costly equipment at locations where they have no control but may be subject to liability in the event of accidents. Accordingly, refiners may be more likely to contract with other parties, such as the existing providers who are already in the hydrogen business and with whom refiners already have business relationships, to establish new outlets specializing in hydrogen. At this point, that prospect too may be speculative, but it appears to make economic sense. But those new outlets are unlikely to be sited at existing retail service stations. At the least, ARB has provided no justification for assuming that the development of outlets in new locations will not occur.

In sum, the facts suggest that it is reasonable to expect a significant number of CFO facilities may be located outside existing retail service stations, contrary to the assumption in the EA. As a result, there is no substantial evidence to support the EA's conclusions that are predicated on the restriction of CFO facilities to existing stations, in order to avoid impacts in new locations."

ARB disagrees. The EA discloses that some facilities would be located at existing facilities, some may be located outside existing facilities, or on otherwise developed property, so the commenter's perception of the environmental analysis is not correct. It is reasonable to predict that these locations are likely to be in urban areas where they are positioned to serve the most drivers, and therefore sell the most fuel. Thus, it is unlikely that new hydrogen fuel outlets *would be located in non-urban areas on "greenfield" sites (i.e., land not previously developed). Outlets would also be reasonably expected to be built in locations consistent with local zoning, because local governments anticipate fueling stations as allowable uses in appropriate zone districts (e.g., commercial or industrial zone districts).*

Regardless of whether a facility is sited at an existing fueling facility versus other locations, the EA discloses the impacts associated with site preparation and construction at a programmatic level.

26-8 The commenter expresses that there was "Improper Use of "Hypothetical Future Conditions" Baseline. ARB assumes that the existing conditions or "baseline" for purposes of determining impacts of the CFO amendments (as well as the ZEV and LEV III provisions addressed in the EA and EIA) consists of:

> existing vehicle and related fuel emissions programs, policies, and regulations. The existing regulatory condition includes the existing LEV regulation (LEV II), including the GHG requirements that are part of LEV II (known as the Pavley regulations), the EPL regulation, and the existing ZEV regulation, as well as other relevant, previous California rulemakings, such as the LCFS and all comparable federal regulations. . . . In the context of regulatory programs, impacts on the physical environment are the result of compliance responses to regulations. Compliance responses to the existing LEV II, ZEV, and CFO regulations are already in place and underway. The environmental effects of proposed amendments to regulations that reduce CAP and/or GHG emissions from light- and medium-duty vehicles would build upon the compliance responses to these existing regulations.

ISOR Appendix B, pp. 24-26. On the contrary, the CEQA baseline consists only of the physical environmental conditions that actually exist. Hypothetical conditions that do not physically exist are not properly included in the CEQA baseline, no matter how reasonable the expectation that those conditions will come to pass. Similarly, anticipated future conditions that will exist on completion of plans, rules and compliance responses cited by the EA cannot be included in the baseline here. Instead, impacts of the CFO amendments must be determined by comparison to the physical environment that now exists. By improperly including regulatory developments which are still in progress in the baseline, the EA obscures the actual impacts required to be disclosed under CEQA, by understating changes compared to conditions that exist today."

As noted by the commenter, the CEQA Guidelines state that the baseline for determining the significance of environmental impacts is normally the existing physical conditions at the time the environmental review is initiated. (See CEQA Guidelines, section 15125 (a).) The existing conditions at the time the EA was initiated include the existing vehicle and related fuel emissions programs, *policies, and regulations. Regulations that are currently in place are assumed to be implemented and complied with, and are therefore properly included in the existing conditions.*

The EA properly analyzed the potential environmental impacts of the reasonably foreseeable methods of compliance related to the proposed amendments under the ACC Program with the current methods of compliance related to the existing State and federal regulatory framework. (See Black Property Owners Assn. v. City of Berkeley (1994) 22 Cal.App.4th 974, 985 [in updating general plan, city needed only to assess the impacts of the changes or amendments to the plan].)

Situations appearing in the case law relating to hypothetical future conditions are not comparable to the conditions in the EA. The existing conditions include the compliance responses to the existing LEV II, ZEV, and CFO regulations already in place and underway. These are not hypothetical future conditions. The cases concerned with the reliance on hypothetical future conditions are concerned that an illusory baseline masks the severity of impacts of the proposed project. (See Communities for A Better Environment v. South Coast Air Quality Management Dist. (2010) 48 Cal.4th 310, 322.) This is not the case with the approach to baseline used in the EA analysis. The EA analysis that looks at the potential environmental impacts of the reasonably foreseeable methods of compliance related to the proposed amendments under the ACC Program compared with the current methods of compliance related to the existing State and federal regulatory framework, does not mask or obscure the potential severity of the potential impacts of implementation of the regulatory amendments. The impacts of the CFO amendments are determined by comparison to the physical environment that now exists by analyzing (at a programmatic level) the potential impacts of the new fueling stations expected by the amendments. Commenter's general assertions about baseline fail to demonstrate specifically how the EA baseline approach obscures impacts required to be disclosed under CEQA.

Other reasonably foreseeable actions that are approved or proposed to take place in the time frame of the proposed ACC Program, but are not yet in effect, are referred to in the EA as "complementary measures" (e.g., Environmental Standards for Hydrogen Production [requires GHG reductions and use of renewables in accordance with SB 1505]). These help define the future, cumulative scenario of reasonably foreseeable compliance measures. The complementary measures are designed to reduce CAPs and GHGs by increasing the efficiency with which California uses all forms of energy and by reducing dependence on the fossil fuels.

26-9 The commenter expresses that there was "Failure to Correctly Analyze Air Emissions. Even if ARB were justified in considering the future conditions resulting from compliance with the pre-amendment regulatory regime as the CEQA "baseline", it failed to correctly implement this approach. The Emissions Impact Analysis, ISOR Appendix D, compares scenarios of fast and slow fuel cell vehicle (FCV) deployment to gasoline vehicles only. However, compliance with the existing regulatory regime, including existing ZEV regulations, should result in the deployment of battery electric vehicles (BEVs) instead. Accordingly, the CFO amendments, fostering the development of the FCV market by ensuring the availability of hydrogen fuel, would be expected to result in the replacement of BEVs with FCVs. Therefore, the EIA should have focused on the differences in air emissions between BEVs and FCVs, the emissions associated with the generation and distribution of electricity and hydrogen, and any secondary issues associated with the use of conventional vehicles for long-distance travel by owners of both BEVs (which require frequent battery charging) and FCVs (which require proximity to hydrogen fueling stations). In particular, utilizing the EA's claimed baseline, the EIA should have compared hydrogen production to electricity generation emissions, rather than to those of gasoline production. These comparisons not only affect the claim of overriding benefits to justify significant and unavoidable impacts, but also have implications for the analysis of adverse impacts. Hydrogen generation, whether at central facilities or at fueling stations, generally can be expected to occur in developed areas, which are more likely to be in non-attainment of ambient air quality standards. By contrast, electricity in California is often generated outside urban and developed areas and in some cases outside the state. Emission increases associated with hydrogen thus may be more likely to cause significant air quality impacts."

Please refer to the response to Comment 26-8. The baseline for the EA was determined for the entire ACC Program, which includes the CFO regulation.

ARB disagrees that air emissions were incorrectly analyzed for the CFO regulation. ARB believes that the commenter misinterpreted the EIA presented in the CFO ISOR, which clearly identifies all assumptions and baseline values. The CFO's EIA evaluated the penetration of FCVs into the existing transportation fuel pool that is dominated by gasoline vehicles. In both the Lower and Upper-Bound scenarios, the number of FCVs anticipated as a result of the ZEV regulation was shown. The Lower-Bound scenario can be interpreted as the number of FCVs that is anticipated if OEMs chose to produce more BEVs. Similarly, the Upper Bound Scenario can be viewed as the case in which they chose to produce fewer BEVs. When the ZEV regulation becomes effective FCVs and BEVs will together be used by OEMs to meet the regulation's requirement. For the CFO EIA, the goal is to a) measure the emissions resulting from the production, transport and use of hydrogen in response to the number of FCVs projected and b) to determine the emissions reductions if the projected number of FCVs successfully penetrated the transportation market and replaced the comparable gasoline counterparts. Regardless of the number of FCVs deployed, whether high or low, it is critical that the emissions measurement be made against the current baselines, which are gasoline and gasoline vehicles. Measuring emissions of one alternative fuel versus another only demonstrates which alternative fuel is cleaner, whether or not the alternative fuel has any *emission benefit within the existing transportation sector that is and will continue to be dominated by gasoline vehicles in the timeframe evaluated.*

26-10 The commenter expresses that there was "Failure to Analyze and Disclose Air Quality and GHG Impacts from Construction of New Hydrogen Fueling Stations. The EA air quality section, p. 142, states: "Based on typical emission rates and default parameters for above mentioned equipment and activities, construction activities could result in hundreds of pounds of daily NOx and PM, which may exceed general mass emissions limits depending on the exact location of generation." The short-term construction impact (which is not so "short term" when considering construction of over 450 fueling stations) is considered potentially significant, and mitigation is left to the local permitting authorities during project-level CEQA review. However, the EA does not say what those casual references to "typical emission rates" and "default parameters" may mean, nor explain the "general mass emissions limits" which may apply. Neither the EA nor the EIA (ISOR Appendix D, the emissions impact technical analysis) provides any quantitative estimates of air pollutant emissions beyond the vague acknowledgment of "hundreds of pounds of daily NOx and PM." Readers are given no information to understand or comment on whatever basis ARB may have for that order-of-magnitude figure. Moreover, other construction air quality impacts (e.g., toxic air contaminants) are not even described with order-of-magnitude estimates, and neither the EA nor the EIA even mentions greenhouse gas (GHG) emissions from fueling station construction.

As discussed above, the programmatic nature of the EA and the anticipated future project-level review (at least, for those projects not found exempt from CEQA) are not a shield from CEQA's disclosure obligations. Determining the readily identifiable magnitude of emission impacts was not properly left as an exercise for the reader."

The commenter asserts that the air quality analysis should provide quantitative estimates of air pollutant emissions. See response to Comment 26-2 for an explanation of the appropriate level of review for the ACC Program. As stated in that response, the EA analysis is necessarily general, programmatic and qualitative in nature. A more detailed analysis is not reasonably feasible at this time because it is unknown what specific future actions will be and any site-specific impacts, including quantitative estimates of air pollutant emissions for the construction of as of yet unidentified future stations, cannot be known and assessed with any level of specificity at this time.

The Commenter also asserts that neither the EA nor the EIA mentions GHG emissions from fueling station construction. Fueling station construction is just one compliance response of the amendments and the EA analyzes the GHG impacts for the entire ACC Program. Page 149 of the EA indicates that the proposed ACC Program would result in an emissions benefit as compared to current regulations. Table 5-4 shows the GHG emission benefits in 2020, 2025, *2035, and 2050. By 2025, CO_2 equivalent emissions would be reduced by almost 14 MMT/yr, which is 12 percent from baseline levels. The reduction increases in 2035 to 32 MMT/Year, a 27 percent reduction from baseline levels. By 2050, the proposed regulation will reduce emissions by more than 42 MMT/yr, a reduction of 33 percent from baseline levels. Viewed cumulatively over the life of the regulation (2017-2050), the proposed ACC Program would reduce emissions by more than 870 MMT CO_2e. Please refer to discussion of construction impacts in the EA starting on Page 141.*

26-11 The commenter expresses that there was “Failure to Evaluate Construction and Operation Impacts of New Hydrogen Generating Capacity. The EA (pp. 134-145) acknowledges that compliance with the CFO requirements would require an increase of up to 9.2% in the state’s currently projected supply of merchant hydrogen. The EA also notes that increased hydrogen purity may be required for merchant hydrogen to be suitable for use as fuel for FCVs. Accordingly, the EA explains: “For delivered gaseous hydrogen, modifications of the central plants may be necessary to further purify the hydrogen so that it meets the purity standards required for fuel cell vehicles” and goes on to rely on other agencies for mitigation as it does elsewhere, noting that “the construction work associated with these plant modifications would have to satisfy State and local requirements for permitting, hazardous materials, and other resource areas, which are typically handled by local agencies” (EA, p. 135).

However, the EA fails to indicate what percentage of currently available or forecast merchant hydrogen complies with existing specifications for hydrogen as an alternative vehicle fuel. More important, it does not provide any justification for assuming adding up to 9.2% of higher purity hydrogen to the existing supply can be accomplished merely be “modifications” to existing hydrogen generating plants. In fact, in every reference to impacts associated with meeting hydrogen demand, the EA is careful to assert that the demand will be met with “modifications” of existing plants. See, e.g., EA pp. 139, 141, 148, 151, 152, 155, 158, 161-163, 167-169, 171 (each asserting that “New hydrogen fueling stations could also be constructed and operated along with modifications to existing hydrogen production plants”).

By assuming only modifications to existing facilities, the EA can avoid any impacts from construction and operation of new hydrogen generating capacity, which can be substantial. New merchant scale hydrogen plants are major industrial facilities whose construction and operation, like that of other industrial plants, can have significant environmental impacts requiring evaluation under CEQA. (Among other things, hydrogen generation itself produces GHG emissions, which must be mitigated or offset.) However, the EA provides no basis for the assumption. In fact, it seems unreasonable that so great an increase in supply can be accomplished without new facilities. Moreover, as the EA also notes, pursuant to SB 1505, once statewide demand for hydrogen as a transportation fuel reaches certain levels, state law requires that 33.3 percent of this hydrogen be made from renewable resources. There is no estimate of the amount of hydrogen available from existing sources that meets both this requirement and vehicle fuel specifications. Yet under these circumstances, it seems inevitable that there will be more than a modification of existing facilities.

Just as the EA's unrealistic assumption that all fueling facilities will be located on existing retail service stations serves to understate impacts from new facilities, so does the assumption that only modifications of existing generating capacity are needed. However, given the far larger footprint and environmental effects of new hydrogen generating capacity, the omission has greater consequences for the inadequacy of the EA."

The commenter asserts the EA analysis underestimates impacts by assuming only modifications to existing facilities and understating the construction and operation of new hydrogen facilities. Contrary to commenter's assertion, the EA impact analysis does address construction and operation of new hydrogen generating capacity. The EA (at page 135) indicates that recently California has favored hydrogen fueling stations using delivered hydrogen with central production over stations that produce hydrogen on site (CEC 2011). The EA also indicates that new hydrogen fueling stations could also be constructed and operated along with modifications to existing hydrogen production plants (see EA page 135). The EA found that these new facilities would likely occur within existing footprints or in areas with consistent zoning. This analysis does not mask or hide potential impacts of new facilities. The commenter is reminded that the EA provides a programmatic level of analysis and discloses impacts associated with the foreseeable compliance responses by the regulated community (see response to Comment 26-2).

26-12 The commenter expresses that there was a "Failure to Analyze Hydrogen Hazards. The EA, p. 158, summarily dismisses impacts related to hazardous materials transport and use, asserting that "New hydrogen fueling stations [and] . . .modifications to existing hydrogen production plants. . . . would likely occur within existing footprints or in areas with consistent zoning." As discussed above, there is reason to doubt these speculative and unsupported assumptions. The EA (pp. 158-159) goes on to address explosion risk from electric vehicle batteries (for the ZEV portion of the ACC initiative) but, remarkably, omits any mention of explosion risk from hydrogen transport and use. Still more remarkably, the only risk of spills the EA discusses is minor diesel spills from fueling construction equipment. No potential impacts (not even insignificant impacts) are recognized for hydrogen transport to fueling stations and operations at stations. No mitigation measures are provided for hydrogen hazards, not even recommended measures to be implemented by local authorities in project-level CEQA review for permitting or approvals."

The commenter asserts the EA failed to discuss the explosion risk from hydrogen transport and use. The Existing Conditions and Regulatory Setting sections of *the EA do address the ignitable characteristics of explosive material. The EA also identifies the respective governing laws that, when complied with, would avoid or reduce this potential impact (see EA at pages 80-83)*

The EA starting at page 158 discloses that the project could potentially create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment and that this impact would be potentially significant. This EA found that this impact could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but the authority to impose mitigation is beyond the authority of the ARB. The commenter asserts additional analysis of the potential for explosion risk from hydrogen transport and use should have been addressed but provides no evidence supporting this type of impact. In fact, the notices of exemptions for hydrogen fueling stations submitted by commenter rely on categorical exemptions, and the submitted mitigated negative declaration support finding no potential for significant impacts from explosion risk from hydrogen transport or use (see response to Comment 26-3). Therefore commenter's submissions contradict commenter's assertion that the EA should have addressed in more detail potential hazards from hydrogen.

The commenter also expresses that there was "failure to discuss hazards or the impacts of hazard mitigation strategies in relation to hydrogen transport and refueling facility operation is a significant omission in the EA. The California Energy Commission (CEC) evaluated potential failure modes and the effects of those failures at hydrogen refueling stations, which include failure modes associated with hydrogen delivery vehicles and on-site generation. The U.S. Department of Energy developed an on-line tool for hydrogen hazard and risk analysis. As indicated in these references, the outcomes of many potential failure modes are explosion and fire. Some of the analyzed scenarios have low or moderate frequency but, if they do occur, would have severe consequences." Both of these references also address potential mitigation measures that are not addressed at all in the EA which might address hazards but could create other potential environmental impacts not to mention impact refueling facility design, throughput, cost, and other important factors.

The CEC report (p. 6-3) concludes that:

> hydrogen is relatively leak prone, particularly considering the fact that it is usually stored at high pressures, flammable mixtures are easily ignited, and it is difficult to detect. These characteristics may make hydrogen less safe than other fuels in some accident scenarios. While hydrogen's industrial-use safety record is good, this application does not include all vehicle fuel and lay person issues. Fortunately, safety research is underway and codes and standards are being developed to address hydrogen vehicle fuel applications.

However, neither the Existing Conditions section (pp. 79-83) nor the Hazards and Hazardous Materials section (pp. 158-160) of the EA describes any such codes and standards, either as part of the regulatory setting or as a source of mitigation measures. Moreover, as recognized in the CEC's allusion to "lay person issues", customers at hydrogen fueling stations cannot be expected to observe safety procedures as rigorously as trained personnel."

Please refer to response 26-12, above.

26-13 The commenter expresses that there was "Failure to Consider Fire Protection/Public Service Impacts. As in the Hazards and Hazardous Materials section, the EA's Public Services section contains no discussion of hydrogen risks. Given that the impacts of failure modes at hydrogen refueling facilities are frequently fire, explosion, or both, the EA's conclusion (p. 168) of a less than significant impact on fire protection public services is untenable.

As shown in the ISOR, Table I-1 (p. 10), there are only ten public hydrogen refueling stations currently open in California. The largest of those ten stations has a capacity of 100 kg/day of hydrogen. Given the lack of existing stations, most fire departments would not be expected to be familiar with nor trained to deal with emergencies at hydrogen refueling stations. These departments could be faced with the need to purchase new equipment, engage in additional training or add additional fire fighters. Moreover, ARB assumes that hydrogen stations attributable to the CFO amendments will be designed for throughputs of 400 kg/day, or four times the capacity of the largest existing station. Even fire departments that are familiar with and trained to deal with emergencies at existing hydrogen stations will be faced with much larger potential fires and explosions at facilities with larger volumes of stored hydrogen and/or the increased number of hydrogen delivery vehicle trips. Finally, the increase in hydrogen transport vehicles on the state's roadway network would introduce increased risks, necessitating training and, potentially, new equipment for fire departments in locations that do not have fueling stations, as well as those that do.

If the EA were to follow its usual pattern, relying on the authority of local agencies to address increased demands on local fire protection service, then the impact should be found significant and unavoidable, not less than significant. At the least, the impact must be acknowledged and recommended mitigation measures provided. The EA should also recognize that agencies responsible for disaster response (e.g., in the event of earthquake), as well as local fire departments, likely would be affected by the risks associated with over 450 new hydrogen outlets and the delivery trucks necessary to service them."

Commenter asserts that "given that the impacts of failure modes at hydrogen refueling facilities are frequently fire, explosion, or both, the EA's conclusion (p.

168) of a less than significant impact on fire protection public services is untenable." The EA found that hydrogen fueling facilities would be expected to be sited at existing facilities, or in appropriately zoned areas and addressed the potential for hazards (see response to comment 26-12). The EA found that emergency systems for these kinds of projects would already be in place. Commenter asserts refueling facilities are subject to fire and explosion but has not submitted any evidence to support this assumption and the resulting potential for impacts on public service that would result from such fires and explosions. On the contrary, the documents provided by the commenter (categorical exemptions and negative declaration) support a finding of no impact from such facilities including alleged impacts to public services (see response to comment 26-3).

26-14 The commenter expresses that there was "Failure to Analyze Population and Housing and Related Impacts. Typical impacts in several areas – e.g., population and housing, land use, recreation, utilities, public services in addition to fire protection, and growth-inducing impacts – relate to the numbers of workers involved in construction and operation of hydrogen facilities. The EA makes broad, unsupported assertions that worker numbers will be low and impacts related to worker numbers accordingly insignificant (see, e.g., EA p. 168). Again, the reader has no basis to know how well-founded such assertions are and it was ARB's responsibility to provide support for public review and comment."

The EA concludes that the potential for impacts to population and housing would be less than significant because construction activities associated with new fueling facilities would be anticipated to require relatively small crews as new plants, stations, and modifications would likely occur within existing footprints or in areas with consistent zoning. In addition, demand for these crews would be temporary (e.g., 6-12 months per project). Therefore, it would be anticipated that the need for a substantial amount of construction worker migration would not occur and that a sufficient construction employment base would likely be available. Furthermore, it would not be anticipated that a substantial amount of new personnel would be needed to operate the facilities and that sufficient employment base would likely be available because these would likely occur within existing footprints or in areas with consistent zoning. The commenter has not submitted any information to contradict the EA analysis of potential for impacts on housing and population. In fact, the documents provided by the commenter (categorical exemptions and negative declaration) support a finding of no impact from such facilities on population and housing (see response to comment 26-3).

26-15 The commenter expresses that there was "Failure to Consider a Reasonable Range of Feasible Alternatives. Alternatives analysis is a central aspect of the CEQA review process. A lead agency must consider and evaluate a range of potentially feasible alternatives that will foster informed decision-making and public participation. To accomplish this, the CEQA document must develop and evaluate a range of reasonable alternatives that would feasibly attain most of the basic objectives of the project, but "would avoid or substantially lessen any of the significant effects of the project." However, with respect to the CFO amendments, the EA fails to meet even the "reasonable range" standard.

Other than the statutorily required no project alternative, the sole alternative to the CFO amendments considered is the Memorandum of Agreement (MOA) with major gasoline refiners and importers to carry out the exactly same objectives provided in the CFO amendments.

Accordingly, the EA concludes (pp. 195-196) that its impacts would be the same or less than those of the proposed project, since potentially "varying levels of commitment" by MOA participants could lead to fewer hydrogen fueling stations being constructed.

WSPA strongly disagrees with the implication that MOA participants would breach the agreement. ARB has no grounds to impugn the intent of MOA participants to fully comply with requirements to which they have committed. Moreover, intent aside, compliance would not be optional. As the EA (p. 195) states, the "MOA would have the binding power of a contract and be legally enforceable."

The unsupported presumption of inadequate MOA compliance also has an important consequence for the CEQA review of alternatives. The MOA alternative is designed to and can be expected to achieve the same results as the CFO amendments. Accordingly, the EA fails to consider any CFO alternative that is designed to "avoid or substantially lessen any of the significant effects of the project" as required by CEQA. Not every feasible alternative that an agency (or a commenter) can conceive of need be considered. Nevertheless, ARB is obligated to revise the EA to contain, and must then fully and fairly consider, some other alternatives that reasonably can be expected to accomplish actual reductions in significant impacts.

While it is ARB's obligation to develop a reasonable range of alternatives that can avoid or less impacts, at least two potential alternatives appear feasible.

First, as discussed above, the EA analysis assumes that hydrogen fueling facilities will be constructed at existing gasoline service stations. However, ARB could accomplish the same objective, promoting the availability of hydrogen fuel and so encouraging the manufacturing and purchase of FCVs, without assuming that hydrogen fueling will only occur at public fueling stations. Deployment of FCVs could also create a market for in-home hydrogen fueling. In-home fueling for natural gas vehicles already exists. Hydrogen fueling could be accomplished through exchange of canisters, such as is already being tested on light electric vehicles with fuel cells (such as scooters) in Taiwan. FCV fueling by this method could occur at some public fueling stations, but canisters also could be purchased at retail outlets and installed at home. Under this alternative, far fewer than the 450 public hydrogen dispensing facilities assumed by the EA would be necessary, and associated impacts would be reduced.

Second, refiners and importers could be provided the option of meeting CFO obligations through hydrogen dispensing or electric vehicle charging facilities. Electricity is also a clean fuel that could satisfy CFO requirements. The regulatory language in proposed 13 Cal. Code Regs. section 2300(a)(2) defines “clean alternative fuel” as “any fuel used as the certification fuel in a zero-emission vehicle” which includes both electricity and hydrogen. Since this alternative would have the effect of promoting a mixed fleet of FCVs and BEVs, the CEQA evaluation would include consideration of impacts associated with BEV batteries. Nevertheless, BEVs are a more mature technology with which consumers are more familiar than FCVs. At the least, hazard impacts and firefighting public service impacts associated with the use of explosive hydrogen fuel could be reduced. In particular, hydrogen handling by “lay persons” as opposed to trained personnel was recognized as an issue by the CEC (see above). Accordingly, this alternative merits consideration by ARB in a revised EA.”

In accordance with the substantive requirements of CEQA, the alternatives in the EA represent a “reasonable range” that could potentially attain most of the basic project objectives while having the potential to reduce or eliminate significant environmental effects. The range of alternatives analyzed in the EA was governed by the “rule of reason,” requiring evaluation of those alternatives “necessary to permit a reasoned choice.” (See CEQA Guidelines, section 15126.6(f). The candidate alternatives must have the potential to meet the project objectives and be potentially feasible, based on technical, legal and regulatory grounds, to be considered for evaluation.

The project consists of a set of regulations that comprise the proposed ACC Program, of which the CFO regulation is one component. The EA examined the “No Project”, a More Stringent Emissions Standard in the Low Emission Vehicles and the Zero Emission Vehicle Regulations, a Less Stringent Emissions Standard in the Low Emission Vehicles and the Zero Emission Vehicle Regulations, a Clean Fuels Outlet Regulation Based on a Memorandum of Agreement with Major Refiners and Importers of Gasoline, and three other alternatives that were considered by rejected as infeasible. These include a Feebate Regulation, Targeting High-Emitting Vehicles in the Existing Fleet and targeting Battery Electric Vehicles or Hydrogen Fuel Cell Vehicles Only.

The commenter suggests two additional alternatives for the CFO regulation that commenter believes ARB should analyzed in an EA. These include an alternative where hydrogen fueling could be accomplished through exchange of canisters and another that targets BEVS. The commenter suggests an “exchange of canisters for light electric scooters and micro cars alternative” as a viable alternative to hydrogen fueling infrastructure by automobile manufacturers, *government and academic agencies, or other parties involved in researching the advancement of hydrogen and fuel cell vehicles.*

The alternative suggested by the commenter is rejected for a number of reasons. First, it would not meet the overall objective of the Advanced Clean Cars program and would not serve the same purpose as the proposed regulation. The suggested alternative would reduce the overall scale of the regulation, and would result in different safety issues and a different suite of potential environmental impacts. Additionally, there could be feasibility issues that could be challenging to address. The alternative would require that NHSTA approve the full- function, highway legal vehicles to use detachable canisters of high pressure hydrogen. FCVs are designed to achieve a driving range similar to today's vehicles. The mass of storage systems required to achieve this range can be greater than 100 kg. The idea of routinely swapping storage containers weighing greater than 100 kg obtained at retail outlets would likely be impractical to perform at home. In addition, drivers and vehicles used for transporting high-pressure gas canisters would likely be required to obtain special permitting and licensing, thereby preventing the average fuel cell vehicle owner from purchasing canisters, transporting and storing them for use in their vehicles.

Please refer to response 26-15 above. The BEV alternative that the commenter is advocating includes electric vehicle charging and CFO. BEV-only ZEV scenario would place more focus on public fast-charging facilities, and presents several challenges surrounding the necessity for a mandate, the parties who incur the cost, and the establishment of a standard for fast-charging the plug. The CFO ISOR analysis found that a charging infrastructure mandate is unwarranted and could hinder the current development of public charging infrastructure. Staff also found that more information is needed to determine what should done to from a regulatory perspective to increase BEV sales and electric miles traveled as BEVs are experiencing a successful commercial launch today without a public charging mandate. For this reason and with the support of and input from auto manufacturers and electric vehicle advocates, staff's regulatory proposal included the public charging infrastructure needs assessment (section 2302(c)). At this time, it is uncertain that regulatory mandate for charging infrastructure is necessary to promote BEVs, but ARB intends to find out via the assessment proposed in section 2302(c). If the commenter is suggesting that regulated parties be allowed to choose to build charging stations instead of hydrogen stations, the end result would be insufficient hydrogen stations necessary to promote commercialization of FCVs. If they are suggesting an alternative that mandates fueling infrastructure for all ZEVs, then they would be required to provide both charging infrastructure and hydrogen dispensers based on on-road ZEVs and automaker projections.

Further, and although highly unlikely, battery fires have occurred and the EA discloses the potential for that impact. This contention is in contrast with the documents provided by the commenter that show that no impact would result *with hydrogen fueling, per the NOEs and the mitigated negative declaration submitted.*

Finally, the commenter repeats several concerns regarding hydrogen safety and public interaction with a new fuel that have been addressed in the EA. At this point, the commenter should be well aware that, regardless of the vehicle or fuel type, commercial introduction of any new technology will depend on strict adherence to codes and standards designed to protect the "lay person" against exposures, fires, explosions, or electrocution.

The commenter also expresses that "However, even there it is not even clear exactly how many new hydrogen fueling stations ARB attributes to the CFO amendments. ISOR Table IV-2b, p. 50, includes a column for Total Stations and a column for Total New Stations Installed Per CFO under the fast-entry Upper Bound FCV Scenario. In the Total New Stations column, 31 stations are indicated prior to the rule and 488 stations by 2024, the difference representing 457 new stations attributable to the rule. However, the sum of the Total New Stations Installed Per CFO, adding the numbers for each year from 2015 to 2024, is 461. This discrepancy is not explained in the document."

As indicated earlier in response to comment 26-6, the scenario presented on Table IV-2b includes the assumption that four of the hydrogen fueling stations present in 2014 will be decommissioned in the 2015-2020 timeframe. For example, in the 2015 row on this table, nine new stations are added bringing the 2015 total to 38, but the total stations in 2014 was 31. This indicates the assumption that two stations would have to be decommissioned between 2014 and 2015. Staff made the assumption that stations currently in operation today or under construction would close in this timeframe because of inability to meet increasing fueling demands in the future, and that these stations would be replaced by higher volume newer stations nearby. This clarifies the discrepancy mentioned in the comment.

26-16 The commenter expresses a need for "Revision and Recirculation of the EA. Correcting the deficiencies discussed above would require extensive revisions to the EA. Substantial changes (including the addition of feasible new alternatives that clearly would lessen significant impacts) must be made available for public review and comment. Accordingly, the EA should be revised and recirculated for additional public comment before ARB takes action on the proposed CFO amendments."

ARB disagrees. The EA is not deficient and need not be recirculated. As explained in response to commenter's detailed comments above, the commenter has raised no new issues or provided new information about potentially significant impacts that require ARB to revise the EA. Since no significant new information is being added to the EA after public review, no recirculation is required (see e.g. CEQA Guidelines CCR section 15088.5).

26-17 The commenter expresses "Comments on Appendix B: Environmental Analysis Environmental Analysis Related to Hazards, Hazardous Materials, and Public Services WSPA recommends ARB staff review the deficiencies and issues identified below and augment/correct them in the final regulatory documents. As part of the ARB's Environmental Analysis for the Advanced Clean Cars Program (Appendix B to the Initial Statement of Reasons (ISOR) for the 2012 Proposed Amendments to the Clean Fuel Outlet (CFO) Regulation), the potential impacts of the CFO regulation on Hazards, WSPA combined CFO comments 1-24 legal.doc 32 Hazardous Materials, and Public Services are analyzed along with means to mitigate potentially significant impacts.

Beginning with Hazards and Hazardous Materials ARB analyzed three issues. These are:

1. Routine Transport, Use, or Disposal of Hazardous Materials

2. Upset and Accident Conditions, and

3. Hazardous Emissions, Materials, or Substances Near Schools, Hazardous Material Site, Airport Land Use Plan, Private Airstrip, Emergency Response Plan or Emergency Evacuation Plan, and Wildland Fires."

With respect to Public Services ARB analyzed only the following issue:

4. Response Time for Fire Protection, Police Protection, Schools, Parks, and Other Facilities.

See response to 26-16 above for why the EA does not require any revision. With respect to issues 1 and 4, the EA concluded that impacts would be less than significant. More generally, the public was not deprived of a meaningful opportunity to comment. Please refer to the description provided in the Introduction of this document of the public review process.

With respect to issue 2, the EA identified the potential for fuel spillage associated with the refueling of construction equipment as a potentially significant impact but went on to indicate "…this impact could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but is beyond the authority of the ARB."

The EA identifies laws and regulations (Regulatory Setting) that assumes but cannot guarantee compliance. Compliance with these laws and regulations are enforced at the local level. These laws apply to transport of hazardous materials, which include flammable substances. Further, since the fueling stations would likely be located in an appropriately zoned area, public services would already be in place. The EA found the impact to the less than significant and no mitigation is required.

The commenter also expresses “With respect to issue 3, ARB indicates that “impacts…may be significant and unavoidable”. It appears that ARB ignored germane factors that should have been included in the Environmental Analysis for issues 1, 2 and 4 that could have also lead to findings of significant impacts and unavoidable impacts. These factors are related to the potential failure modes and the effects of those failures at hydrogen refueling stations which include failure modes associated with hydrogen delivery vehicles and on-site generation. These factors have been studied extensively and documented, for example, in a report prepared for the California Energy Commission and in an on-line tool for hazard and risk analysis available from the U.S. Department of Energy. As indicate in these references, the outcome of many potential failure modes are “explosion and fire”. This seems to directly contradict ARB’s conclusion that risks with respect to issues 1 and 2 are not significant and do not require mitigation.

Given that the impacts of failure modes at hydrogen refueling facilities are frequently fire, explosion, or fire and explosion, it is difficult to understand how ARB arrived at the conclusion that there would not be significant impacts with regard to fire protection services which are included in issue 4. As described below, it is clear that there will be significant impacts on fire protection services which will require either mitigation or which will have to be deemed to be significant and unavoidable.”

ARB disagrees. Please refer to responses 26-17 above.

The commenter also expresses “As shown in Table I-1 of the CFO ISOR (page 10), there are only ten public hydrogen refueling stations currently open in California and of those ten stations, the highest capacity is 100 kg/day of hydrogen. This is important for at least two reasons. The first is that given the lack of existing stations, most fire departments would not be expected to be familiar with, nor trained, to deal with emergencies at hydrogen refueling stations. These departments could be faced with the need to purchase new equipment, engage in additional training or perhaps add more fire fighters. A similar issue could be raised by the introduction of hydrogen transport vehicles operating in their jurisdictions which could raise new threats necessitating new equipment and/or training. The second reason is that ARB assumes that hydrogen stations created by the CFO will be designed for throughputs of 400 kg/day or four times the capacity of the largest existing station. Given this, even fire departments that are familiar with and trained to deal with emergencies at existing hydrogen stations will be faced with much larger potential fires and explosions owing to the larger volumes of stored hydrogen and/or the increased number of hydrogen delivery vehicle trips created by the operation of the station.”

Please refer to responses above (e.g., 8-1, 26-3) related to siting assumptions and applicable existing regulations.

The commenter also expresses “Another potential factor that could impact public services that was not identified or analyzed by ARB is the impact of hydrogen refueling stations on disaster response requirements. Given that their numbers are currently very small, the increases required under the CFO regulation could affect public agencies responsible for earthquake response requirements as well as responses required for prolonged outages of electric service potentially resulting from high wind events and other types of disasters.

Returning to issue 3, where ARB did indicate that potentially significant and unavoidable impacts could exist, one way to mitigate the risk associated with a hydrogen refueling station could be for the local lead agencies (which ARB states will be responsible for approving construction of those stations) to simply reject applications for station construction submitted by refiners subject to the CFO regulation precluding their ability to comply with the CFO regulation.”

Please refer to responses above (e.g., 8-1, 26-3) related to siting assumptions and applicable existing regulations.

The commenter also expresses that “As review of the CEC and DOE references cited above quickly indicates, there are different potential failure modes and hence risks associated with different hydrogen refueling station designs. Given this, another potential mitigation measure would be to dictate station design. Given that ARB’s economic model presented in Appendix E to the CFO ISOR indicates significant differences in the cost of station construction as a function of their design, these local lead agency actions could have significant impacts on the costs of compliance with the CFO regulation that CARB staff has failed to take into account.

This comment will be responded to in the FSOR for the CFO regulation. It does not pertain to the EA. However, please see response to 26-17.

With regards to the CFO Environmental Analysis Related to Hydrogen Production, “WSPA recommends ARB staff review the deficiencies and issues identified below and augment/correct them in the final regulatory documents.

As part of ARB’s Environmental Analysis for the Advanced Clean Cars Program (Appendix B to the Initial Statement of Reasons (ISOR) for the 2012 Proposed Amendments to the Clean Fuel Outlet (CFO) Regulation), the compliance response of increased hydrogen generation for fuel for fuel cell vehicles (FCVs) is recognized and discussed. The impacts associated with the compliance response are analyzed with respect to air quality but not with respect to greenhouse gas (GHG) emissions.

With respect to air quality, ARB concludes that compliance with CEQA would ensure that all impacts associated with the construction and operation of hydrogen production facilities are mitigated to a “…less-than-significant level”. However, it appears as discussed below that ARB ignored a number of factors in analyzing the air quality and GHG impacts associated with the required increase in hydrogen production for compliance with the CFO regulation."

Please refer to responses above (e.g., 8-1, 26-3) related to siting assumptions and applicable existing regulations.

The commenter expresses that "ARB's discussion of hydrogen production is embedded on pages 134 and 135 of the EA. ARB notes that compliance with the CFO requirements would require increases in the supply of up to 9.2% in the state's currently projected supply of merchant hydrogen. The EA also notes that increased hydrogen purity may also be required for merchant hydrogen to be suitable for use as fuel for FCVs. However, ARB does not indicate what percentage of currently available or forecast merchant hydrogen complies with the agency's existing specifications for hydrogen used an alternative motor vehicle fuel or what the environmental impacts associated with changes required at hydrogen production facilities to produce sufficiently pure hydrogen could be.

ARB also notes that pursuant to SB 1505, once statewide demand for hydrogen as a transportation fuel reaches certain levels, state law requires that 33.3 percent of this hydrogen be made from "eligible renewable resources as defined in subdivision (a) of section 399.12 of the Public Utilities Code." However, ARB provides no estimate of the current amount of hydrogen that is available that meets both this requirement as well as its motor vehicle fuel specifications and does not include any forecasted estimates.

Finally, ARB assumes the required hydrogen will be available (and in its economic analysis, at prices equivalent to those associated with local production at centralized steam methane reforming facilities). However, no basis is provided for that assumption."

This comment is the same as comments 8-1 and 26-3. Please refer to responses above (e.g., 8-1, 26-3) related to siting assumptions and applicable existing regulations.

The commenter expresses that the "first problem with the ARB analysis is the assumption that all potential air quality impacts will be mitigated to be non-significant as a result of the need for CEQA compliance, and the simultaneous assumption that all of the increase in hydrogen production capacity required for CFO compliance will occur in a timely fashion.

Looking first at central hydrogen production facilities producing local merchant hydrogen, ARB has provided no evidence that refiners either have direct control over these plants or that refiners can somehow compel the expansion of their capacity. Therefore, the decision with regard to whether or not to expand hydrogen production will likely be made based on economics by the plant owner who will factor the costs of CEQA compliance into that analysis and may well conclude that expansion does not make economic sense, particularly in areas such as the South Coast Air Basin where necessary emissions offsets are difficult to obtain or expensive. If merchant hydrogen meeting ARB's hydrogen fuel specifications is in short supply, costs will likely rise and to the extent that supply is unable to satisfy FCV demand, FCV owners would have to turn to other modes of transportation, most likely conventional vehicles with the result being increases in emissions of both air pollutants as well as GHG emissions.

Similarly, existing merchant hydrogen plants are subject to the AB32 cap-and-trade regulation, which will likely require reductions in GHGs from those plants. Expansion of those plants would increase GHG emissions and force plant operators to purchase additional offsets. Again, this fact would be accounted for in the economic decision-making of hydrogen plant owners and tend to discourage decisions to increase capacity.

ARB also fails to identify the potential impacts of the need to increase hydrogen supply and the specific production methods used on hydrogen prices which in turn may have environmental impacts. As noted by the California Hydrogen Highway Network (see Attachment H) and as CARB staff is aware, the cost of hydrogen produced by different methods varies dramatically, in this case ranging from $1.44 to more $7.00 per kilogram. As hydrogen fuel prices will be related to the marginal cost of the source of the last increment of hydrogen needed to satisfy demand, it is crucial that CARB identify the sources of supply it assumes will be added to satisfy the increased demand. The price of hydrogen will be critical to decisions made regarding supply increases and also to FCV purchase decisions made by consumers."

This comment is the same as comments 8-1 and 26-3. Please refer to responses above (e.g., 8-1, 26-3) related to siting assumptions and applicable existing regulations.

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Miles T. Heller
Senior Advisor, Regulatory Fuels Issues

BP West Coast Products LLC
4 Centerpointe Drive
La Palma, California 90623-2503

January 25, 2012

California Air Resources Board
1001 I Street
Sacramento, CA

Re: BP West Coast Products, LLC Comments on the Clean Fuels Outlet Regulation for public hearing at the January 26-27 CARB Board Meeting

Dear Chairwoman Nichols and board members:

The proposed amendment to the Clean Fuels Outlet regulation (CFO)is a legally tenuous, heavy-handed, fundamentally flawed attempt to direct private investment in the most inappropriate and unjustified manner. The regulation and proposed amendments compel private companies to invest hundreds of millions of dollars in infrastructure to manufacture, distribute and sell a product that they do not currently produce and, based on all evidence thus far, consumers are unwilling to buy. Ostensibly, the CFO is designed to promote zero emission vehicles in furtherance of California environmental policy. Yet, the facts clearly show that hydrogen fuels and vehicles are high cost options and not zero carbon. Forcing private companies to invest in high cost infrastructure that may not be used does nothing to advance the environmental interests of California. Accordingly, CARB should reject this proposal as fundamentally flawed public policy. 1

BP recently celebrated 100 years in business and we plan to be in the business of selling transport fuels for the next hundred years. To be successful in the long run, our products have to be increasingly sustainable, lower in carbon and ultimately accepted by consumers without subsidy. To that end, we are constantly looking at the future of all transport fuels – with a short, mid and long term investment horizon.

BP was one of the largest investors in hydrogen fueling research, demonstration and infrastructure build-out. We have built, in partnership with others, 15 hydrogen fueling sites around the world. Five of those sites have been in California. The most recent one - the so-called SMUD site along highway 50 – was built for renewable generation of hydrogen. That site is now closed for lack of use.

BP has extensive experience in siting, constructing and operating hydrogen fueling stations. In additional to our global research and siting experience, we actively participated in the California Fuel Cell Partnership for six years. Our detailed research and experience has led us to the conclusion that hydrogen for transport will not be a viable transportation pathway in the long term, if

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ever. BP is instead focusing on what we believe to be more viable pathways – including advanced low carbon biofuels used in highly efficient conventional engines and vehicle hybridization.

"In order to get significant [hydrogen fuel] deployment, you need four significant technological breakthroughs.... If you need four miracles that's unlikely: saints only need three miracles". Dr. Stephen Chu, US Secretary of Energy, Interview with MIT's Technology Review, May 14, 2009.

There are many barriers to the hydrogen future as alluded to by Secretary Chu. First, on a well to wheels (WtW) basis, hydrogen fuel has a higher carbon footprint than electric vehicles and hybrid vehicles since the fuel would likely be reformed from natural gas. Despite the renewable hydrogen requirements of SB1505, there is no certainty that renewable hydrogen will be available is sufficient quantities, or at a reasonable price, during the period covered by this regulation.

Second, the extremely high costs of the hydrogen vehicle's fuel cell and storage tank make vehicle costs prohibitive. BP estimates that the current cost of an FVC is about $180,000 (for a 60kW fuel cell module). Moreover, BP sees little prospect for significant technology cost reductions gleaned from learning that accompany "doublings" of manufacturing capacity. In order to achieve the Department of Energy's fantasy cost target of $51 per kW (at production of 500,000 units), there would need to be 18 "doublings" of capacity via production of over 6 million FVCs, with an extremely aggressive and unlikely experience curve factor of 80%. BP estimates that the subsidies required to manufacture the first one million FVCs will range between 29 and 67 billion dollars, far greater than the approximately 14-16 billion dollars in subsidies required to produce electric vehicles. 1 cont'd

Finally, BP does not believe that anticipated hydrogen fuel cost savings will offset the higher fixed costs of making a FCV. Assuming natural gas prices at $4.00 per mmbtu and other costs associated with the hydrogen production and fuelling infrastructure, we estimate the cost of hydrogen would be between $5 and $7 per kg, A kilogram of hydrogen in energy terms is equivalent to one gallon of gasoline. Therefore, unlike hybrid and plug-in hybrid vehicles where the cost of fuel is lower than for a conventional gasoline vehicle, for a fuel cell vehicle the cost of fuel will be higher than a conventional gasoline vehicle. Therefore an FCV user won't have a chance to recoup some or all of the higher vehicle cost through lower fuel costs.

Our decision to exit the hydrogen for transport business was made at the highest levels of the company and supported by significant on-the-ground experience and research. At the time we exited the business, BP's hydrogen efforts exceeded the efforts of all other energy corporations in the U.S. combined. Furthermore, we are not aware of any company that invested more in California hydrogen fueling at the time of our exit.

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We believe it is extremely perilous for policymakers, including CARB, to believe that they can pick and choose technology winners and losers better than the open marketplace – and to compel private investment in fledgling, unproven technology. Policymakers do not have a good track record for picking winners and losers in technology or fuels. CARB has seemingly understood this concept in their design and promotion of the LCFS. CARB members have touted the LCFS as performance based and fuel neutral. For all its faults – the LCFS at least recognizes the benefits of letting the market pick winners and strives for neutrality. It is incongruous, to say the least, for CARB with one hand to tout the benefits of a technology neutral fuels policy, while with the other hand plucking a single technology out of that "fuel neutral" policy and in the most heavy-handed way, mandating its deployment.

CARB staff has chosen to overlook the fact that there are entities who are voluntarily investing in this infrastructure and companies that will directly benefit from development and deployment of these technologies (Linde, Air Products, etc.). These companies have been most involved in the AB118 grants for refueling stations in California – and have been involved in hydrogen infrastructure build out in other countries. Rather than compel unwilling investment in this technology, CARB should work with those who are interested in deploying the technology to remove the hurdles to more investment.

1 cont'd

CARB staff argue that the vehicle manufacturers have invested billions of dollars in alternative fuel drive trains and now the fuel providers must do likewise. This alleged parity ignores the billions of dollars the oil industry has spent over the years on reformulated fuels (multiple times) pursuant to CARB's regulations; and the billions more estimated to be spent to comply with the California LCFS and the federal Renewable Fuels Standard. At the same time, CARB now wants to require the industry to spend more money to displace the same fuel we have invested in reformulating.

Fuel providers and station owners deserve the fundamental protection and the freedom to elect the business opportunities in which they choose to invest. As staff has acknowledged, most retail stations are no longer owned and operated by the fuel providers and even further divestments by refiners/importers are anticipated. The amended regulation requires fuel providers develop and invest in hydrogen fuel outlets and presumes that this will occur on other people's property. Most retail stations are owned by an individual who only owns one station with an annual net income of about $40,000 on a national basis. The owner could face significant business loss from the lack of on-going hydrogen fuel sales should the vehicles not materialize, or from displaced business when forced to site the hydrogen equipment.– or more significantly, if the plot space required for the hydrogen storage and dispensing infrastructure requires displacement of conventional fuel dispensers, convenience store space, car washes and the concomitant loss of associated revenue.

In another scenario, retail station owners may deny access for fuel providers to construct and operate hydrogen dispensing facilities. In this case, infrastructure

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required by this regulation would have to be built and operated at new retail sites – adding substantially to the costs and environmental impacts of the proposal. This potential outcome is completely ignored by staff.

The CFO would require fuel providers to commit hundreds of millions of dollars based on very uncertain projections of vehicle sales from vehicle manufacturers. The Clean Car rule appears to be a flexible, performance-based approach which results in giving automakers choices in which technologies they use to comply. In theory, the LCFS is supposed to be the equivalent, performance-based regulation for fuel providers –and the mechanism by which the market will deliver the most efficient lower carbon fuels However, CARB has chosen to take the unprecedented step of regulating one sector based on the choices and whims of another sector. As previously stated, the CFO would require refiners and importers to invest hundreds of millions of dollars based on projections – not actual vehicle sales – by automakers. This means CARB is requiring refiners and importers to invest based on the compliance pathway that automakers may choose to take. Ultimately, automakers may not chose the pathway (without penalty), consumers may choose not to purchase the vehicles, or automakers may choose to take advantage of the regulation's provision (travel provision) that allows them to comply by delivering these vehicles outside of California – even though the regulation would require build out of fueling infrastructure within California.. What is CARB's plan to reimburse refiners and importers should the investments in fueling infrastructure be required and the cars don't show up? What is CARB's plan to reimburse operators of fueling outlets should they continue to operate at a loss (whether or not the cars show up)?

1 cont'd

While the latest version of the regulation adds a penalty for car companies who do not produce 80% of the number of vehicles they projected, the penalty is inconsequential ($35,000) compared to the cost of building and operating even a single hydrogen fueling outlet (let alone the 500 required by the regulation); and the penalty is only based on what is manufactured and not what is sold to a customer. Moreover, fuel providers are subjected to a penalty of $35,000 or higher for every day that the station is late in coming on-line or not operating properly. A single problem or missed deadline could result in penalties an order of magnitude higher than what CARB proposes to levy on the auto manufacturers.

CARB staff and vehicle manufacturers claim that the underlying surveys and projections are accurate, however, the projections are all based on secret discussion between CARB and individual automakers. None of the assumptions that go into these projections, nor the individual automaker projections have been publicly made available – yet CARB is compelling hundreds of millions of dollars of private investment based on these secret projections. Recent experience involving battery electrical vehicles suggests that there should be considerable skepticism leveled at automaker projections of sales of these new technologies. Fuel providers and retail station operators should not be required to invest, construct, and operate such facilities with this

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level of uncertainty. There is no discussion in the regulation regarding the probability and circumstances associated with stranded assets.

BP's recommendations for a sound policy and regulatory approach

- Due to the early stages of development of hydrogen for transport, policy should focus on helping those who are interested in and will benefit from deployment of this technology. Policy should not force unwilling participants into this business.
- Continue public funding of retail stations through programs like AB118 and ensure that in the AB118 reauthorization process, adequate money is allocated for hydrogen refueling stations in the geographic areas desired. The public should share in the risk of this early commercialization phase.
- Seek public-private partnerships and creative financing approaches to extend the use of the public money in contrast to the grant programs that are prevalent now.
- Seek incentives for fleet conversions (public and private) that reward operators who make their fueling facilities accessible to the public. 1 cont'd

In addition to the overarching policy concerns expressed above, BP has concerns about specific regulatory language and the supporting staff documentation for the regulation that is included in an appendix to this letter. BP also supports the comments submitted by the Western States Petroleum Association (WSPA) In summary, BP recommends that the board oppose the proposed CFO amendment, direct staff to rescind current regulation, and pursue the public incentive based concepts outlined above. BP appreciates CARB's consideration of these comments regarding the CFO regulation and we look forward to your response.

Sincerely,

Miles T. Heller
Senior Advisor, Regulatory Fuels Issues

c.c w/attachment.

CARB Board Members
CARB Executive Officer
Tom Cackette – CARB
Analisa Bevon – CARB
Leslie Goodbody - CARB

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APPENDIX 1

Regulatory Order

1. The regulation defines a major refiner/importer as being an entity that produces or imports more than 32,616 bbl/day (based on 500 mmgl/year) and then applies the requirements for retail outlets to major refiner/importers. However, CARB proposes to use BOE data based on sales volume for determining the percentage of outlets assigned to a particular company. To be consistent with the definition of producer/importer, and other CARB regulations like the AB32 Admin Fee regulation, the basis for share of regulatory burden should be the volume a company produces and imports.

2. Both the current and the existing regulation includes provisions for fleets. It is assumed that 25% (subject to change) of fleet vehicle fuel demand will be provided by retail outlets so this quantity plays into the calculation for number of stations. What basis did CARB use to determine 25% factor? 1 cont'd

3. The regulation is very prescriptive regarding station requirements including a requirement to provide H2 at both 5,000 psi and 10,000 psi. It is our understanding that the 10,000 psi pressure is likely the preferred pressure going forward. It would be best to standardize on one pressure to prevent customer confusion and to bring more consistency to costs. BP suggests CARB analyze the cost increment of offering two pressures as opposed to just one.

4. Please confirm that while CARB utilizes 400 kg/day to determine a retail station count based on projected hydrogen demand, CARB does not specify that all stations must be 400 kg/day. If CARB is specifying this capacity per retail station, it needs to be clear in the regulatory language and CARB must analyze the costs, with ample contingency, of a 400 kg/day refueling station which notably is larger than any station built to date in California.

5. While it is helpful that CARB provide notification nearly 3 years in advance, this can contribute to less accurate projections. It appears that CARB will reconcile progress on the annual projections about 2 years out and make adjustments to the retail station counts. BP suggests that this same exercise also be done about 12 months ahead of when stations are required. Furthermore, stations should be able to be installed and brought on-line ratably across the calendar year in which they are required. This is necessary to ensure that engineering and construction resources are available. In addition, both of these changes will help ensure that the stations built most closely match vehicle roll-out and anticipated fuel demand.

6. It appears that existing retail stations not owned by producers/importers are accounted for against the projected need if they meet the design standards and pledge to operate for a year. In addition, stations owned/operated by third parties can be 'constructively allocated' to obligated parties under this regulation for credit under specified conditions. BP suggests that any stations

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funded by AB 118, or similar public incentive funds, be credited up-front, with little restriction, to ensure that these stations are used fully before incremental stations are required by the regulation.

7. The regulation requires that if a subsequent calculation shows no incremental retail stations are required, then the existing stations have to remain in operation. However, this section does not define how long. There needs to be a finite amount of time that stations are required to be kept open when the vehicles and fuel demand are not progressing. The ISOR indicates 1-year of O&M costs (page 62) in this scenario where stations shutdown and are decommissioned. For consistency, the time horizon for continued operation of under-utilized retail stations should be no longer than 1-year in the regulation.

8. The regulation provides for very limited relief from operating requirements under breakdown provisions. However, it appears that there is no relief when construction and start-up of stations is delayed. This can occur for a number of reasons beyond the control of the regulated party – for example, permitting delays, equipment availability and delivery. Language outlining a procedure should be added to enable companies to avoid penalties when there are circumstances beyond their control occur.

1 cont'd

9. The regulation contains penalty provisions, including a new provision to penalize an OEM that does not deliver (vs. sale) 80% of the vehicles they projected. While adding a penalty for OEMs that do not make their projections is a good step, this proposal does not go far enough. First, it is preferable that it be based on amount sold since it is vehicles sold that will generate the fuel demand to enable stations to recover their costs. If CARB retains the provision based on delivered vehicles, then it should be based on 100% of their projections and not 80% projections. There are substantial per day penalties also for refiner/importers who do not complete the stations in time, or do not operate them in accordance with the standards (barring breakdowns/malfunctions covered in other parts of the reg). However, the penalty for the OEMs is a small fine only assessed each time a projection is missed – not per vehicle or per day that the OEM fails to deliver or sell a vehicle. The penalty provisions should comparably penalize the OEMs to what is proposed for retail stations.

ISOR

1. The regulation contemplates the option to fulfill the requirements with a stand-alone hydrogen fueling station in lieu of equipping existing retail sites. In fact, if no retail station owners allow a fuel provider to build and operate a dispenser on their site, all fueling infrastructure required by this regulation would have to be built on new sites – incurring huge incremental costs relative to the premise of the regulation. Do the analyses include the additional costs (land and other improvements) required to build a freestanding station? Do the environmental analyses include the consideration of additional impacts for the construction, traffic, etc. for such stations?

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2. The ISOR asserts (on page 2) that hydrogen vehicle roll-out is hampered by the lack of publically available hydrogen refueling infrastructure. The citation referenced to substantiate this assertion is a New York Times Article (footnote 2). Is the staff really using a newspaper article citation as justification for compelling private entities to invest hundreds of millions of dollars ahead of market demand? Perhaps the article cited includes underlying data or studies, but those primary references should be included in the staff analysis – not a newspaper article.

3. On page 11, CARB staff discusses additional future stations funded by AB118 and that stations are required to operate for a minimum of 3 years. After 3 years, if a station elects to shutdown, it is unclear whether the regulators are going adjust the number of stations that are required to be constructed and operated under CFO. If it is anticipated that parties regulated under CFO (fuel providers) will be required to operate an unprofitable station beyond the 3 years, what incentive does the current owner/operator have to try and stay in business. Fuel providers should not be required to "take-over" or make-up the capacity of AB118 funded stations that fail. Moreover, if stations are failing, this suggests lack of demand for the vehicles and fuel – necessitating a system-wide review of the need or wisdom of the CFO regulation. 1 cont'd

4. On page 24, we would appreciate confirmation that when the projections for each year are added together that these are the incremental projections for each year and that there is no double-counting of vehicles. This is not clear in the staff report or the regulation. Similarly, it is not clear why the 1/3rd factor is used for the year that is three years prior to the year that is being projected. Since this factor is applied during that year that the forward-looking projection is being made, it would seem logical that the amount of vehicles actually sold in the first part of the year should be extrapolated over the balance of the year verses using one-third of a dated projection value.Date

CFO – L27 Response

27-1 The commenter supports the comments submitted by WSPA. Appendix 1 under the ISOR heading of the comment letter inquires “Do the environmental analyses include the consideration of additional impacts for construction, traffic, etc. for such stations?”

Please refer to responses CFO – L26. Regarding the EA and the impact analysis, Chapter 5 “Impacts and Mitigation” provides a full analysis of potential impacts that may result from establishment of CFO facilities and identifies mitigation.

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MEETING

STATE OF CALIFORNIA

AIR RESOURCES BOARD

METROPOLITAN WATER DISTRICT OF

SOUTHERN CALIFORNIA

BOARD ROOM

700 NORTH ALAMEDA STREET

LOS ANGELES, CALIFORNIA

FRIDAY, JANUARY 27, 2012

8:52 A.M.

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Ms. Mary Nichols, Chairperson

Ms. Sandra Berg

Ms. Doreene D'Adamo

Mr. Hector De La Torre

Mr. Ronald Loveridge

Mrs. Barbara Riordan

Dr. Daniel Sperling

Mr. Ken Yeager

STAFF

Mr. James Goldstene, Executive Officer

Mr. Tom Cackette, Chief Deputy Executive Officer

Mr. Bob Fletcher, Deputy Executive Officer

Ms. Lynn Terry, Deputy Executive Officer

Ms. Mary Alice Morency, Board Clerk

Ms. Anna Wong, Air Pollution Specialist, Zero-Emission Vehicle Implementation Section, MSCD

ALSO PRESENT

Mr. Jay Bajaria

Mr. Harvey Eder

Mr. Edward Olson

INDEX

PROCEEDINGS

CHAIRPERSON NICHOLS: Before we get started, I want to try to clarify where we are.

This is day two of our January Board meeting, and it's a continuation of the proceeding that we began yesterday dealing with the Advanced Clean Cars Program.

Yesterday, at the end of the day, or very close to the end of the day, I announced the record was closed because I believed that we had gone through the entire list of witnesses and that everyone who had signed up to testify had either testified or decided not to testify.

It turned out that there was some confusion on the part of two people who signed up who thought that when I indicated that we would be going over a second day that meant they could come back and testify. And so in the interest of keeping this proceeding as open as possible, I have agreed that they could come back today and that we would reopen the record for the very limited purpose of allowing those individuals to testify, which they would have done if they hadn't been confused. So I think it's just cleaning up an error that was made. And I don't believe that means that we need to or that we should reopen the record, otherwise, there would be no end. People could keep coming with more new ideas. So that's going to be the first thing we're going to do.

But right now what I'm going to do is call the meeting to order. And we'll do the Pledge of Allegiance as we normally do, and the roll call. And then we'll just get going.

(Thereupon the Pledge of Allegiance was
Recited in unison.)

CHAIRPERSON NICHOLS: The Clerk of the Board will please call the roll.

BOARD CLERK MORENCY: Dr. Balmes?

BOARD MEMBER BALMES: Here.

BOARD CLERK MORENCY: Ms. Berg?

BOARD MEMBER BERG: Here.

BOARD CLERK MORENCY: Ms. D'Adamo?

BOARD MEMBER D'ADAMO: Here.

BOARD CLERK MORENCY: Mr. De La Torre?

BOARD MEMBER DE LA TORRE: Here.

BOARD CLERK MORENCY: Mayor Loveridge?

BOARD MEMBER LOVERIDGE: Here.

BOARD CLERK MORENCY: Mrs. Riordan?

BOARD MEMBER RIORDAN: Here.

BOARD CLERK MORENCY: Supervisor Roberts?

Dr. Sherriffs?

Professor Sperling?

BOARD MEMBER SPERLING: Here.

BOARD CLERK MORENCY: Supervisor Yeager?

BOARD MEMBER YEAGER: Here.

BOARD CLERK MORENCY: Chairman Nichols?

CHAIRPERSON NICHOLS: Here.

BOARD CLERK MORENCY: Madam Chairman, we have a quorum.

CHAIRPERSON NICHOLS: Let's then continue the public hearing, which as everybody will recall is dealing with amendments to the California greenhouse gas and criteria pollutant exhaust and evaporative emissions standards and test procedures. I won't read out the whole rest of what it is. It's a package of rules that we're working on.

And here are the two names of the people who left yesterday under the mistaken belief that the record was going to be open, Edward Olson and Jay Bajaria. If you would come forward and we will give you each the three minutes that you would otherwise have been entitled to. So whichever order you'd like to speak in, there is a podium right here.

MR. OLSON: Board members, my name is Edward Olson with (inaudible) Enterprises. I have been in gas station business and car wash business over 30 years, owning several gas stations in both Orange County and San Diego county.

Olsen

The first major concern I had with hydrogen pumps is the safety of my customers and employees. The pumps will contain like 5,000 to 10,000 PSI. The risk of explosion, especially with the customers is using a cell phone while pumping or if a customer forget the nozzle in their car and drive off is very scary.

We live in a busy and fast-paced world, and we have this issue of people driving off with the nozzles occur often at my stations. If this occur with the hydrogen pump, this will not only be costly to the place but can be extremely dangerous to my station and to the customers of our stations.

The second major concern I have is the time it will take to install the pumps and how much business it will lose during construction. I may have to shut down for some time and install them. And even if I can't stay open, the space would take by the construction would be a big inconvenience to my customers and it may drive them away.

A gas station that has installed hydrogen pumps in south Orange County was shut down for over a year during construction. This be very bad to my business and my ability to provide to my family.

The final concern I have is the lack of demand for the product. It's not economically feasible for a gas station owner like myself to take up real estate and tank

Olsen cont'd

space to commit to hydrogen pumps. Currently, very few manufacturers are making cars that run on hydrogen. If there is a high business demand, let the market decide the need. For us, adding these pumps, the government shouldn't be forcing small business owners, such as myself, to place unnecessary and unwanted pumps in my station.

Olsen cont'd

Thank you very much.

CHAIRPERSON NICHOLS: Okay. Thank you, Mr. Olson.

Ms. D'Adamo.

Before you go, excuse me, if you could stay for just a second.

BOARD MEMBER D'ADAMO: I just wanted to say, there have been a number of small business owners that have provided similar testimony. And I don't see anything in this regulation where you would be required to install this infrastructure. And I think you're absolutely correct; that small business owners should not be required to do so.

So I hope you leave today with maybe a little more assurance that this regulation is -- the purpose of it is to provide an incentive for a small number of these projects to begin with. Hopefully, you can continue to follow it and have your fears alleviated somewhat.

Olsen cont'd

MR. OLSON: Thank you.

CHAIRPERSON NICHOLS: Mr. Bajaria.

Bajaria

MR. BAJARIA: Let me first thank all members of the Board for hearing my comments.

Hello. My name is Jay Bajaria. I own several gas stations with full service car washes in Los Angeles.

Let me start by saying I'm just as much in favor of having clean air as anybody here. However, I believe there is a right way to achieve it and a wrong way to achieve it. At my gas station, the primary profit center is the car wash. For me to install hydrogen in my locations require me to close down the car wash to accommodate the footprint of the hydrogen equipment. Effectively, this will put me out of business.

Business owners should be able to determine what they do sell and what they don't sell. It should be at the discretion of the business owner whether or not he or she takes existing space and dedicates it to a product that has no demand as of yet.

And as for the safety of hydrogen, I would not be comfortable having it on my property from a safety and liability perspective. Often see cars driving away from the pump with the nozzle in their car. I can only imagine the damage and destruction that would be caused by a car driving off with a hydrogen nozzle that is under pressure

Bajaria cont'd

up to 10,000 PSI.

I would ask that you please let business owners and property owners to decide what services to provide rather than forcing it on them.

Thank you for your time.

CHAIRPERSON NICHOLS: Thank you for coming back and for taking the time. It's been helpful to us to hear these concerns, because I think someone has been out attempting to convince people that this regulation that we're considering would have the effects that you're talking about. And I have to agree with Ms. D'Adamo that there's absolutely nothing in this rule that would require you or any other service station owner to install hydrogen on your property. There is nothing in the rule. Let me say it as clearly as I possibly can that would require any service station to have hydrogen on their property that didn't want it.

And the other thing I would say, by the way, is that we also agree with you very strongly that hydrogen, as with gasoline, is a fuel that requires very careful handling. And we do not want to be and don't intend to be a party to anything that is going to increase safety risks. I don't think we would be allowed to be, even if we wanted to, because unfortunately there are other agencies in state government and local fire marshals, et

Transcript – Oral Public Comments and Responses

Edward Olson

The commenter expresses "I have been in gas station business and car wash business over 30 years, owning several gas stations in both Orange County and San Diego County. The first major concern I had with hydrogen pumps is the safety of my customers and employees. The pumps will contain like 5,000 to 10,000 PSI. The risk of explosion, especially with the customers is using a cell phone while pumping or if a customer forgets the nozzle in their car and drive off is very scary. We live in a busy and fast-paced world, and we have this issue of people driving off with the nozzles occur often at my stations. If this occurs with the hydrogen pump, this will not only be costly to the place but can be extremely dangerous to my station and to the customers of our stations."

Jay Bajaria

The commenter expresses "...And as for the safety of hydrogen, I would not be comfortable having it on my property from a safety and liability perspective. Often see cars driving away from the pump with the nozzle in their car. I can only imagine the damage and destruction that would be caused by a car driving off with a hydrogen nozzle that is under pressure up to 10,000 PSI. I would ask that you please let business owners and property owners to decide what services to provide rather than forcing it on them. .

ARB agrees that hydrogen, as with gasoline, is a fuel that requires very careful handling. The EA Environmental and Regulatory Setting chapters describe hazards associated with hydrogen as well as all applicable laws and regulations. The EA starting at page 158 discloses that the project could potentially create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment and that this impact would be potentially significant. This EA found that this impact could be reduced to a less-than-significant level by mitigation that can and should be implemented by local lead agencies, but the authority to impose mitigation is beyond the authority of the ARB. The potential for hazard related to customers driving off with the nozzle still attached would be alleviated because the cars and fueling stations are designed so that they communicate electronically (e.g. when there is a fueling connection, the car and pump communicate electronically and cannot be started up) minimizing the potential for adverse impact.

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ATTACHMENT A-1

FINAL REGULATION ORDER

Amendments to Sections 1900, 1956.8, 1960.1, 1961, 1961.1, 1965, 1968.2, 1968.5, 1976, 1978, 2037, 2038, 2062, 2112, 2139, 2140, 2145, 2147, 2235, and 2317, and
Adoption of new Sections 1961.2 and 1961.3,
Title 13, California Code of Regulations

Set forth below are the proposed amendments to title 13 of the California Code of Regulations. Amendments to existing section proposed and subject to comment in this rulemaking are shown in underline to indicate additions and ~~strikeout~~ to indicate deletions. Subsections for which no changes are proposed in this rulemaking are indicated with [No change] or "* * * *". Sections 1961.2 and 1961.3 are new sections, shown without underline for easier reading.

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1. Amend title 13, CCR, section 1900 to read as follows:

§ 1900. Definitions.

* * * *

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

* * * *

(9) "Intermediate volume manufacturer" means any pre-2001 model year manufacturer with California sales between 3,001 and 60,000 new light- and medium-duty vehicles per model year based on the average number of vehicles sold by the manufacturer each model year from 1989 to 1993; any 2001 through 2002 model year manufacturer with California sales between 4,501 and 60,000 new light- and medium-duty vehicles per model year based on the average number of vehicles sold by the manufacturer each model year from 1989 to 1993; ~~and~~ any 2003 ~~and subsequent~~ through 2017 model year manufacturer with California sales between 4,501 and 60,000 new light- and medium-duty vehicles based on the average number of vehicles sold for the three previous consecutive model years for which a manufacturer seeks certification; and any 2018 and subsequent model year manufacturer with California sales between 4,501 and 20,000 new light- and medium-duty vehicles based on the average number of vehicles sold for the three previous consecutive model years for which a manufacturer seeks certification. For a manufacturer certifying for the first time in California, model year sales shall be based on projected California sales. 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.

For purposes of applying the 2005 ~~and subsequent~~ through 2017 model year zero-emission vehicle requirements for intermediate-volume manufacturers under section 1962(b) or 1962.1(b), as applicable, the annual sales from different firms shall be aggregated in the case of (1) vehicles produced by two or more firms, each one of which either has a greater than 50% equity ownership in another or is more than 50% owned by another; or (2) vehicles produced by any two or more firms if a third party has equity ownership of greater than 50% in each firm.

For purposes of applying the 2009 ~~and subsequent~~ through 2016 model year Greenhouse Gas requirements for intermediate volume manufacturers under section 1961.1, the annual sales from different firms shall be aggregated in the following situations: (1) vehicles produced by two or more firms, each one of which either has a greater than 10% equity ownership in another or is more than 10% owned by another; or (2) vehicles produced by any two or more firms if a third party has equity ownership of greater than 10% in each firm.

For the 2018 and subsequent model years, 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 33.4% or greater part owned by another; or (2) vehicles produced by any two or more firms if a third party has equity ownership of 33.4% 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 any firms where the vehicles are manufactured by the same entity and the importer or distributor is an authorized agent of the entity.

* * * *

(22) "Small volume manufacturer" means, with respect to the 2001 and subsequent model-years, a manufacturer with California sales less than 4,500 new passenger cars, light-duty trucks, medium-duty vehicles, heavy-duty vehicles and heavy-duty engines based on the average number of vehicles sold for the three previous consecutive model years for which a manufacturer seeks certification as a small volume manufacturer; however, for manufacturers certifying for the first time in California model-year sales shall be based on projected California sales. 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. Except as provided in the next paragraph, ~~beginning with~~ for the 2009 through 2017 model years, 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; 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~~ any firms where the vehicles are manufactured by the same entity and the importer or distributor is an authorized agent of the entity. Notwithstanding the provisions of this paragraph, upon application to the Executive Officer, a manufacturer may be classified as a "small volume manufacturer" for the 2015 through 2017 model years if the Executive Officer determines that it is operationally independent of the firm that owns 10% or more of the applicant or has a greater than 10% equity ownership in the applicant based on the criteria provided in the last paragraph of this subsection (b)(22).

For purposes of compliance with the zero-emission vehicle requirements, heavy-duty vehicles and engines shall not be counted as part of a manufacturer's sales. For purposes of applying the 2005 ~~and subsequent~~ through 2017 model year zero-emission vehicle requirements for small-volume manufacturers under sections 1962(b) and 1962.1(b), the annual sales from different firms shall be aggregated in the case of (1) vehicles produced by two or more firms, each one of which either has a greater than 50% equity ownership in another or is more than 50% owned by another; or (2) vehicles produced by any two or more firms if a third party has equity ownership of greater than 50% in each firm. Notwithstanding the provisions of this paragraph, upon application to the Executive Officer, a manufacturer may be classified as a "small volume manufacturer" for the 2015 through 2017 model years if the Executive Officer determines that it is operationally independent of the firm that owns 50% or more of the applicant or has a greater than 50% equity ownership in the applicant based on the criteria provided in the last paragraph of this subsection (b)(22).

Except as provided in the next paragraph, for the 2018 and subsequent model years, 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 33.4% or greater part owned by another; or (2) vehicles produced by any two or more firms if a third party has equity ownership of 33.4% 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 any firms where the vehicles are manufactured by the same entity and the importer or distributor is an authorized agent of the entity. Notwithstanding the provisions of this paragraph, upon application to the Executive Officer, a manufacturer may be classified as a "small volume manufacturer" for the 2018 and subsequent model years if the Executive Officer determines that it is operationally independent of the firm that owns 33.4% or more of the applicant or has a greater than 33.4% equity ownership in the applicant based on the criteria provided in the last paragraph of this subsection (b)(22).

For the purposes of this paragraph, all manufacturers whose annual sales are aggregated together under the provisions of this subsection (b)(22) shall be defined as "related manufacturers." Notwithstanding such aggregation, the Executive Officer may make a determination of operational independence if all of the following criteria are met for at least 24 months preceding the application submittal: (1) for the three years preceding the year in which the initial application is submitted, the average California sales for the applicant does not exceed 4,500 vehicles per year; (2) no financial or other support of economic value is provided by related manufacturers for purposes of design, parts procurement, R&D and production facilities and operation, and any other transactions between related manufacturers are conducted under normal commercial arrangements like those conducted with other parties, at competitive pricing rates to the manufacturer; (3) related manufacturers maintain separate and independent research and development, testing, and production facilities; (4) related manufacturers do not use any vehicle powertrains or platforms developed or produced by related manufacturers; (5) patents are not held jointly with related manufacturers; (6) related manufacturers maintain separate business administration, legal, purchasing, sales, and marketing departments, as well as autonomous decision-making on commercial matters; (7) the overlap of the Board of Directors between related manufacturers is limited to 25% with no sharing of top operational management, including president, chief executive officer, chief financial officer, and chief operating officer, and provided that no individual overlapping director or combination of overlapping directors exercises exclusive management control over either or both companies; and (8) parts or components supply between related companies must be established through open market process, and to the extent that the manufacturer sells parts/components to non-related manufacturers, it does so through the open market a competitive pricing. Any manufacturer applying for operational independence must submit to ARB an Attestation Engagement from an independent certified public accountant or firm of such accountants verifying the accuracy of the information contained in the application, as defined by and in accordance with the procedures established in 40 C.F.R. §80.125, as last amended January 19, 2007, which is incorporated herein by reference. The applicant must submit information to update any of the above eight criteria as material changes to any of the criteria occur. If there are no material changes to any of the criteria, the applicant must certify that to the Executive Officer annually. With respect to any such changes, the Executive Officer may consider extraordinary conditions (e.g., changes to economic conditions, unanticipated market changes, etc.) and may continue to find the applicant to be operationally independent. In the event that a manufacturer loses eligibility as a “small volume manufacturer” after a material change occurs, the manufacturer must begin compliance with the primary emissions program in the third model year after the model year in which the manufacturer loses its eligibility. The Executive Officer may, in his or her discretion, re-establish lost “small volume manufacturer” status if the manufacturer shows that it has met the operational independence criteria for three consecutive years.

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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.

2. Amend title 13, CCR, section 1956.8 to read as follows:

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

* * * *

(b) The test procedures for determining compliance with standards applicable to 1985 and subsequent model heavy-duty diesel engines and vehicles and the requirements for participating in the averaging, banking and trading programs, are set forth in the "California Exhaust Emission Standards and Test Procedures for 1985 through 2003 Model Heavy-Duty Diesel-Engines and Vehicles, " adopted April 8, 1985, as last amended December 12, 2002, the "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles," adopted December 12, 2002, as last amended ~~October 12, 2011~~ [insert date of amendment for this rulemaking], and the "California Interim Certification Procedures for 2004 and Subsequent Model Hybrid-Electric Vehicles, in the Urban Bus and Heavy-Duty Vehicle Classes," adopted October 24, 2002, which are incorporated by reference herein.

* * * *

(c)(1)(B) The exhaust emissions from new 2005 and subsequent model heavy-duty Otto-cycle engines, except for Otto-cycle medium- and heavy-duty engines subject to the alternative standards in 40 CFR §86.005-10(f), shall not exceed:

California Emission Standards for 2005 and Subsequent Model Heavy-Duty Otto-Cycle Engines[A]

(in g/bhp-hr)

Model Year	*Emission Category*	*NMHC + NOx*	*NMHC*	*NOx*	*CO*[~~F~~G]	*HCHO*	*PM*
Standards for Heavy-Duty Otto-Cycle Engines Used in 2005 through 2019 Model Incomplete Medium-Duty Vehicles 8,501 to 10,000 ~~14,000~~ pounds GVW[B] and 2005 and Subsequent Model Incomplete Medium-Duty Vehicles 10,001 to 14,000 pounds GVW[C]							
2005 through 2007	ULEV	1.0[C,E]	n/a	n/a	14.4	0.05	n/a
	SULEV	0.5	n/a	n/a	7.2	0.025	n/a
2008 and subsequent	ULEV	n/a	0.14[E]	0.20[E]	14.4	0.01	0.01
	SULEV	n/a	0.07[E]	0.10[E]	7.2	0.005	0.005
Standards for Heavy-Duty Otto-Cycle Engines Used In Heavy-Duty Vehicles Over 14,000 pounds GVW							
2005 through 2007	n/a	1.0[~~C,E~~D,F]	n/a	n/a	37.1	0.05[~~D~~E]	n/a
2008 and subsequent	n/a	n/a	0.14[E]	0.20[E]	14.4	0.01	0.01

A These standards apply to petroleum-fueled, alcohol-fueled, liquefied petroleum gas-fueled and natural gas-fueled Otto-cycle engines.

B For the 2020 and subsequent model years, medium-duty vehicles 8,501 to 10,000 pounds GVW must certify to the primary emission standards and test procedures for complete vehicles specified in section 1961.2, title 13, CCR.

~~B~~C A manufacturer of engines used in incomplete medium-duty vehicles may choose to comply with these standards as an alternative to the primary emission standards and test procedures for complete vehicles specified in section 1961 or 1961.2, title 13, CCR. A manufacturer that chooses to comply with these optional heavy-duty engine standards and test procedures shall specify, in the Part I application for certification, an in-use compliance test procedure, as provided in section 2139(c), title 13 CCR.

~~C~~D A manufacturer may request to certify to the Option 1 or Option 2 federal NMHC + NOx standards as set forth in 40 CFR § 86.005-10(f). However, for engines used in medium-duty vehicles, the formaldehyde level must meet the standard specified above.

~~D~~E This standard only applies to methanol-fueled Otto-cycle engines.

~~E~~F A manufacturer may elect to include any or all of its medium- and heavy-duty Otto-cycle engine families in any or all of the emissions ABT programs for HDEs, within the restrictions described in section I.15 of the "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Otto-Cycle Engines," incorporated by reference in section 1956.8(d). For engine families certified to the Option 1 or 2 federal standards, the FEL must not exceed 1.5 g/bhp-hr. If a manufacturer elects to include engine families certified to the 2005 and subsequent model year standards, the NOx plus NMHC FEL must not exceed 1.0 g/bhp-hr. For engine families certified to the 2008 and subsequent model year standards, the FEL is the same as set forth in 40 CFR 86.008-10(a)(1).

~~F~~G Idle carbon monoxide: For all Otto-cycle heavy-duty engines utilizing aftertreatment technology, and not certified to the on-board diagnostics requirements of section 1968, et seq, as applicable, the CO emissions shall not exceed 0.50 percent of exhaust gas flow at curb idle.

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(3) *Optional Standards for Complete Heavy-Duty Vehicles that Use Heavy-Duty Otto-Cycle Engines.* Manufacturers may request to group complete heavy-duty Otto-cycle vehicles into the same test group as Otto-cycle vehicles certifying to the LEV III exhaust emission standards and test procedures specified in title 13, CCR, §1961.2, so long as those complete heavy-duty Otto-cycle vehicles meet the most stringent LEV III standards to which any vehicle within that test group certifies.

*   *   *   *

(d) The test procedures for determining compliance with standards applicable to 1987 and subsequent model heavy-duty Otto-cycle engines and vehicles are set forth in the "California Exhaust Emission Standards and Test Procedures for 1987 through 2003 Model Heavy-Duty Otto-Cycle Engines and Vehicles," adopted April 25, 1986, as last amended December 27, 2000, the "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Otto-Cycle Engines," adopted December 27, 2000, as last amended ~~September 27, 2010~~ [insert date of amendment for this rulemaking], the "California Non-Methane Organic Gas Test Procedures," adopted July 12, 1991, as last amended ~~July 30, 2002~~ [insert date of amendment for this rulemaking], and the "California Interim Certification Procedures for 2004 and Subsequent Model Hybrid-Electric Vehicles, in the Urban Bus and Heavy-Duty Vehicle Classes," adopted October 24, 2002, which are incorporated by reference herein.

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(h) The exhaust emissions from new:

*   *   *   *

(2) 1992 and subsequent model diesel engines used in medium-duty low-emission vehicles, ultra-low-emission vehicles and super-ultra-low-emission vehicles shall not exceed:

Exhaustive Emission Standards for Engines Used in 1992 through 2004 Model Incomplete Otto-Cycle Medium-Duty Low-Emission Vehicles, Ultra-Low-Emission Vehicles, and Super Ultra-Low-Emission Vehicles, and ~~for~~ 1992 and Subsequent Model Diesel Engines Used in Medium-Duty Low-Emission Vehicles, Ultra-Low-Emission Vehicles, and Super Ultra-Low-Emission Vehicles[A,F]

(grams per brake horsepower-hour)

Model Year	*Vehicle Emissions Category*[B]	*Carbon Monoxide*	*NMHC + NOx* [C]	*Non-Methane Hydrocarbons*	*Oxides of Nitrogen*	*Formaldehyde*	*Particulates*[D]
1992[E] - 2001	LEV	14.4	3.5 [K]	n/a	n/a	0.050	0.10 [K]
2002-2003[E]	LEV	14.4	3.0 [K]	n/a	n/a	0.050	0.10 [K]
1992-2003[E,H]	ULEV	14.4	2.5 [K]	n/a	n/a	0.050	0.10 [K]
2004-2006 ~~and subsequent~~ [L]	ULEV - Opt A	14.4	2.5 [I,J,K]	n/a	n/a	0.050	0.10 [J,K]
2004-2006 ~~and subsequent~~ [L]	ULEV - Opt. B	14.4	2.4 [I,J,K]	n/a	n/a	0.050	0.10 [J,K]
2007 and subsequent [D] (diesel only)	ULEV	15.5	n/a	0.14	0.20	0.050	0.01
1992-2006 ~~and subsequent~~ [L]	SULEV	7.2	2.0 [K]	n/a	n/a	0.025	0.05 [K]
2007 and subsequent [D] (diesel only)	SULEV	7.7	n/a	0.07	0.10	0.025	0.005

[A] This set of standards is optional. For the 1992 through 2019 model years, m~~M~~anufacturers of engines used in incomplete medium-duty vehicles or diesel engines used in medium-duty vehicles from 8501-10,000 ~~14,000~~ pounds gross vehicle weight rating may choose to comply with these standards as an alternative to the primary emission standards and test procedures specified in section 1960.1, ~~or~~ section 1961, or section 1961.2 Title 13, California Code of Regulations. For the 1992 and subsequent model years, manufacturers of engines used in incomplete medium-duty vehicles or diesel engines used in medium-duty vehicles from 10,001-14,000 pounds gross vehicle weight rating may choose to comply with these standards as an alternative to the primary emission standards and test procedures specified in section 1960.1, section 1961, or section 1961.2 Title 13, California Code of Regulations. For the 2020 and subsequent model years, both incomplete medium-duty vehicles and medium-duty vehicles that use a diesel engine 8,501 to 10,000 pounds GVW must certify to the primary emission standards and test procedures for complete vehicles specified in section 1961.2, title 13, CCR. Manufacturers that choose to comply with these optional heavy-duty standards and test procedures shall specify, in the application for certification, an in-use compliance test procedure, as provided in section 2139(c), Title 13, California Code of Regulations.

[B] "LEV" means low-emission vehicle.
"ULEV" means ultra-low-emission vehicle.
"SULEV" means super ultra-low-emission vehicle.

[C] This standard is the sum of the individual non-methane hydrocarbon emissions and oxides of nitrogen emissions. For methanol-fueled engines, non-methane hydrocarbons shall mean organic material hydrocarbon equivalent ("OMHCE").

[D] These standards apply only to diesel engines and vehicles.

[E] Manufacturers may certify engines used in incomplete medium-duty vehicles or diesel engines used in medium-duty vehicles to these standards to meet the requirements of section 1956.8(g), Title 13, California Code of Regulations.

[F] In-use compliance testing shall be limited to vehicles or engines with fewer than 90,000 miles.

[G] [Reserved]

[H] For engines certified to the 3.5 grams per brake horsepower-hour (g/bhp-hr) LEV standards, the in-use compliance standard shall be 3.7 g/bhp-hr for the first two model years of introduction. For engines certified to the 2002 and 2003 model year LEV standards, the in-use compliance standard shall be 3.2 g/bhp-hr. For engines certified to the 1992 through 2003 model year ULEV standards, the in-use compliance standard shall be 2.7 g/bhp-hr for the first two model years of introduction. For engines certified to the 1992 and subsequent SULEV standards, the in-use compliance standard shall be 2.2 g/bhp-hr for the first two model years of introduction.

[I] Manufacturers have the option of certifying to either option A or B. Manufacturers electing to certify to Option A must demonstrate that the NMHC emissions do not exceed 0.5 g/bhp-hr.

[J] Emissions averaging may be used to meet these standards for diesel engines, using the requirements for participation in averaging, banking and trading programs, as set forth in the "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles," incorporated by reference in section 1956.8 (b), above.

[K] Engines of 1998 and subsequent model years may be eligible to generate averaging, banking and trading credits based on these standards according to the requirements of the averaging, banking and trading programs described in the "California Exhaust Emission Standards and Test Procedures for 1985 through 2003 Model Heavy-Duty Engines and Vehicles" and the "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles," incorporated by reference in section 1956.8(b), above.

[L] For the 2005 and 2006 model years, these emission standards only apply to diesel engine and vehicles. ~~For 2007 and subsequent model year diesel engines used in medium-duty vehicles, these emission standards are not applicable.~~

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(5) *Optional Standards for Complete Heavy-Duty Vehicles that Use Heavy-Duty Diesel Engines.* Manufacturers may request to group complete heavy-duty diesel vehicles into the same test group as medium-duty diesel vehicles certifying to the LEV III exhaust emission standards and test procedures specified in title 13, CCR, §1961.2, so long as those complete heavy-duty diesel vehicles meet the most stringent LEV III standards to which any vehicle within that test group certifies.

NOTE: Authority cited: Sections 39500, 39600, 39601, 43013, 43018, 43100, 43101, 43102, 43104, 43105, 43106, 43107 and 43806, Health and Safety Code; and Section 28114, Vehicle Code. Reference: Sections 39002, 39003, 39500, 39667, 43000, 43009.5, 43013, 43017, 43018, 43100, 43101, 43101.5, 43102, 43104, 43105, 43106, 43107, 43202, 43204, 43205, 43205.5, 43206, 43210, 43211, 43212, 43213, and 43806, Health and Safety Code; and Section 28114, Vehicle Code.

3. Amend title 13, CCR, section 1960.1 to read as follows:

§ 1960.1. Exhaust Emission Standards and Test Procedures - 1981 through 2006 Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles.

* * * *

(r) *4000-Mile Supplemental FTP Emission Standards.* The Supplemental Federal Test Procedure (SFTP) standards in this section are ~~represent~~ the maximum SFTP exhaust emissions at 4,000 miles ± 250 miles or at the mileage determined by the manufacturer for emission-data vehicles in accordance with the "California Exhaust Emission Standards and Test Procedures for 1988 Through 2000 Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles," as incorporated by reference in section 1960.1(k), and with the "California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and ~~for 2001~~ 2009 through 2016 ~~and Subsequent~~ Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles," as incorporated by reference in section 1961(d). The SFTP exhaust emission levels from new 2001 through 2020 ~~and subsequent~~ model low-emission vehicles, ultra-low-emission vehicles and super-ultra-low-emission vehicles in the passenger car and light-duty truck class certifying to the LEV II exhaust emission standards in section 1961, and new 2003 through 2020 model ~~and subsequent~~ low-emission vehicles, ultra-low-emission vehicles, and super-ultra-low-emission vehicles in the medium-duty class certifying to the LEV II exhaust emission standards in section 1961, shall not exceed:

SFTP EXHAUST EMISSION STANDARDS FOR LOW-EMISSION VEHICLES, ULTRA-LOW-EMISSION VEHICLES, AND SUPER-ULTRA-LOW-EMISSION VEHICLES IN THE PASSENGER CAR, LIGHT-DUTY TRUCK, AND MEDIUM-DUTY VEHICLE CLASSES

(grams per mile) [5,6,7,8,9,10~~,11~~]

Vehicle Type[1]	Gross Vehicle Weight Rating (lbs.)	~~Loaded Vehicle~~ Test Weight (lbs.)[2]	US06 Test[1]		A/C Test[1,~~4~~5]	
			NMHC[~~3~~4] + NOx[1]	CO[1]	NMHC[~~3~~4] + NOx[1]	CO[1]
PC	All	All Vehicles in this category are tested at their loaded vehicle weight (curb weight plus 300 lbs.)	0.14	8.0	0.20	2.7
LDT ~~LDT~~	< 6,000 lbs.	0-3750 Vehicles in this category are tested at their loaded vehicle weight (curb weight plus 300 lbs.)	0.14	8.0	0.20	2.7
		3751-5750 Vehicles in this category are tested at their loaded vehicle weight (curb weight plus 300 lbs.)	0.25	10.5	0.27	3.5
MDV ~~MDV~~	6,001-8,500 lbs.[2]	3751-5750 Vehicles in this category are tested at their adjusted loaded vehicle weight (average of curb weight and GVWR)	0.40	10.5	0.31	3.5
		5751-8500 Vehicles in this category are tested at their adjusted loaded vehicle weight (average of curb weight and GVWR)	0.60	11.8	0.44	4.0

1 *Abbreviations and Definitions.* For the purposes of this SFTP standards table only, the following abbreviations and definitions apply:
"PC" means passenger car.
"LDT" means light-duty truck, defined as any motor vehicle rated at 6,000 pounds gross vehicle weight or less, which is designed primarily for purposes of transportation of property or is a derivative of such a vehicle, or is available with special features enabling off-street or off-highway operation and use.

"MDV" means medium-duty truck, defined as any motor vehicle having a manufacturer's gross vehicle weight rating of greater than 6,000 pounds and less than 14,001 pounds, except passenger cars.

"NMHC+NOx" means non-methane hydrocarbon plus oxides of nitrogen emissions.

"CO" means carbon monoxide emissions.

"US06" means the test cycle designed to evaluate emissions during aggressive and microtransient driving.

"A/C" means air-conditioning.

2 ~~For MDVs, "Loaded Vehicle Weight" shall mean "Test Weight," which is the average of the vehicle's curb weight and gross vehicle weight.~~

2~~3~~ Vehicles with a gross vehicle weight rating over 8,500 pounds are exempted from the requirements of this subsection.

3~~4~~ *Non-Methane Hydrocarbon Emissions.* Hydrocarbon emissions shall be measured in accordance with Part B (Determination of Non-Methane Hydrocarbon Mass Emissions by Flame Ionization Detection) of the "California Non-Methane Organic Gas Test Procedures" as incorporated by reference in section 1960.1(g)(1), note (3). For alcohol-fueled vehicles certifying to these standards, including flexible-fuel vehicles when certifying on methanol or ethanol, "Non-Methane Hydrocarbons" shall mean "Organic Material Non-Methane Hydrocarbon Equivalent."

4~~5~~ *A/C-on Specific Calibrations*. A/C-on specific calibrations (e.g. air to fuel ratio, spark timing, and exhaust gas recirculation), may be used which differ from A/C-off calibrations for given engine operating conditions (e.g., engine speed, manifold pressure, coolant temperature, air charge temperature, and any other parameters). Such calibrations must not unnecessarily reduce the NMHC+NOx emission control effectiveness during A/C-on operation when the vehicle is operated under conditions which may reasonably be expected to be encountered during normal operation and use. If reductions in control system NMHC+NOx effectiveness do occur as a result of such calibrations, the manufacturer shall, in the Application for Certification, specify the circumstances under which such reductions do occur, and the reason for the use of such calibrations resulting in such reductions in control system effectiveness.

A/C-on specific "open-loop" or "commanded enrichment" air-fuel enrichment strategies (as defined below), which differ from A/C-off "open-loop" or "commanded enrichment" air-fuel enrichment strategies, may not be used, with the following exceptions: cold-start and warm-up conditions, or, subject to Executive Officer approval, conditions requiring the protection of the vehicle, occupants, engine, or emission control hardware. Other than these exceptions, such strategies which are invoked based on manifold pressure, engine speed, throttle position, or other engine parameters shall use the same engine parameter criteria for the invoking of this air-fuel enrichment strategy and the same degree of enrichment regardless of whether the A/C is on or off.

"Open-loop" or "commanded" air-fuel enrichment strategy is defined as enrichment of the air to fuel ratio beyond stoichiometry for the purposes of increasing engine power output and the protection of engine or emissions control hardware. However, "closed-loop biasing," defined as small changes in the air-fuel ratio for the purposes of optimizing vehicle emissions or driveability, shall not be considered an "open-loop" or "commanded" air-fuel enrichment strategy. In addition, "transient" air-fuel enrichment strategy (or "tip-in" and "tip-out" enrichment), defined as the temporary use of an air-fuel ratio rich of stoichiometry at the beginning or duration of rapid throttle motion, shall not be considered an "open-loop" or "commanded" air-fuel enrichment strategy.

5~~6~~ *SFTP.* SFTP means the additional test procedure designed to measure emissions during aggressive and microtransient driving, as described in section 86.159-00, Title 40, Code of Federal Regulations, as adopted October 22, 1996, over the US06 cycle, and also the test procedure designed to measure urban driving emissions while the vehicle's air conditioning system is operating, as described in section 86.160-00, Title 40, Code of Federal

Regulations, as adopted October 22, 1996, over the SC03 cycle, except the test weight shall be that specified in this subsection 1960.1(r), regardless of what may be specified in the Code of Federal Regulations. These sections of the Code of Federal Regulations are incorporated herein by reference.

6~~7~~ *Applicability to Alternative Fuel Vehicles.* These SFTP standards do not apply to vehicles certified on fuels other than gasoline and diesel fuel, but the standards do apply to the gasoline and diesel fuel operation of flexible-fuel vehicles and dual-fuel vehicles.

7~~8~~ *Air to Fuel Ratio Requirement.* With the exception of cold-start conditions, warm-up conditions and rapid-throttle motion conditions (“tip-in” or “tip-out” conditions), the air to fuel ratio shall not be richer at any time than, for a given engine operating condition (e.g., engine speed, manifold pressure, coolant temperature, air charge temperature, and any other parameters), the leanest air to fuel mixture required to obtain maximum torque (lean best torque), with a tolerance of six percent of the fuel consumption. The Executive Officer may approve a manufacturer’s request for approval to use additional enrichment in subsequent testing if the manufacturer demonstrates that additional enrichment is needed to protect the vehicle, occupants, engine, or emission control hardware.

8~~9~~ *“Lean-On-Cruise” Calibration Strategies.* In the Application for Certification, the manufacturer shall state whether any “lean-on-cruise” strategies are incorporated into the vehicle design. A “lean-on-cruise” air-fuel calibration strategy is defined as the use of an air-fuel ratio significantly greater than stoichiometry, during non-deceleration conditions at speeds above 40 mph. “Lean-on-cruise” air-fuel calibration strategies shall not be employed during vehicle operation in normal driving conditions, including A/C-usage, unless at least one of the following conditions is met:

1. Such strategies are substantially employed during the FTP or SFTP, or

2. Such strategies are demonstrated not to significantly reduce vehicle NMHC+NOx emission control effectiveness over the operating conditions in which they are employed, or

3. Such strategies are demonstrated to be necessary to protect the vehicle, occupants, engine, or emission control hardware.

If the manufacturer proposes to use a “lean-on-cruise” calibration strategy, the manufacturer shall specify the circumstances under which such a calibration would be used, and the reason or reasons for the proposed use of such a calibration.

The above provisions shall not apply to vehicles powered by “lean-burn” engines or Diesel-cycle engines. A “lean-burn” engine is defined as an Otto-cycle engine designed to run at an air-fuel ratio significantly greater than stoichiometry during the large majority of its operation.

9~~10~~ *Phase-In Requirements*. For the purposes of this 1960.1(r) section only, each manufacturer’s PC and LDT fleet shall be defined as the total projected number of low-emission and ultra-low-emission PCs and LDTs from 0-5750 pounds loaded vehicle weight sold in California. Each manufacturer’s MDV fleet shall be defined as the total projected number of low-emission, ultra-low-emission, and super-ultra-low-emission MDVs less than 8501 pounds gross vehicle weight rating sold in California.

a. For the 2001 through 2014 model years, m~~M~~anufacturers of PCs, LDTs, and MDVs, except small volume manufacturers, shall certify a minimum percentage of their PC and LDT fleet, and a minimum percentage of their MDV fleet, according to the following phase-in schedule.

	Percentage	
Model Year	PC, LDT	MDV
2001	25	NA
2002	50	NA
2003	85	25
2004	100	50
2005 through 2014 ~~and subsequent~~	100	100

b. Manufacturers may use an “Alternative or Equivalent Phase-in Schedule” to comply with the phase-in requirements. An “Alternative Phase-in” is one that achieves at least equivalent emission reductions by the end of the last model year of the scheduled phase-in. Model-year emission reductions shall be calculated by multiplying the percent of vehicles (based on the manufacturer’s projected California sales volume of the applicable vehicle fleet) meeting the new requirements per model year by the number of model years implemented prior to and including the last model year of the scheduled phase-in. The “cumulative total” is the summation of the model-year emission reductions (e.g., a four model-year 25/50/85/100 percent phase-in schedule would be calculated as: (25%*4 years) + (50%*3 years) + (85%*2 years) + (100%*1 year) = 520). Any alternative phase-in that results in an equal or larger cumulative total than the required cumulative total by the end of the last model year of the scheduled phase-in shall be considered acceptable by the Executive Officer under the following conditions: 1) all vehicles subject to the phase-in shall comply with the respective requirements in the last model year of the required phase-in schedule and 2) if a manufacturer uses the optional phase-in percentage determination in section 1960.1(q) note (9), the cumulative total of model-year emission reductions as determined only for PCs and LDTs certified to this section 1960.1(r) must also be equal to or larger than the required cumulative total by end of the 2004 model year. Manufacturers shall be allowed to include vehicles introduced before the first model year of the scheduled phase-in (e.g., in the previous example, 10 percent introduced one year before the scheduled phase-in begins would be calculated as: (10%*5 years) and added to the cumulative total).

c. Small volume manufacturers of PCs, LDTs, and MDVs shall certify 100% of their PC and LDT fleet in the 2004 through 2014 ~~and subsequent~~ model years, and 100% of their MDV fleet in the 2005 through 2014 ~~and subsequent~~ model years.

[10~~1~~] *Single-Roll Electric Dynamometer Requirement.* For all vehicles certified to the SFTP standards, a single-roll electric dynamometer or a dynamometer which produces equivalent results, as set forth in the “California Exhaust Emission Standards and Test Procedures for 1988 Through 2000 ~~and Subsequent~~ Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles” as incorporated by reference in section 1960.1(k) or the “California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2009 through 2016 Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles,” as incorporated by reference in section 1961(d), as applicable, must be used for all types of emission testing to determine compliance with the associated emission standards.

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, 43103, 43104, 43105, 43106, 43107, and 43204-43205.5, Health and Safety Code.

4. Amend title 13, CCR, section 1961 to read as follows:

§ 1961. Exhaust Emission Standards and Test Procedures - 2004 through 2019 ~~and Subsequent~~ Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles.

Introduction. This section 1961 contains the California "LEV II" exhaust emission standards for 2004 through 2019 ~~and subsequent~~ model passenger cars, light-duty trucks and medium-duty vehicles. A manufacturer must demonstrate compliance with the exhaust standards in section 1961(a) applicable to specific test groups, and with the composite phase-in requirements in section 1961(b) applicable to the manufacturer's entire fleet. Section 1961(b) also includes the manufacturer's fleet-wide composite phase-in requirements for the 2001 - 2003 model years.

* * * *

(a) *Exhaust Emission Standards.*

(1) *"LEV II" Exhaust Standards*. The following standards are ~~represent~~ the maximum exhaust emissions for the intermediate and full useful life from new 2004 through 2019 ~~and subsequent~~ model-year "LEV II" LEVs, ULEVs, and SULEVs, including fuel-flexible, bi-fuel and dual fuel vehicles when operating on the gaseous or alcohol fuel they are designed to use.~~:~~ 2015 – 2019 model-year LEV II LEV vehicles may be certified to the NMOG+NOx numerical values for LEV160, LEV395, or LEV630, as applicable, in subsection 1961.2(a)(1) and the corresponding NMOG+NOx numerical values in subsection 1961.2(a)(4), in lieu of the separate NMOG and NOx exhaust emission standards in this subsection (a)(1) and subsection (a)(4); LEV II ULEV vehicles may be certified to the NMOG+NOx numerical values for ULEV125, ULEV340, or ULEV570, as applicable, in subsection 1961.2(a)(1) and the corresponding NMOG+NOx numerical values in subsection 1961.2(a)(4), in lieu of the separate NMOG and NOx exhaust emission standards in this subsection (a)(1) and the corresponding NMOG+NOx numerical values in subsection (a)(4); and LEV II SULEV vehicles may be certified to the NMOG+NOx numerical values for SULEV30, SULEV170, or SULEV230, as applicable, in subsection 1961.2(a)(1) and the corresponding NMOG+NOx numerical values in subsection 1961.2(a)(4), in lieu of the separate NMOG and NOx exhaust emission standards in this subsection (a)(1) and the corresponding NMOG+NOx numerical values in subsection (a)(4).

LEV II Exhaust Mass Emission Standards for New 2004 through 2019 ~~and Subsequent~~ Model LEVs, ULEVs, and SULEVs in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes							
Vehicle Type	*Durability Vehicle Basis (mi)*	*Vehicle Emission Category*	*NMOG (g/mi)*	*Carbon Monoxide (g/mi)*	*Oxides of Nitrogen (g/mi)*	*Formaldehyde (mg/mi)*	*Particulates (g/mi)*
All PCs; LDTs 8500 lbs. GVWR or less Vehicles in this category are tested at their loaded vehicle weight	50,000	LEV	0.075	3.4	0.05	15	n/a
		LEV, Option 1	0.075	3.4	0.07	15	n/a
		ULEV	0.040	1.7	0.05	8	n/a
	120,000	LEV	0.090	4.2	0.07	18	0.01
		LEV, Option 1	0.090	4.2	0.10	18	0.01
		ULEV	0.055	2.1	0.07	11	0.01
		SULEV	0.010	1.0	0.02	4	0.01
	150,000 (Optional)	LEV	0.090	4.2	0.07	18	0.01
		LEV, Option 1	0.090	4.2	0.10	18	0.01
		ULEV	0.055	2.1	0.07	11	0.01
		SULEV	0.010	1.0	0.02	4	0.01
MDVs 8501 - 10,000 lbs. GVWR Vehicles in this category are tested at their adjusted loaded vehicle weight	120,000	LEV	0.195	6.4	0.2	32	0.12
		ULEV	0.143	6.4	0.2	16	0.06
		SULEV	0.100	3.2	0.1	8	0.06
	150,000 (Optional)	LEV	0.195	6.4	0.2	32	0.12
		ULEV	0.143	6.4	0.2	16	0.06
		SULEV	0.100	3.2	0.1	8	0.06
MDVs 10,001-14,000 lbs. GVWR Vehicles in this category are tested at their adjusted loaded vehicle weight	120,000	LEV	0.230	7.3	0.4	40	0.12
		ULEV	0.167	7.3	0.4	21	0.06
		SULEV	0.117	3.7	0.2	10	0.06
	150,000 (Optional)	LEV	0.230	7.3	0.4	40	0.12
		ULEV	0.167	7.3	0.4	21	0.06
		SULEV	0.117	3.7	0.2	10	0.06

* * * *

(3) *LEV II NMOG Standards for Bi-Fuel, Fuel-Flexible and Dual-Fuel Vehicles Operating on Gasoline*. For fuel-flexible, bi-fuel, and dual-fuel PCs, LDTs and MDVs, compliance with the NMOG exhaust mass emission standards shall be based on exhaust emission tests both when the vehicle is operated on the gaseous or alcohol fuel it is designed to use, and when the vehicle is operated on gasoline. A manufacturer must demonstrate compliance with the applicable exhaust mass emission standards for NMOG, CO, NOx, and formaldehyde set forth in the table in section 1961(a)(1) when certifying the vehicle for operation on the gaseous or alcohol fuel.

The following standards are ~~represent~~ the maximum NMOG emissions when the vehicle is operating on gasoline. A manufacturer shall not apply a reactivity adjustment factor to the exhaust NMOG mass emission result when operating on gasoline. A manufacturer may measure NMHC in lieu of NMOG when fuel-flexible, bi-fuel, and dual-fuel vehicles are operated on gasoline, in accordance with the test procedures incorporated by reference in section 1961(d). Testing at 50°F is not required for fuel-flexible, bi-fuel, and dual-fuel vehicles when operating on gasoline. The applicable CO, NOx, and formaldehyde standards are set forth in section 1961(a)(1).

LEV II NMOG Standards for Bi-Fuel, Fuel-Flexible, and Dual-Fuel Vehicles Operating on Gasoline (g/mi)			
Vehicle Type	*Vehicle Emission Category*	*Durability Vehicle Basis*	
		50,000 mi	*120,000 mi*
All PCs; LDTs, 0-8500 lbs. GVWR	LEV	0.125	0.156
	ULEV	0.075	0.090
	SULEV	0.010	0.040
MDVs, 8501-10,000 lbs. GVWR	LEV	n/a	0.230
	ULEV	n/a	0.167
	SULEV	n/a	0.117
MDVs, 10,001-14,000 lbs. GVWR	LEV	n/a	0.280
	ULEV	n/a	0.195
	SULEV	n/a	0.143

(4) *LEV II 50°F Exhaust Emission Standards.* All LEV II light- and medium-duty LEVs, ULEVs, and SULEVs must demonstrate compliance with the following exhaust emission standards for NMOG and formaldehyde (HCHO) measured on the FTP (40 CFR, Part 86, Subpart B) conducted at a nominal test temperature of 50°F, as modified by Part II, Section C of the "California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and ~~for~~ 2009 through 2016 ~~and Subsequent~~ Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles" incorporated by reference in section 1961(d). The NMOG mass emission result shall be multiplied by the applicable reactivity adjustment factor, if any, prior to comparing to the applicable adjusted 50,000 mile certification standards set forth below. A manufacturer may demonstrate compliance with the NMOG and HCHO certification standards contained in this subparagraph by measuring NMHC exhaust emissions or issuing a statement of compliance for HCHO in accordance with Section D.1, subparagraph (p) and Section G.3.1.2, respectively, of the "California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and ~~for~~ 2009 through 2016 ~~and Subsequent~~ Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles" incorporated by reference in section 1961(d). Emissions of CO and NOx measured at 50°F shall not exceed the standards set forth in §1961(a)(1) applicable to vehicles of the same emission category and vehicle type subject to a cold soak and emission test at 68° to 86°F. Natural gas and diesel-fueled vehicles are exempt from the 50°F test requirements.

Vehicle Weight Class	*Vehicle Emission Category (g/mi)*					
	LEV		*ULEV*		*SULEV*	
	NMOG	*HCHO*	*NMOG*	*HCHO*	*NMOG*	*HCHO*
PCs; LDTs 0-8500 lbs. GVWR	0.150	0.030	0.080	0.016	0.020	0.008
MDVs 8501-10,000 lbs. GVWR	0.390	0.064	0.286	0.032	0.200	0.016
MDVs 10,001-14,000 lbs. GVWR	0.460	0.080	0.334	0.042	0.234	0.020

(5) *LEV II Cold CO Standard*. The following standards are ~~represent~~ the 50,000 mile cold temperature exhaust carbon monoxide emission levels from new 2001 through 2019 ~~and subsequent~~ model-year LEV II passenger cars, light-duty trucks, and medium-duty vehicles:

2001 THROUGH 2019 ~~AND SUBSEQUENT~~ MODEL-YEAR COLD TEMPERATURE
CARBON MONOXIDE EXHAUST EMISSIONS STANDARDS FOR LEV II PASSENGER CARS, LIGHT-DUTY TRUCKS, AND MEDIUM-DUTY VEHICLES
(grams per mile)

Vehicle Type	*Carbon Monoxide*
All PCs, LDTs 0-3750 lbs. LVW;	10.0
LDTs, 3751 lbs. LVW - 8500 lbs. GVWR; LEV I and Tier 1 MDVs 8500 lbs. GVWR and less	12.5

These standards are applicable to vehicles tested at a nominal temperature of 20°F (-7°C) in accordance with 40 CFR Part 86 Subpart C, as amended by the "California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and ~~for~~ 2009 through 2016 ~~and Subsequent~~ Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles" incorporated by reference in section 1961(d). Natural gas, diesel-fueled, and zero-emission vehicles are exempt from these standards.

* * * *

(7) *Supplemental Federal Test Procedure (SFTP) Off-Cycle Emission Standards.* The SFTP exhaust emission levels from new 2004 through 2019 ~~and subsequent~~ model LEV II LEVs, ULEVs, and SULEVs shall not exceed the standards set forth in section 1960.1(r).

(8) *Requirements for Vehicles Certified to the Optional 150,000 Mile Standards.*

* * * *

(B) *Requirement to Generate a Partial ZEV Allowance.* A vehicle that is certified to the 150,000 mile SULEV standards shall also generate a partial ZEV allocation according to the criteria set forth in section C.3 of the "California Exhaust Emission Standards and Test Procedures for 2005 through 2008 ~~and Subsequent~~ Model Zero-Emission Vehicles, and 2001 through 2008 ~~and~~

~~Subsequent~~ Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes," incorporated by reference in section 1962, the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes," incorporated by reference in section 1962.1, or the "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes," incorporated by reference in section 1962.2,as applicable.

* * * *

(14) *When a Federally-Certified Vehicle Model is Required in California.*

(A) *General Requirement.* Whenever a manufacturer federally-certifies a 2004 through 2014 ~~or subsequent~~ model-year passenger car, light-duty truck or medium-duty vehicle model to the standards for a particular emissions bin that are more stringent than the standards for an applicable California emission category, the equivalent California model may only be certified to (i) the California standards for a vehicle emissions category that are at least as stringent as the standards for the corresponding federal emissions bin, or (ii) the exhaust emission standards to which the federal model is certified. However, where the federal exhaust emission standards for the particular emissions bin and the California standards for a vehicle emissions category are equally stringent, the California model may only be certified to either the California standards for that vehicle emissions category or more stringent California standards. The federal emission bins are those contained in Tables S04-1 and S04-2 of 40 CFR §86.1811-04(c) as adopted February 10, 2000. The criteria for applying this requirement are set forth in Part I. Section H.1 of the "California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and ~~for~~ 2009 through 2016 ~~and Subsequent~~ Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles," as incorporated by reference in section 1961(d).

* * * *

(b) *Emission Standards Phase-In Requirements for Manufacturers.*

(1) *Fleet Average NMOG Requirements for Passenger Cars and Light-Duty Trucks.*

(A) The fleet average non-methane organic gas exhaust mass emission values from the passenger cars and light-duty trucks certified to the Tier 1, LEV I, and LEV II standards that are produced and delivered for sale in California each model year from 2001 through 2014 by a manufacturer other than a small volume manufacturer or an independent low volume manufacturer shall not exceed:

FLEET AVERAGE NON-METHANE ORGANIC GAS EXHAUST MASS EMISSION REQUIREMENTS FOR LIGHT-DUTY VEHICLE WEIGHT CLASSES (50,000 mile Durability Vehicle Basis)		
Model Year	*Fleet Average NMOG (grams per mile)*	
	All PCs; LDTs 0-3750 lbs. LVW	*LDTs 3751 lbs. LVW - 8500 lbs. GVW*
2001	0.070	0.098
2002	0.068	0.095
2003	0.062	0.093
2004	0.053	0.085
2005	0.049	0.076
2006	0.046	0.062
2007	0.043	0.055
2008	0.040	0.050
2009	0.038	0.047
2010 through 2014[1] ~~+~~	0.035	0.043

[1] For the 2014 model year only, a manufacturer may comply with the fleet average NMOG+NOx values in subsection 1961.2(b)(1)(A) in lieu of complying with the NMOG fleet average values in this table. A manufacturer must either comply with the NMOG+NOx fleet average requirements for both its PC/LDT1 fleet and its LDT2/MDPV fleet or comply with the NMOG fleet average requirements for both its PC/LDT1 fleet and its LDT2/MDPV fleet. A manufacturer must calculate its fleet average NMOG+NOx values using the applicable full useful standards.

(B) *Calculation of Fleet Average NMOG Value.*

1. *Basic Calculation.*

* * * *

c. The applicable emission standards to be used in the above equations are as follows:

Model Year	*Emission Category*	*Emission Standard Value*	
		All PCs; LDTs 0-3750 lbs. LVW	*LDTs 3751-5750 lbs. LVW*
2001 through 2014 ~~and subsequent~~ (§1960.5 “AB 965” vehicles only)	All	Federal Emission Standard to which Vehicle is Certified	Federal Emission Standard to which Vehicle is Certified
2001 - 2003 (§1960.1(f)(2))	Tier 1	0.25	0.32
2001 - 2006 model year vehicles certified to the “LEV I” standards in §1960.1(g)(1) (For TLEVs, 2001 - 2003 model years only)	TLEVs	0.125	0.160
	LEVs	0.075	0.100
	ULEVs	0.040	0.050
Model Year	Emission Category	All PCs; LDTs 0-3750 lbs. LVW	LDTs 3751 lbs. LVW - 8500 lbs. GVW
2004 through 2014 ~~and subsequent~~ model year vehicles certified to the “LEV II” standards in §1961(a)(1)	LEVs	0.075	0.075
	ULEVs	0.040	0.040
	SULEVs	0.01	0.01
2004 through 2014 ~~and subsequent~~ model year vehicles certified to the optional 150,000 mile “LEV II” standards for PCs and LDTs in 1961(a)(1)	LEVs	0.064	0.064
	ULEVs	0.034	0.034
	SULEVs	0.0085	0.0085

* * * *

3. *Federally-Certified Vehicles.* A vehicle certified to the federal standards for a federal exhaust emissions bin in accordance with Section H.1 of the “California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and ~~for~~ 2009 through 2016 ~~and Subsequent~~ Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles,” as incorporated by reference in section 1961(d), shall use the corresponding intermediate useful life NMOG standard to which the vehicle is deemed certified in the fleet average calculation.

(C) *Requirements for Small Volume Manufacturers*.

1. In 2001 through 2006 model years, a small volume manufacturer shall not exceed a fleet average NMOG value of 0.075 g/mi for PCs and LDTs from 0-3750 lbs. LVW or 0.100 g/mi for LDTs from 3751-5750 lbs. LVW calculated in accordance with section 1961(b)(1)(B). In 2007 through 2014 ~~and subsequent~~ model years, a small volume manufacturer shall not exceed a fleet average NMOG value of 0.075 for PCs and LDTs from 0-3750 lbs. LVW or 0.075 for LDTs from 3751 lbs. LVW - 8500 lbs. GVW calculated in accordance with section 1961(b)(1)(B).

* * * *

(D) *Phase-in Requirements for Independent Low Volume Manufacturers*. In 2001 through 2006 model years, an independent low volume manufacturer shall not exceed a fleet average NMOG value of 0.075 g/mi for PCs and LDTs from 0-3750 lbs. LVW or 0.100 g/mi for LDTs from 3751-5750 lbs. LVW calculated in accordance with section 1961(b)(1)(B). In 2007 through 2014 ~~and subsequent~~ model years, an independent low volume manufacturer shall not exceed a fleet average NMOG value of 0.060 for PCs and LDTs from 0-3750 lbs. LVW or 0.065 g/mi for LDTs from 3751 lbs. LVW - 8500 lbs. GVW calculated in accordance with section 1961(b)(1)(B).

* * * *

(3) *Medium-Duty Vehicle Phase-In Requirements*.

(A) A manufacturer of MDVs, other than a small volume manufacturer, shall certify an equivalent percentage of its MDV fleet according to the following phase-in schedule:

Model Year	*Vehicles Certified to §1960.1(h)(1), (h)(2), and §1961(a)(1) (%)*		*Vehicles Certified to §1956.8(g) or (h) (%)*		
	LEV	*ULEV*	*Tier 1*	*LEV*	*ULEV*
2001	80	20	100	0	0
2002	70	30	0	100	0
2003	60	40	0	100	0
2004 through 2014 ~~+~~	40	60	0	0	100

(B) *Phase-In Requirements for LEV II MDVs*. For the 2004 through 2006 model years, a manufacturer, other than a small volume manufacturer must phase-in at least one test group per model year to the MDV LEV II standards. All 2007 through 2014 ~~and subsequent~~ model year MDVs, including those produced by a small volume manufacturer, are subject to the LEV II MDV standards. Beginning in the 2005 model year, all medium-duty engines certified to the optional medium-duty engine standards in title 13, CCR §1956.8(c) or (h), including those produced by a small volume manufacturer, must meet the standards set forth in title 13, CCR §1956.8(c) or (h), as applicable. A manufacturer that elects to certify to the Option 1 or Option 2 federal standards as set forth in 40 CFR §86.005-10(f) is not subject to these phase-in requirements.

(C) *Identifying a Manufacturer's MDV Fleet*. For the 2001 through 2014 ~~and subsequent~~ model years, each manufacturer's MDV fleet shall be defined as the total number of California-certified MDVs produced and delivered for sale in California. The percentages shall be applied to the manufacturers' total production of California-certified medium-duty vehicles delivered for sale in California. For the 2005 through 2014 ~~and subsequent~~ model years, a manufacturer that elects to certify to the optional medium-duty engine standards in title 13, CCR, §1956.8(c) or (h) shall not count those engines in the manufacturer's total production of California-certified medium-duty vehicles for purposes of this subsection.

* * * *

(E) For a manufacturer that elects to certify to the optional medium-duty engine standards in title 13, CCR §1956.8(c) or (h), all such 2005 through 2014 ~~and subsequent~~ model year MDVs, including those produced by a small volume manufacturer, shall be subject to the emissions averaging provisions applicable to heavy-duty diesel or Otto-cycle engines as set forth in the

"California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Otto-Cycle Engines," or the "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel Engines, incorporated by reference in §1956.8(b) or (d), as applicable.

(c) *Calculation of NMOG Credits/Debits*

(1) *Calculation of NMOG Credits for Passenger Cars and Light-Duty Trucks*. In 2001 through 2014 ~~and subsequent~~ model years, a manufacturer that achieves fleet average NMOG values lower than the fleet average NMOG requirement for the corresponding model year shall receive credits in units of g/mi NMOG determined as:

[(Fleet Average NMOG Requirement) - (Manufacturer's Fleet Average NMOG Value)] x
(Total No. of Vehicles Produced and Delivered for Sale in California, Including ZEVs and HEVs).

A manufacturer with 2001 through 2014 ~~and subsequent~~ model year fleet average NMOG values greater than the fleet average requirement for the corresponding model year shall receive debits in units of g/mi NMOG equal to the amount of negative credits determined by the aforementioned equation. For the 2001 through 2014 ~~and subsequent~~ model years, the total g/mi NMOG credits or debits earned for PCs and LDTs 0-3750 lbs. LVW, for LDTs 3751-5750 lbs. LVW and for LDTs 3751 lbs. LVW - 8500 lbs. GVW shall be summed together. The resulting amount shall constitute the g/mi NMOG credits or debits accrued by the manufacturer for the model year.

(2) *Calculation of Vehicle Equivalent NMOG Credits for Medium-Duty Vehicles*.

(A) In 2001 through 2014 ~~and subsequent~~ model years, a manufacturer that produces and delivers for sale in California MDVs in excess of the equivalent requirements for LEVs, ULEVs and/or SULEVs certified to the exhaust emission standards set forth in section 1961(a)(1) or to the exhaust emission standards set forth in Title 13, CCR, Section 1956.8(h) shall receive "Vehicle-Equivalent Credits" (or "VECs") calculated in accordance with the following equation, where the term "produced" means produced and delivered for sale in California:

* * * *

(3) *Procedure for Offsetting Debits.*

(A) A manufacturer shall equalize emission debits by earning g/mi NMOG emission credits or VECs in an amount equal to the g/mi NMOG debits or VEDs, or by submitting a commensurate amount of g/mi NMOG credits or VECs to the Executive Officer that were earned previously or acquired from another manufacturer. For 2001 through 2003 and for 2007 through 2014 ~~and subsequent~~ model years, manufacturers shall equalize emission debits by the end of the following model year. For 2004 through 2006 model years, a manufacturer shall equalize NMOG debits for PCs and LDTs and LEV II MDVs within three model years and prior to the end of the 2007 model year. If emission debits are not equalized within the specified time period, the manufacturer shall be subject to the Health and Safety Code section 43211 civil penalty applicable to a manufacturer which 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 emission debits are not equalized by the end of the specified time period. For the purposes of Health and Safety Code section 43211, the number of passenger cars and light-duty trucks not meeting the state board's emission standards shall be determined by dividing the total amount of g/mi NMOG emission debits for the model year by the g/mi NMOG fleet average requirement for PCs and LDTs 0-3750 lbs. LVW applicable for the model year in which the debits were first incurred and the number of medium-duty vehicles not meeting the state board's emission standards shall be equal to the amount of VEDs incurred.

* * * *

(d) *Test Procedures.* The certification requirements and test procedures for determining compliance with the emission standards in this section are set forth in the "California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and ~~for~~ 2009 through 2016 ~~and Subsequent~~ Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles," as amended ~~September 27, 2010~~ [INSERT DATE OF AMENDMENT], ~~and~~ the "California Non-Methane Organic Gas Test Procedures," as amended ~~July 30, 2002~~ [INSERT DATE OF AMENDMENT], which are incorporated herein by reference. In the case of hybrid electric vehicles and on-board fuel-fired heaters, the certification requirements and test procedures for determining compliance with the emission standards in this section are set forth in the "California Exhaust Emission Standards and Test Procedures for 2005 through 2008 Model Zero-Emission Vehicles, and 2001 through 2008 Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," incorporated by reference in section 1962, ~~and~~ the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 ~~and Subsequent~~ Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," incorporated by reference in section 1962.1, and the "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" incorporated by reference in section 1962.2.

* * * *

NOTE: Authority cited: Sections 39500, 39600, 39601, 43013, 43018, 43101, 43104, 43105, and 43106, Health and Safety Code. Reference: Sections 39002, 39003, 39667, 43000, 43009.5, 43013, 43018, 43100, 43101, 43101.5, 43102, 43104, 43105, 43106, 43204, and 43205, Health and Safety Code.

5. Amend title 13, CCR, section 1961.1 to read as follows:

§ 1961.1. Greenhouse Gas Exhaust Emission Standards and Test Procedures - 2009 through 2016 ~~and Subsequent~~ Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles.

(a) *Greenhouse Gas Emission Requirements.* The greenhouse gas emission levels from new 2009 through 2016 ~~and subsequent~~ model year passenger cars, light-duty trucks, and medium-duty passenger vehicles shall not exceed the following requirements. Light-duty trucks from 3751 lbs. LVW – 8500 lbs. GVW that are certified to the Option 1 LEV II NOx Standard in section 1961(a)(1) are exempt from these greenhouse gas emission requirements, however, passenger cars, light-duty trucks 0-3750 lbs. LVW, and medium-duty passenger vehicles are not eligible for this exemption.

(1) *Fleet Average Greenhouse Gas Requirements for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.*

(A)(i) The fleet average greenhouse gas exhaust mass emission values from passenger cars, light-duty trucks, and medium-duty passenger vehicles that are produced and delivered for sale in California each model year by a large volume manufacturer shall not exceed:

FLEET AVERAGE GREENHOUSE GAS EXHAUST MASS EMISSION REQUIREMENTS FOR PASSENGER CAR, LIGHT-DUTY TRUCK, AND MEDIUM-DUTY PASSENGER VEHICLE WEIGHT CLASSES[1] (4,000 mile Durability Vehicle Basis)		
Model Year	*Fleet Average Greenhouse Gas Emissions (grams per mile CO_2-equivalent)*	
	All PCs; LDTs 0-3750 lbs. LVW	*LDTs 3751 lbs. LVW - 8500 lbs. GVW; MDPVs*
2009	323	439
2010	301	420
2011	267	390
2012	233	361
2013	227	355
2014	222	350
2015	213	341
2016~~+~~	205	332

[1] Each manufacturer shall demonstrate compliance with these values in accordance with section 1961.1(a)(1)(B).

1. For each model year, a manufacturer must demonstrate compliance with the fleet average requirements in this section 1961.1(a)(1)(A) based on one of two options applicable throughout the model year, either:

Option 1: the total number of passenger cars, light-duty trucks, and medium-duty passenger vehicles that are certified to the California exhaust emission standards in this section 1961.1, and are produced and delivered for sale in California; or

Option 2: the total number of passenger cars, light-duty trucks, and medium-duty passenger vehicles that are certified to the California exhaust emission standards in this section 1961.1, and are produced and delivered for sale in California, the District of Columbia, and all states that have adopted California's greenhouse gas emission standards for that model year pursuant to Section 177 of the federal Clean Air Act (42 U.S.C. § 7507).

a. For the 2009 and 2010 model years, a manufacturer that selects compliance Option 2 must notify the Executive Officer of that selection, in writing, within 30 days of the effective date of the amendments to this section (a)(1)(A)1 or must comply with Option 1.

b. For the 2011 through 2016 ~~and later~~ model years, a manufacturer that selects compliance Option 2 must notify the Executive Officer of that selection, in writing, prior to the start of the applicable model year or must comply with Option 1.

c. When a manufacturer is demonstrating compliance using Option 2 for a given model year, the term "in California" as used in subsections 1961.1(a)(1)(B)3. and 1961.1 (b) means California, the District of Columbia, and all states that have adopted California's greenhouse gas emission standards for that model year pursuant to Section 177 of the federal Clean Air Act (42 U.S.C. § 7507).

d. A manufacturer that selects compliance Option 2 must provide to the Executive Officer separate values for the number of vehicles produced and delivered for sale in the District of Columbia and for each individual state within the average.

(A)(ii) For the 2012 through 2016 model years, a manufacturer may elect to demonstrate compliance with this section 1961.1 by demonstrating compliance with the 2012 through 2016 MY National greenhouse gas program as follows:

1. A manufacturer that selects compliance with this option 1961.1(a)(1)(A)(ii) must notify the Executive Officer of that selection, in writing, prior to the start of the applicable model year or must comply with 1961.1(a)(1)(A)(i).

2. The manufacturer must submit to ARB a copy of the Model Year CAFE report that it submitted to EPA as required under 40 CFR §86.1865-12 (May 7, 2010) ~~(as proposed at 74 Fed. Reg. 49454, 49760 (September 28, 2009) and adopted by EPA on April 1, 2010, 75 Fed. Reg. [insert page] (April [insert date], 2010)~~, for demonstrating compliance with the 2012 through 2016 MY National greenhouse gas program and the EPA determination of compliance. These must be submitted within 30 days of receipt of the EPA determination of compliance, for each model year that a manufacturer selects compliance with this option 1961.1(a)(1)(A)(ii).

3. The manufacturer must provide to the Executive Officer separate values for the number of vehicles produced and delivered for sale in California, the District of Columbia, and each individual state that has adopted California's greenhouse gas emission standards for that model year pursuant to Section 177 of the federal Clean Air Act (42 U.S.C. § 7507). and

~~3~~4. If a manufacturer has outstanding greenhouse gas debits at the end of the 2011 model year, as calculated in accordance with 1961.1(b), the manufacturer must submit to the Executive Officer a plan for offsetting all outstanding greenhouse gas debits by using greenhouse gas credits earned under the 2012 through 2016 MY National greenhouse gas program before applying those credits to offset any 2012 through 2016 MY National greenhouse gas program debits. Upon approval of the plan by the Executive Officer, the manufacturer may demonstrate compliance with this section 1961.1 by demonstrating compliance with the 2012 through 2016 MY National greenhouse gas program. Any California debits not offset by the end of the 2016 model year National greenhouse gas program reporting period are subject to penalties as provided in this Section 1961.1.

* * * *

(C) *Requirements for Intermediate Volume Manufacturers.*

* * * *

3. In the 2016 ~~and subsequent~~ model year~~s~~, an intermediate volume manufacturer shall either:

a. not exceed a fleet average greenhouse gas emissions value of 233 g/mi for PCs and LDT1s and 361 g/mi for LDT2s and MDPVs, or

b. not exceed a fleet average greenhouse gas value of 0.75 times the baseline fleet average greenhouse gas value for PCs and LDT1s and 0.82 times the baseline fleet average greenhouse gas value for LDT2s and MDPVs, as calculated in section 1961.1(a)(1)(C)2.

* * * *

(D) *Requirements for Small Volume Manufacturers and Independent Low Volume Manufacturers.*

* * * *

3. In the 2016 ~~and subsequent~~ model year~~s~~, a small volume manufacturer and an independent low volume manufacturer shall either:

a. not exceed the fleet average greenhouse gas emissions value calculated for each GHG vehicle test group for which a comparable vehicle is sold by a large volume manufacturer, in accordance with section 1961.1(a)(1)(D)2; or

b. not exceed a fleet average greenhouse gas emissions value of 233 g/mi for PCs and LDT1s and 361 g/mi for LDT2s and MDPVs; or

c. upon approval of the Executive Officer, if a small volume manufacturer demonstrates a vehicle model uses an engine, transmission, and emission control system that is identical to a configuration certified for sale in California by a large volume manufacturer, those small volume manufacturer vehicle models are exempt from meeting the requirements in paragraphs 3.a. and b. of this section.

* * * *

(b) *Calculation of Greenhouse Gas Credits/Debits.*

(1) *Calculation of Greenhouse Gas Credits for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.*

* * * *

(B) In 2009 <u>through 2016</u> ~~and subsequent~~ model years, a manufacturer that achieves fleet average Greenhouse Gas values lower than the fleet average Greenhouse Gas requirement for the corresponding model year shall receive credits in units of g/mi Greenhouse Gas determined as:

[(Fleet Average Greenhouse Gas Requirement) - (Manufacturer's Fleet Average
Greenhouse Gas Value)] x (Total No. of Vehicles Produced and Delivered for Sale in California, Including ZEVs and HEVs).

(2) A manufacturer with 2009 <u>through 2016</u> ~~and subsequent~~ model year fleet average Greenhouse Gas values greater than the fleet average requirement for the corresponding model year shall receive debits in units of g/mi Greenhouse Gas equal to the amount of negative credits determined by the aforementioned equation. For the 2009 <u>through 2016</u> ~~and subsequent~~ model years, the total g/mi Greenhouse Gas credits or debits earned for PCs and LDT1s and for LDT2s and MDPVs shall be summed together. The resulting amount shall constitute the g/mi Greenhouse Gas credits or debits accrued by the manufacturer for the model year.

(3) *Procedure for Offsetting Greenhouse Gas Debits.*

* * * *

(B) Greenhouse Gas emission credits earned in the 2000 through 2008 model years shall be treated as if they were earned in the 2011 model year and shall retain full value through the 2012 model year. Greenhouse Gas emission credits earned in the 2009 <u>through 2016</u> ~~and subsequent~~ model years shall retain full value through the fifth model year after they are earned. The value of any credits earned in the 2000 through 2008 model years that are not used to equalize debits accrued in the 2009 through 2012 model years shall be discounted by 50% at the beginning of the 2013 model year, shall be discounted to 25% of its original value if not used by the beginning of the 2014 model year, and will have no value if not used by the beginning of the 2015 model year. Any credits earned in the 2009 <u>through 2016</u> ~~and subsequent~~ model years that are not used by the end of the fifth model year after they are accrued shall be discounted by 50% at the beginning of the sixth model year after being earned, shall be discounted to 25% of its original value if not used by the beginning of the seventh model year after being earned, and will have no value if not used by the beginning of the eighth model year after being earned.

(c) *Test Procedures.* The certification requirements and test procedures for determining compliance with the emission standards in this section are set forth in the "California <u>2001 through 2014 Model Criteria Pollutant</u> Exhaust Emission Standards and Test Procedures <u>and</u> ~~for 2001~~ <u>2009 through 2016</u> ~~and Subsequent~~ Model <u>Greenhouse Gas Exhaust Emission Standards and Test Procedures for</u> Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles," incorporated by reference in section 1961(d). In the case of hybrid electric vehicles and on-board fuel-fired heaters, the certification requirements and test procedures for determining compliance with the emission standards in this section are set forth in the "California Exhaust Emission Standards and Test Procedures for <u>2009 through 2017</u> ~~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," incorporated by reference in section 1962<u>.1</u>.

* * * *

(e) *Definitions Specific to this Section.* The following definitions apply to this section 1961.1:

* * * *

(7) "<u>2012 through 2016 MY</u> National greenhouse gas program" means the national program that applies to new 2012 through 2016 model year passenger cars, light-duty trucks, and medium-duty passenger vehicles as ~~proposed by the U.S. Environmental Protection Agency at 74 Fed.Reg. 49454 (September 28, 2009) and~~ adopted by <u>the U.S. Environmental Protection Agency at</u> ~~EPA on April 1, 2010,~~ 75 Fed.Reg. <u>25324</u> ~~[insert page]~~, <u>(May 7, 2010)</u> ~~April [insert date], 2010~~, as incorporated in and amended by the " California <u>2001 through 2014 Model Criteria Pollutant</u> Exhaust Emission Standards and Test Procedures <u>and</u> ~~for 2001~~ <u>2009 through 2016</u> ~~and Subsequent~~ Model <u>Greenhouse Gas Exhaust Emission Standards and Test Procedures for</u> Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles."

*   *   *   *

(9) "Optional GHG Test Vehicle Configuration" means any GHG vehicle configuration that is selected for testing by the manufacturer as allowed by section G.2.3 of the "California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and ~~for 2001~~ 2009 through 2016 ~~and Subsequent~~ Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles," other than the worst-case configuration.

*   *   *   *

NOTE: Authority cited: Sections 39500, 39600, 39601, 43013, 43018, 43018.5, 43101, 43104 and 43105, Health and Safety Code. Reference: Sections 39002, 39003, 39667, 43000, 43009.5, 43013, 43018, 43018.5, 43100, 43101, 43101.5, 43102, 43104, 43105, 43106, 43204, 43205, and 43211, Health and Safety Code.

6. Adopt new title 13, CCR, section 1961.2 to read as follows: (Note: the entire text of section 1961.2 set forth below is new language proposed to be added to the California Code of Regulations.)

§ 1961.2. Exhaust Emission Standards and Test Procedures - 2015 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles.

Introduction. This section 1961.2 contains the California "LEV III" exhaust emission standards for 2015 and subsequent model year passenger cars, light-duty trucks, and medium-duty vehicles. A manufacturer must demonstrate compliance with the exhaust standards in subsection (a) applicable to specific test groups, and with the composite phase-in requirements in subsection (b) applicable to the manufacturer's entire fleet.

Before the 2015 model year, a manufacturer that produces vehicles that meet the standards in subsection (a) has the option of certifying the vehicles to those standards, in which case the vehicles will be treated as LEV III vehicles for purposes of the fleet-wide phase-in requirements. Similarly, 2015 - 2019 model-year vehicles may be certified to the "LEV II" exhaust emission standards in subsection 1961(a)(1), in which case the vehicles will be treated as LEV II vehicles for purposes of the fleet-wide phase-in requirements.

A manufacturer has the option of certifying engines used in incomplete and diesel medium-duty vehicles with a gross vehicle weight rating of greater than 10,000 lbs. GVW to the heavy-duty engine standards and test procedures set forth in title 13, CCR, subsections 1956.8(c) and (h). All medium-duty vehicles with a gross vehicle weight rating of less than or equal to 10,000 lbs. GVW, including incomplete otto-cycle medium-duty vehicles and medium-duty vehicles that use diesel cycle engines, must be certified to the LEV III chassis standards and test procedures set forth in this section 1961.2.

Pooling Provision.

For each model year, a manufacturer must demonstrate compliance with this section 1961.2 based on one of two options applicable throughout the model year, either:

Option 1: the total number of passenger cars, light-duty trucks, and medium-duty vehicles that are certified to the California exhaust emission standards in subsection (a) and subsection 1961(a)(1), and are produced and delivered for sale in California; or

Option 2: the total number of passenger cars, light-duty trucks, and medium-duty vehicles that are certified to the California exhaust emission standards in subsection (a) and subsection 1961(a)(1), and are produced and delivered for sale in California, the District of Columbia, and all states that have adopted California's criteria pollutant emission standards set forth in this section 1961.2 for that model year pursuant to section 177 of the federal Clean Air Act (42 U.S.C. § 7507).

A manufacturer that selects compliance Option 2 must notify the Executive Officer of that selection in writing prior to the start of the applicable model year or must comply with Option 1. Once a manufacturer has selected compliance Option 2, that selection applies unless the manufacturer selects Option 1 and notifies the Executive Officer of that selection in writing before the start of the applicable model year.

When a manufacturer is demonstrating compliance using Option 2 for a given model year, the term "in California" as used in this section 1961.2 means California, the District of Columbia, and all states that have adopted California's criteria pollutant emission standards set forth in this section 1961.2 for that model year pursuant to Section 177 of the federal Clean Air Act (42 U.S.C. § 7507).

(a) *Exhaust Emission Standards.*

(1) *"LEV III" Exhaust Standards*. The following standards are the maximum exhaust emissions for the full useful life from new 2015 and subsequent model year "LEV III" passenger cars, light-duty trucks, and medium-duty vehicles, including fuel-flexible, bi-fuel and dual fuel vehicles when operating on the gaseous or alcohol fuel they are designed to use. 2015 – 2019 model-year LEV II LEV vehicles may be certified to the NMOG+NOx numerical values for LEV160, LEV395, or LEV630, as applicable, in this subsection (a)(1) and the corresponding NMOG+NOx numerical values in subsection (a)(4), in lieu of the separate NMOG and NOx exhaust emission standards in subsections 1961(a)(1) and 1961(a)(4); LEV II ULEV vehicles may be certified to the NMOG+NOx numerical values for ULEV125, ULEV340, or ULEV570, as applicable, in this subsection (a)(1) and the corresponding NMOG+NOx numerical values in subsection (a)(4), in lieu of the separate NMOG and NOx exhaust emission standards in subsections 1961(a)(1) and 1961(a)(4); and LEV II SULEV vehicles may be certified to the NMOG+NOx numerical values for SULEV30, SULEV170, or SULEV230, as applicable, in subsection (a)(1) and the corresponding NMOG+NOx numerical values in subsection (a)(4), in lieu of the separate NMOG and NOx exhaust emission standards in subsections 1961(a)(1) and 1961(a)(4). Such vehicles will be treated as LEV II vehicles for purposes of the fleet-wide phase-in requirements.

LEV III Exhaust Mass Emission Standards for New 2015 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles						
Vehicle Type	*Durability Vehicle Basis (mi)*	*Vehicle Emission Category*[2]	*NMOG + Oxides of Nitrogen (g/mi)*	*Carbon Monoxide (g/mi)*	*Formaldehyde (mg/mi)*	*Particulates*[1] *(g/mi)*
All PCs; LDTs 8500 lbs. GVWR or less; MDPVs Vehicles in this category are tested at their loaded vehicle weight	150,000	LEV160	0.160	4.2	4	0.01
		ULEV125	0.125	2.1	4	0.01
		ULEV70	0.070	1.7	4	0.01
		ULEV50	0.050	1.7	4	0.01
		SULEV30	0.030	1.0	4	0.01
		SULEV20	0.020	1.0	4	0.01
MDVs 8501 - 10,000 lbs. GVWR Vehicles in this category are tested at their adjusted loaded vehicle weight	150,000	LEV395	0.395	6.4	6	0.12
		ULEV340	0.340	3.2	6	0.06
		ULEV250	0.250	2.6	6	0.06
		ULEV200	0.200	2.6	6	0.06
		SULEV170	0.170	1.5	6	0.06
		SULEV150	0.150	1.5	6	0.06
MDVs 10,001-14,000 lbs. GVWR Vehicles in this category are tested at their adjusted loaded vehicle weight	150,000	LEV630	0.630	7.3	6	0.12
		ULEV570	0.570	3.7	6	0.06
		ULEV400	0.400	3.0	6	0.06
		ULEV270	0.270	3.0	6	0.06
		SULEV230	0.230	1.7	6	0.06
		SULEV200	0.200	1.7	6	0.06

[1] These standards shall apply only to vehicles not included in the phase-in of the particulate standards set forth in subsection (a)(2).
[2] The numeric portion of the category name is the NMOG+NOx value in thousandths of grams per mile.

(2) *"LEV III" Particulate Standards.*

(A) *Particulate Standards for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.* Beginning in the 2017 model year, a manufacturer, except a small volume manufacturer, shall certify a percentage of its passenger car, light-duty truck, and medium-duty vehicle fleet to the following particulate standards according to the following phase-in schedule. These standards are the maximum particulate emissions allowed at full useful life. All vehicles certifying to these particulate standards must certify to the LEV III exhaust emission standards set forth in subsection (a)(1).

LEV III Particulate Emission Standard Values and Phase-in for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles		
Model Year	**% of vehicles certified to a 3 mg/mi standard**	**% of vehicles certified to a 1 mg/mi standard**
2017	10	0
2018	20	0
2019	40	0
2020	70	0
2021	100	0
2022	100	0
2023	100	0
2024	100	0
2025	75	25
2026	50	50
2027	25	75
2028 and subsequent	0	100

(B) *Particulate Standards for Medium-Duty Vehicles Other than Medium-Duty Passenger Vehicles*.

1. Beginning in the 2017 model year, a manufacturer, except a small volume manufacturer, shall certify a percentage of its medium-duty vehicle fleet to the following particulate standards. These standards are the maximum particulate emissions allowed at full useful life. All vehicles certifying to these particulate standards must certify to the LEV III exhaust emission standards set forth in subsection (a)(1). This subsection (a)(2)(B)1 shall not apply to medium-duty passenger vehicles.

LEV III Particulate Emission Standard Values for Medium-Duty Vehicles, Other than Medium-Duty Passenger Vehicles	
Vehicle Type[1]	**Particulates (mg/mi)**
MDVs 8501 - 10,000 lbs. GVWR, excluding MDPVs	8
MDVs 10,001 - 14,000 lbs. GVWR	10

[1] Vehicles in these categories are tested at their adjusted loaded vehicle weight.

2. A manufacturer of medium-duty vehicles, except a small volume manufacturer, shall certify at least the following percentage of its medium-duty vehicle fleet to the particulate standards in subsection (a)(2)(B)1 according to the following phase-in schedule. This subsection (a)(2)(B)2 shall not apply to medium-duty passenger vehicles.

LEV III Particulate Emission Standard Phase-in for Medium-Duty Vehicles, Other than Medium-Duty Passenger Vehicles	
Model Year	**Total % of MDVs certified to the 8 mg/mi PM Standard or to the 10 mg/mi PM Standard, as applicable**
2017	10
2018	20
2019	40
2020	70
2021 and subsequent	100

(C) *Particulate Standards for Small Volume Manufacturers.* In the 2021 through 2027 model years, a small volume manufacturer shall certify 100 percent of its passenger car, light-duty truck, and medium-duty passenger vehicle fleet to the 3 mg/mi particulate standard. In the 2028 and subsequent model years, a small volume manufacturer shall certify 100 percent of its passenger car, light-duty truck, and medium-duty passenger vehicle fleet to the 1 mg/mi particulate standard. In the 2021 and subsequent model years, a small volume manufacturer shall certify 100 percent of its medium-duty vehicles 8501 - 10,000 lbs. GVWR, excluding MDPVs, to the 8 mg/mi particulate standard. In the 2021 and subsequent model years, a small volume manufacturer shall certify 100 percent of its medium-duty vehicles 10,001 - 14,000 lbs. GVWR to the 10 mg/mi particulate standard. These standards are the maximum particulate emissions allowed at full useful life. All vehicles certifying to these particulate standards must certify to the LEV III exhaust emission standards set forth in subsection (a)(1).

(D) *Alternative Phase-in Schedule for Particulate Standards.*

1. *Alternative Phase-in Schedules for the 3 mg/mi Particulate Standard for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.* A manufacturer may use an alternative phase-in schedule to comply with the 3 mg/mi particulate standard phase-in requirements as long as equivalent PM emission reductions are achieved by the 2021 model year from passenger cars, light-duty trucks, and medium-duty passenger vehicles. Model year emission reductions shall be calculated by multiplying the percent of PC+LDT+MDPV vehicles meeting the 3 mg/mi particulate standard in a given model year (based on

a manufacturer's projected sales volume of vehicles in each category) by 5 for the 2017 model year, 4 for the 2018 model year, 3 for the 2019 model year, 2 for the 2020 model year, and 1 for the 2021 model year. The yearly results for PC+LDT+MDPV vehicles shall be summed together to determine a cumulative total for PC+LDT+MDPV vehicles. The cumulative total must be equal to or greater than 490 in the 2021 model year to be considered equivalent. A manufacturer may add vehicles introduced before the 2017 model year (e.g., the percent of vehicles introduced in 2016 would be multiplied by 5) to the cumulative total.

2. *Alternative Phase-in Schedules for the 1 mg/mi Particulate Standard for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.* A manufacturer may use an alternative phase-in schedule to comply with the 1 mg/mi particulate standard phase-in requirements as long as equivalent PM emission reductions are achieved by the 2028 model year from passenger cars, light-duty trucks, and medium-duty passenger vehicles. Model year emission reductions shall be calculated by multiplying the percent of PC+LDT+MDPV vehicles meeting the 1 mg/mi particulate standard in a given model year (based on a manufacturer's projected sales volume of vehicles in each category) by 4 for the 2025 model year, 3 for the 2026 model year, 2 for the 2027 model year, and 1 for the 2028 model year. The yearly results for PC+LDT+MDPV vehicles shall be summed together to determine a cumulative total for PC+LDT+MDPV vehicles. The cumulative total must be equal to or greater than 500 in the 2028 model year to be considered equivalent. A manufacturer may add vehicles introduced before the 2025 model year (e.g., the percent of vehicles introduced in 2024 would be multiplied by 4) to the cumulative total.

3. *Alternative Phase-in Schedules for the Particulate Standards for Medium-Duty Vehicles Other than Medium-Duty Passenger Vehicles.* A manufacturer may use an alternative phase-in schedule to comply with the particulate standard phase-in requirements as long as equivalent PM emission reductions are achieved by the 2021 model year from medium-duty vehicles other than medium-duty passenger vehicles. Model year emission reductions shall be calculated by multiplying the total percent of MDVs certified to the 8 mg/mi PM standard or to the 10 mg/mi PM standard, as applicable, in a given model year (based on a manufacturer's projected sales volume of vehicles in each category) by 5 for the 2017 model year, 4 for the 2018 model year, 3 for the 2019 model year, 2 for the 2020 model year, and 1 for the 2021 model year. The yearly results for MDVs shall be summed together to determine a cumulative total for MDVs. The cumulative total must be equal to or greater than 490 in the 2021 model year to be considered equivalent. A manufacturer may add vehicles introduced before the 2017 model year (e.g., the percent of

vehicles introduced in 2016 would be multiplied by 5) to the cumulative total.

(3) *NMOG+NOx Standards for Bi-Fuel, Fuel-Flexible, and Dual-Fuel Vehicles*. For fuel-flexible, bi-fuel, and dual-fuel PCs, LDTs and MDVs, compliance with the NMOG+NOx exhaust mass emission standards must be based on exhaust emission tests both when the vehicle is operated on the gaseous or alcohol fuel it is designed to use, and when the vehicle is operated on gasoline. A manufacturer must demonstrate compliance with the applicable exhaust mass emission standards for NMOG+NOx, CO, and formaldehyde set forth in the table in subsection (a)(1) when certifying the vehicle for operation on the gaseous or alcohol fuel, as applicable, and on gasoline or diesel, as applicable.

A manufacturer may measure NMHC in lieu of NMOG when fuel-flexible, bi-fuel and dual-fuel vehicles are operated on gasoline, in accordance with the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles." Testing at 50^{o}F is not required for fuel-flexible, bi-fuel, and dual-fuel vehicles when operating on gasoline.

(4) *50°F Exhaust Emission Standards.* All passenger cars, light-duty trucks, and medium-duty vehicles, other than natural gas and diesel-fueled vehicles, must demonstrate compliance with the following exhaust emission standards for NMOG+NOx and formaldehyde (HCHO) measured on the FTP (40 CFR, Part 86, Subpart B) conducted at a nominal test temperature of 50°F, as modified by Part II, Section C of the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles." A manufacturer may demonstrate compliance with the NMOG+NOx and HCHO certification standards contained in this subparagraph by measuring NMHC exhaust emissions or issuing a statement of compliance for HCHO in accordance with Section D.1, subparagraph (p) and Section G.3.1.2, respectively, of the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles." Emissions of CO measured at 50° F shall not exceed the standards set forth in subsection (a)(1) applicable to vehicles of the same emission category and vehicle type subject to a cold soak and emission test at 68° to 86° F.

(A) *Standards for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles Certified to the LEV III Standards.*

50^{o}F Exhaust Emission Standards for LEV III Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles			
Vehicle Emission Category	*NMOG + NOx (g/mi)*		*HCHO (g/mi)*
	Gasoline	Alcohol Fuel	Both Gasoline and Alcohol Fuel
LEV160	0.320	0.320	0.030
ULEV125	0.250	0.250	0.016
ULEV70	0.140	0.250	0.016
ULEV50	0.100	0.140	0.016
SULEV30	0.060	0.125	0.008
SULEV20	0.040	0.075	0.008

(B) *Standards for Medium-Duty Vehicles (Excluding MDPVs) Certified to the LEV III Standards.*

50°F Exhaust Emission Standards for LEV III Medium-Duty Vehicles (Excluding MDPVs)			
Vehicle Emission Category	*NMOG + NOx (g/mi)*		*HCHO (g/mi)*
	Gasoline	Alcohol Fuel	Both Gasoline and Alcohol Fuel
LEV395	0.790	0.790	0.064
ULEV340	0.680	0.680	0.032
ULEV250	0.500	0.500	0.032
ULEV200	0.400	0.500	0.016
SULEV170	0.340	0.425	0.016
SULEV150	0.300	0.375	0.016
LEV630	1.260	1.260	0.080
ULEV570	1.140	1.140	0.042
ULEV400	0.800	0.800	0.042
ULEV270	0.540	0.675	0.020
SULEV230	0.460	0.575	0.020
SULEV200	0.400	0.500	0.020

(5) *Cold CO Standard*. The following standards are the 50,000 mile cold temperature exhaust carbon monoxide emission levels from new 2015 and subsequent model-year passenger cars, light-duty trucks, and medium-duty passenger vehicles:

2015 AND SUBSEQUENT MODEL-YEAR COLD TEMPERATURE CARBON MONOXIDE EXHAUST EMISSIONS STANDARDS FOR PASSENGER CARS, LIGHT-DUTY TRUCKS, AND MEDIUM-DUTY PASSENGER VEHICLES

(grams per mile)

Vehicle Type	*Carbon Monoxide*
All PCs, LDTs 0-3750 lbs. LVW;	10.0
LDTs, 3751 lbs. LVW - 8500 lbs. GVWR; MDPVs 10000 lbs. GVWR and less	12.5

These standards apply to vehicles tested at a nominal temperature of 20°F (-7°C) in accordance with 40 CFR Part 86 Subpart C, as amended by the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles." Natural gas, diesel-fueled and zero-emission vehicles are exempt from these standards.

(6) *Highway NMOG + NOx Standard.* The maximum emissions of non-methane organic gas plus oxides of nitrogen measured on the federal Highway Fuel Economy Test (HWFET; 40 CFR 600 Subpart B, as modified by the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles," must not be greater than the applicable LEV III NMOG+NOx standard set forth in subsection (a)(1). Both the sum of the NMOG+NOx emissions and the HWFET standard must be rounded in accordance with ASTM E29-67 to the nearest 0.001 g/mi before being compared.

(7) *Supplemental Federal Test Procedure (SFTP) Off-Cycle Emission Standards.*

(A) *SFTP NMOG+NOx and CO Exhaust Emission Standards for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.* Manufacturers shall certify 2015 and subsequent model year LEVs, ULEVs, and SULEVs in the PC, LDT, and MDPV classes to either the *SFTP NMOG+NOx and CO Stand-Alone Exhaust Emission Standards* set forth in subsection (a)(7)(A)1, or in accordance with the *SFTP NMOG+NOx and CO Composite Exhaust Emission Standards and Fleet-Average Requirements* set forth in subsection (a)(7)(A)2. A manufacturer may also certify 2014 model LEVs, ULEVs, or SULEVs in the PC, LDT, or MDPV classes to LEV III SFTP standards, in which case, the manufacturer shall be subject to the LEV III SFTP emission standards and requirements, including the sales-weighted fleet-average NMOG+NOx composite emission standard applicable to 2015 model vehicles if choosing to comply with the *SFTP NMOG+NOx and CO Composite Exhaust Emission Standards and Fleet-Average Requirements* set forth in subsection (a)(7)(A)2. The manufacturer shall notify the Executive Officer of its selected emission standard type in the Application for Certification of the first test group certifying to SFTP NMOG+NOx and CO emission standards on a 150,000 mile durability basis. Once an emission standard type for NMOG+NOx and CO is selected for a fleet, and the Executive Officer is notified of such selection, the selection must be kept through the 2025 model year for the entire fleet, which includes LEV II vehicles if selecting to comply with subsection (a)(7)(A)2. The manufacturer may not change its selection until the 2026 model year. Test groups not certifying to the 150,000-mile SFTP NMOG+NOx and CO emission standards pursuant to this subsection (a)(7)(A) shall be subject to the 4,000-mile SFTP NMOG+NOx and CO emission standards set forth in subsection 1960.1(r).

1. *SFTP NMOG+NOx and CO Exhaust Stand-Alone Emission Standards*. The following standards are the maximum SFTP NMOG+NOx and CO exhaust emissions through full useful life from 2015 and subsequent model-year LEV III LEVs, ULEVs, and SULEVs when operating on the same gaseous or liquid fuel they use for FTP certification. In the case of fuel-flexible vehicles, SFTP compliance shall be demonstrated using the LEV III certification gasoline specified in Part II, Section A.100.3.1.2 of the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles."

SFTP NMOG+NOx and CO Stand-Alone Exhaust Emission Standards for 2015 and Subsequent Model LEV III Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles						
Vehicle Type	*Durability Vehicle Basis (mi)*	*Vehicle Emission Category*[1]	US06 Test *(g/mi)*		*SC03 Test (g/mi)*	
			NMHC + NOx	*CO*	*NMHC + NOx*	*CO*
All PCs; LDTs 0- 8,500 lbs. GVWR; and MDPVs Vehicles in these categories are tested at their loaded vehicle weight (curb weight plus 300 pounds).	150,000	LEV	0.140	9.6	0.100	3.2
		ULEV	0.120	9.6	0.070	3.2
		SULEV (Option A)[2]	0.060	9.6	0.020	3.2
		SULEV	0.050	9.6	0.020	3.2

[1] *Vehicle Emission Category*. Manufacturers must certify all vehicles, which are certifying to a LEV III FTP emission category on a 150,000-mile durability basis, to the emission standards of the equivalent, or a more stringent, SFTP emission category set forth on this table. That is, all LEV III LEVs certified to 150,000-mile FTP emission standards shall comply with the SFTP LEV emission standards in this table, all LEV III ULEVs certified to 150,000-mile FTP emission standards shall comply with the SFTP ULEV emission standards in this table, and all LEV III SULEVs certified to 150,000-mile FTP emission standards shall comply with the SFTP SULEV emission standards in this table.

[2] *Optional SFTP SULEV Standards.* A manufacturer may certify light-duty truck test groups from 6,001 to 8,500 lbs. GVWR and MDPV test groups to the SULEV, option A, emission standards set forth in this table for the 2015 through 2020 model year, only if the vehicles in the test group are equipped with a particulate filter and the manufacturer extends the particulate filter emission warranty mileage to 200,000 miles. Passenger cars and light-duty trucks 0-6,000 lbs. GVWR are not eligible for this option.

2. *SFTP NMOG+NOx and CO Composite Exhaust Emission Standards*. For the 2015 and subsequent model years, a manufacturer selecting this option must certify LEV II and LEV III LEVs, ULEVs, and SULEVs, such that the manufacturer's sales-weighted fleet-average NMOG+NOx composite emission value, does not exceed the applicable NMOG+NOx composite emission standard set forth in the following table. In addition, the CO composite emission value of any LEV III test group shall not exceed the CO composite emission standard set forth in the following table. SFTP compliance shall be demonstrated using the same gaseous or liquid fuel used for FTP certification. In the case of fuel-flexible vehicles, SFTP compliance shall be demonstrated using the LEV III certification gasoline specified in Part II, Section A.100.3.1.2 of the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles."

For each test group subject to this subsection, manufacturers shall calculate a Composite Emission Value for NMOG+NOx and, for LEV III test groups, a separate Composite Emission Value for CO, using the following equation:

Composite Emission Value = 0.28 x US06 + 0.37 x SC03 + 0.35 x FTP [Eq. 1]

where "US06" = the test group's NMOG+NOx or CO emission value, as applicable, determined through the US06 test;
"SC03" = the test group's NMOG+NOx or CO emission value, as applicable, determined through the SC03 test; and
"FTP" = the test group's NMOG+NOx or CO emission value, as applicable, determined through the FTP test.

If no vehicles in a test group have air conditioning units, the FTP cycle emission value can be used in place of the SC03 cycle emission value in Equation 1. To determine compliance with the SFTP NMOG+NOx composite emission standard applicable to the model year, manufacturers shall use a sales-weighted fleet average of the NMOG+NOx composite emission values of every applicable test group. The sales-weighted fleet average shall be calculated using a combination of carry-over and new certification SFTP composite emission values (converted to NMOG+NOx, as applicable). LEV II test groups will use their emission values in the fleet average calculation but will not be considered LEV III test groups. Compliance with the CO composite emission standard cannot be demonstrated through fleet averaging. The NMOG+NOx sales-weighted fleet-average composite emission value for the fleet and the CO composite emission value for each test group shall not exceed:

SFTP NMOG+NOx and CO Composite Emission Standards for 2015 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles (g/mi)[1]

Model Year	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025+**
All PCs; LDTs 8,500 lbs. GVWR or less; and MDPVs[3]	***Sales-Weighted Fleet Average NMOG+NOx Composite Exhaust Emission Standards[2,4,5,6]***										
	0.140	0.110	0.103	0.097	0.090	0.083	0.077	0.070	0.063	0.057	0.050
Vehicles in this category are tested at their loaded vehicle weight (curb weight plus 300 pounds).	***CO Composite Exhaust Emission Standard[7]***										
	4.2										

[1] *Mileage for Compliance.* All test groups certifying to LEV III FTP emission standards on a 150,000-mile durability basis shall also certify to the SFTP on a 150,000-mile durability basis, as tested in accordance

with the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles."

[2] *Determining NMOG+NOx Composite Emission Values of LEV II Test Groups.* For test groups certified to LEV II FTP emission standards, SFTP emission values shall be converted to NMOG+NOx and projected out to 120,000 miles or 150,000 miles (depending on LEV II FTP certification) using deterioration factors or aged components. NMHC emission values for the US06 and SC03 test cycles shall be converted to NMOG emission values by multiplying by a factor of 1.03. In lieu of deriving a deterioration factor specific to SFTP test cycles, carry-over test groups may use the applicable deterioration factor from the FTP cycle in order to determine the carry-over composite emission values for the purpose of the NMOG+NOx sales-weighted fleet-average calculation. If an SFTP full-useful life emission value is used to comply with SFTP 4k standards, that value may be used in the sales-weighted fleet-average without applying an additional deterioration factor.

[3] MDPVs are excluded from SFTP NMOG+NOx and CO emission standards and the sales-weighted fleet average until they are certified to LEV III FTP 150,000-mile NMOG+NOx and CO requirements.

[4] Test groups shall certify to bins in increments of 0.010 g/mi. Beginning with the 2018 model year, vehicles may not certify to bin values above a maximum of 0.180 g/mi.

[5] *Calculating the sales-weighted average for NMOG+NOx.* For each model year, the manufacturer shall calculate its sales-weighted fleet-average NMOG+NOx composite emission value as follows.

$$\frac{\left[\sum_{i=1}^{n}\left(number\ of\ \ vehicles\ in\ the\ test\ group\right)_i \times \left(composite\ value\ of\ bin\right)_i\right]}{\sum_{i=1}^{n}\left(number\ of\ \ vehicles\ in\ the\ test\ group\right)_i} \qquad \text{[Eq. 2]}$$

where "n" = a manufacturer's total number of PC, LDT, and, if applicable, MDPV certification bins, in a given model year including carry-over certification bins, certifying to SFTP composite emission standards in that model year;

"number of vehicles in the test group" = the number of vehicles produced and delivered for sale in California in the certification test group; and

"Composite Value of Bin" = the numerical value selected by the manufacturer for the certification bin that serves as the emission standard for the vehicles in the test group with respect to all testing for test groups certifying to SFTP on a 150,000-mile durability basis, and the SFTP carry-over composite emission value, as described in footnote 7 of this table, for carry-over LEV II test groups.

[6] *Calculation of Fleet Average Total NMOG+NOx Credits or Debits.* A manufacturer shall calculate the total NMOG+NOx credits or debits, as follows:

[(NMOG+NOx Composite Emission Standard) – (Manufacturer's Sales-Weighted Fleet-Average Composite Emission Value)]
x (Total Number of Vehicles Produced and Delivered for Sale in California in the 0-8,500 lbs GVWR plus MDPVs classes, if applicable) [Eq. 3]

A negative number constitutes total NMOG+NOx debits, and a positive number constitutes total NMOG+NOx credits accrued by the manufacturer for the given model year. Total NMOG+NOx credits earned in a given model year retain full value through the fifth model year after they are earned. At the beginning of the sixth model year, the total NMOG+NOx credits have no value. A manufacturer may trade credits with other manufacturers

A manufacturer shall equalize total NMOG+NOx debits within three model years after they have been incurred by earning NMOG+NOx credits in an amount equal to the total NMOG+NOx debits. If total NMOG+NOx debits are not equalized within the three model-year period, the manufacturer is subject to the Health and Safety Code section 43211 civil penalty applicable to a manufacturer which 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 total NMOG+NOx debits are not equalized 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 emission standards is determined by dividing the NMOG+NOx debits for the model year by the NMOG+NOx composite emission standard in effect during the model year in which the debits were incurred.

[7] *Calculating the CO composite emission value.* Composite emission values for CO shall be calculated in accordance with Equation 1 above. Unlike the NMOG+NOx composite emission standards, manufacturers would not be able to meet the proposed CO composite emission standard through fleet averaging: each individual test group must comply with the standard. Test groups certified to 4,000-mile SFTP emission standards are not subject to this CO emission standard.

(B) *SFTP PM Exhaust Emission Standards for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.* The following standards are the maximum PM exhaust emissions through the full useful life from 2017 and subsequent model-year LEV III LEVs, ULEVs, and SULEVs in the PC, LDT, and MDPV classes when operating on the same gaseous or liquid fuel they use for FTP certification. In the case of fuel-flexible vehicles, SFTP compliance shall be demonstrated using the LEV III certification gasoline specified in Part II, Section A.100.3.1.2 of the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles." Manufacturers must certify LEVs, ULEVs, and SULEVs in the PC, LDT, and MDPV classes, which are certifying to LEV III FTP PM emission standards in subsection (a)(2) on a 150,000-mile durability basis, to the *SFTP PM Exhaust Emission Standards* set forth in this subsection (a)(7)(B).

SFTP PM Exhaust Emission Standards for 2017 and Subsequent Model LEV III Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles[1]

Vehicle Type	*Test Weight*	*Mileage for Compliance*	*Test Cycle*	*PM (mg/mi)*
All PCs; LDTs 0-6,000 lbs GVWR	Loaded vehicle weight	150,000	US06	10
LDTs 6,001-8,500 lbs GVWR; MDPVs	Loaded vehicle weight	150,000	US06	20

[1] All PCs, LDTs, and MDPVs certified to LEV III FTP PM emission standards in subsection (a)(2) on a 150,000-mile durability basis shall comply with the SFTP PM Exhaust Emission Standards in this table.

(C) *SFTP NMOG+NOx and CO Exhaust Emission Standards for Medium-Duty Vehicles.* The following standards are the maximum NMOG+NOx and CO composite emission values for full useful life of 2016 and subsequent model-year medium-duty LEV III ULEVs and SULEVs from 8,501 through 14,000 pounds GVWR when operating on the same gaseous or liquid fuel they use for FTP certification. In the case of flex-fueled vehicles, SFTP compliance shall be demonstrated using the LEV III certification gasoline specified in Part II, Section A.100.3.1.2 of the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles."

The following composite emission standards do not apply to MDPVs subject to the emission standards presented in subsections (a)(7)(A) and (a)(7)(B).

SFTP NMOG+NOx and CO Composite Exhaust Emission Standards for 2016 and Subsequent Model ULEVs and SULEVs in the Medium-Duty Vehicle Class						
Vehicle Type	*Mileage for Compliance*	*HP/GVWR*[2]	*Test Cycle*[3,4,5]	*Vehicle Emission Category*[6]	*Composite Emission Standard*[1] *(g/mi)*	
					NMOG + NOx	*Carbon Monoxide*
MDVs 8,501 - 10,000 lbs GVWR	150,000	≤ 0.024	US06 Bag 2, SC03, FTP	ULEV	0.550	22.0
				SULEV	0.350	12.0
		> 0.024	Full US06, SC03, FTP	ULEV	0.800	22.0
				SULEV	0.450	12.0
MDVs 10,001-14,000 lbs GVWR	150,000	n/a	Hot 1435 UC (Hot 1435 LA92), SC03, FTP	ULEV	0.550	6.0
				SULEV	0.350	4.0

[1] Manufacturers shall use Equation 1 in subsection (a)(7)(A)2 to calculate SFTP Composite Emission Values for each test group subject to the emission standards in this table. For MDVs 10,001-14,000 lbs. GVWR, the emission results from the UC test shall be used in place of results from the US06 test.

[2] *Power to Weight Ratio.* If all vehicles in a test group have a power to weight ratio at or below a threshold of 0.024, they may opt to run the US06 Bag 2 in lieu of the full US06 cycle. The cutoff is determined by using a ratio of the engine's maximum rated horsepower, as established by the engine manufacturer in the vehicle's Application for Certification, to the vehicle's GVWR in pounds and does not include any horsepower contributed by electric motors in the case of hybrid electric or plug-in hybrid electric vehicles. Manufacturers may opt to test to the full cycle regardless of the calculated ratio; in such case, manufacturers shall meet the emission standards applicable to vehicles with power-to-weight ratios greater than 0.024.

[3] *Test Weight*. Medium-duty vehicles are tested at their adjusted loaded vehicle weight (average of curb weight and GVWR).

[4] *Road Speed Fan.* Manufacturers have the option to use a road speed modulated fan as specified in § 86.107–96(d)(1) instead of a fixed speed fan for MDV SFTP testing.

[5] If a manufacturer provides an engineering evaluation for a test group showing that SC03 emissions are equivalent to or lower than FTP emissions, the FTP emission value may be used in place of the SC03 emission value when determining the composite emission value for that test group.

[6] *Vehicle Emission Categories.* For MDVs 8,501-10,000 lbs. GVWR, for each model year, the percentage of MDVs certified to an SFTP emission category set forth in this section 1961.2 shall be equal to or greater than the total percentage certified to the FTP ULEV250, ULEV200, SULEV170, and SULEV150 emission categories; of these vehicles, the percentage of MDVs certified to an SFTP SULEV emission category shall be equal to or greater than the total percentage certified to both the FTP SULEV170 and SULEV150 emission categories. For MDVs 10,001-14,000 lbs. GVWR, for each model year, the percentage of MDVs certified to an SFTP emission category set forth in this section 1961.2 shall be equal to or greater than the total percentage certified to the FTP ULEV400, ULEV270, SULEV230, and SULEV200 emission categories; of these vehicles, the percentage of MDVs certified to an SFTP SULEV emission category shall be equal to or greater than the total percentage certified to both the FTP SULEV230 and SULEV200 emission categories.

(D) *SFTP PM Exhaust Emission Standards for Medium-Duty Vehicles.* The following standards are the maximum PM composite emission values for the full useful life of 2017 and subsequent model-year LEV III LEVs, ULEVs, and SULEVs when operating on the same gaseous or liquid fuel they use for FTP certification. In the case of fuel-flexible vehicles, SFTP compliance shall be demonstrated using the LEV III certification gasoline specified in Part II, Section A.100.3.1.2 of the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles." The following composite emission standards do not apply to MDPVs subject to the emission standards set forth in subsections (a)(7)(A) and (a)(7)(B).

SFTP PM Exhaust Emission Standards for 2017 and Subsequent Model Medium-Duty Vehicles[1]					
Vehicle Type	*Test Weight*	*Mileage for Compliance*	*Hp/GVWR*[2]	*Test Cycle*[3,4]	*PM (mg/mi)*
MDVs 8,501-10,000 lbs GVWR	Adjusted loaded vehicle weight	150,000	≤ 0.024	US06 Bag 2	7
			>0.024	US06	10
MDVs 10,001-14,000 lbs GVWR	Adjusted loaded vehicle weight	150,000	n/a	Hot 1435 UC (Hot 1435 LA92)	7

[1] Except for MDPVs subject to the emission standards set forth in subsection (a)(7)(B), MDVs certified to 150,000-mile FTP PM emission standards in subsection (a)(2) shall comply with the SFTP PM Exhaust Emission Standards in this table.

[2] *Power to Weight Ratio.* If all vehicles in a test group have a power to weight ratio at or below a threshold of 0.024, they may opt to run the US06 Bag 2 in lieu of the full US06 cycle. The cutoff is determined by using a ratio of the engine's horsepower to the vehicle's GVWR in pounds and does not include any horsepower contributed by electric motors in the case of hybrid electric or plug-in hybrid electric vehicles. Manufacturers may opt to test to the full cycle regardless of the calculated ratio; in such case, manufacturers shall meet the emission standards applicable to vehicles with power-to-weight ratios greater than 0.024.

[3] *Road Speed Fan.* Manufacturers have the option to use a road speed modulated fan as specified in § 86.107–96(d)(1) instead of a fixed speed fan for MDV SFTP testing.

[4] Manufacturers shall use Equation 1 above to calculate SFTP Composite PM Emission Values for each test group subject to the emission standards in this table. For MDVs 8,501-10,000 lbs. GVWR certifying to the US06 Bag 2 PM emission standard, the emission results from the US06 Bag 2 test shall be used in place of results from the full US06 test. For MDVs 10,001-14,000 lbs. GVWR, the emission results from the UC test shall be used in place of results from the US06 test.

(8) *Interim In-Use Compliance Standards*.

(A) *LEV III NMOG+NOx Interim In-Use Compliance Standards.* The following interim in-use compliance standards shall apply for the first two model years that a test group is certified to the LEV III standards.

1. *NMOG+NOx Interim In-Use Compliance Standards for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.* For the 2015 through 2019 model years, these standards shall apply.

Emission Category	Durability Vehicle Basis (miles)	LEV III PCs, LDTs, and MDPVs
		NMOG + NOx (g/mi)
LEV160	150,000	n/a
ULEV125	150,000	n/a
ULEV70	150,000	0.098
ULEV50	150,000	0.070
SULEV30	150,000	0.042[1]
SULEV20	150,000	0.028[1]

[1]not applicable to test groups that receive PZEV credits

2. *NMOG+NOx Interim In-Use Compliance Standards for Medium-Duty Vehicles, Excluding Medium-Duty Passenger Vehicles.* For the 2015 through 2020 model years, these standards shall apply.

Emission Category	Durability Vehicle Basis (miles)	LEV III MDVs (excluding MDPVs) 8,501 - 10,000 lbs. GVW	LEV III MDVs 10,001 - 14,000 lbs. GVW
		NMOG + NOx (g/mi)	NMOG + NOx (g/mi)
LEV395	150,000	n/a	n/a
ULEV340	150,000	n/a	n/a
ULEV250	150,000	0.370	n/a
ULEV200	150,000	0.300	n/a
SULEV170	150,000	0.250	n/a
SULEV150	150,000	0.220	n/a
LEV630	150,000	n/a	n/a
ULEV570	150,000	n/a	n/a
ULEV400	150,000	n/a	0.600
ULEV270	150,000	n/a	0.400
SULEV230	150,000	n/a	0.340
SULEV200	150,000	n/a	0.300

(B) *LEV III Particulate Interim In-Use Compliance Standards.* The following interim in-use compliance standards shall apply for the first two model years that a test group is certified to the LEV III standards.

1. *LEV III Particulate Interim In-Use Compliance Standards for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.* For the 2017 through 2020 model years, the interim in-use compliance standard for vehicles certifying to the 3 mg/mi particulate standard is 6 mg/mi. For the 2025 through 2028 model years, the interim in-use compliance standard for vehicles certifying to the 1 mg/mi particulate standard is 2 mg/mi.

2. *LEV III Particulate Interim In-Use Compliance Standards for Medium-Duty Vehicles, excluding Medium-Duty Passenger Vehicles.* For the 2017 through 2020 model years, the interim in-use compliance standard for vehicles certifying to the 8 mg/mi particulate standard shall be 16 mg/mi and the interim in-use compliance standard for vehicles certifying to the 10 mg/mi particulate standard shall be 20 mg/mi.

(C) SFTP *Interim In-Use Compliance Standards.*

1. Test groups certified prior to the 2020 model year may use an in-use compliance standard for NMOG+NOx for the first two model years that they are certified to new standards.

a. For light-duty vehicle test groups and medium-duty passenger vehicle test groups certifying to the standards in subsection (a)(7)(A)1, in-use compliance emission standards for NMOG+NOx shall be 1.4 times the applicable certification standard.

b. For light-duty vehicle test groups and medium-duty passenger vehicle test groups certifying to the standards in subsection (a)(7)(A)2, in-use compliance emission standards for NMOG+NOx shall be 1.4 times the Composite Value of the bin to which a test group is certified.

c. For medium-duty vehicle tests groups certifying to the standards in subsection (a)(7)(C), in-use compliance emission standards for NMOG+NOx shall be 1.4 times the applicable certification standard.

2. Test groups certified prior to the 2021 model year will be allowed an in-use compliance standard for PM for the first five model years that they are certified to the SFTP PM standard.

a. For light-duty vehicle test groups and medium-duty passenger vehicle test groups certifying to SFTP PM exhaust emission standards in subsection (a)(7)(B), in-use compliance emission standards for PM shall be 5.0 mg/mi higher than the applicable certification standard.

b. For medium-duty vehicle test groups certifying to SFTP PM Exhaust Emission Standards in subsection (a)(7)(D), in-use compliance emission standards for PM shall be 5.0 mg/mi higher than the applicable certification standard.

(9) *Requirement to Generate Additional NMOG+NOx Fleet Average Credit.* For a vehicle that is certified to the LEV III standards in subsection (a)(1), which does not generate a partial ZEV allocation according to the criteria set forth in section C.3 of the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" and the "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," a manufacturer may subtract 5 mg/mi from the NMOG+NOx emission standards value set forth in subsection (b)(1)(B)1.c when calculating the manufacturer's fleet average, provided that the manufacturer extends the performance and defects warranty period to 15 years or 150,000 miles, whichever occurs first.

(10) *Requirement to Generate a Partial ZEV Allowance.* For the 2015 through 2017 model years, a manufacturer that certifies to the LEV III SULEV30 or the LEV III SULEV20 standards may also generate a partial ZEV allocation according to the criteria set forth in section C.3 of the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes."

(11) *NMOG Credit for Direct Ozone Reduction Technology.* A manufacturer that certifies vehicles equipped with direct ozone reduction technologies shall be eligible to receive NMOG credits that can be applied to the NMOG exhaust emissions of the vehicle when determining compliance with the standard. In order to receive credit, the manufacturer must submit the following information for each vehicle model for which it gets credit, including, but not limited to:

(A) a demonstration of the airflow rate through the direct ozone reduction device and the ozone-reducing efficiency of the device over the range of speeds encountered in the Unified Cycle Driving Schedule;

(B) an evaluation of the durability of the device for the full useful life of the vehicle; and

(C) a description of the on-board diagnostic strategy for monitoring the performance of the device in-use.

Using the above information, the Executive Officer shall determine the value of the NMOG credit based on the calculated change in the one-hour peak ozone level using an approved airshed model.

(12) *When a Federally-Certified Vehicle Model is Required in California.*

(A) *General Requirement.* Whenever a manufacturer federally-certifies a 2015 or subsequent model-year passenger car, light-duty truck, or medium-duty vehicle model to the standards for a particular emissions bin that are more stringent than the standards for an applicable California emission category, the equivalent California model may only be certified to (i) the California standards for a vehicle emissions category that are at least as stringent as the standards for the corresponding federal emissions bin, or (ii) the exhaust emission standards to which the federal model is certified. However, where the federal exhaust emission standards for the particular emissions bin and the California standards for a vehicle emissions category are equally stringent, the California model may only be certified to either the California standards for that vehicle emissions category or more stringent California standards. The federal emission bins are those contained in Tables S04-1 and S04-2 of 40 CFR §86.1811-04(c) as adopted February 10, 2000. The criteria for applying this requirement are set forth in Part I. Section H.1 of the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles."

(B) *Exception for clean fuel fleet vehicles.* Subsection (a)(12)(A) does not apply in the case of a federally-certified vehicle model that is only marketed to fleet operators for applications that are subject to clean fuel fleet requirements established pursuant to section 246 of the federal Clean Air Act (42 U.S.C. sec. 7586). In addition, the Executive Officer shall exclude from the requirement a federally-certified vehicle model where the manufacturer demonstrates to the Executive Officer's reasonable satisfaction that the model will primarily be sold or leased to clean fuel fleet operators for such applications, and that other sales or leases of the model will be incidental to marketing to those clean fuel fleet operators.

(13) *Emission Standard for a Fuel-Fired Heater.* Whenever a manufacturer elects to utilize an on-board fuel-fired heater on any passenger car, light-duty truck or medium-duty vehicle, the fuel-fired heater must meet ULEV125 standards for passenger cars and light-duty trucks less than 8,500 pounds GVWR as set forth in subsection 1961(a)(1). The exhaust emissions from the fuel-fired heater shall be determined in accordance with the ""California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-

Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" or the "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," as applicable. If the on-board fuel-fired heater is capable of operating at ambient temperatures above 40°F, the measured emission levels of the on-board fuel-fired heater shall be added to the emissions measured on the FTP (40 CFR, Part 86, Subpart B), as amended by the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles" to determine compliance with the exhaust emission standards in subsection (a)(1).

(b) *Emission Standards Phase-In Requirements for Manufacturers.*

(1) *Fleet Average NMOG + NOx Requirements for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.*

(A) The fleet average non-methane organic gas plus oxides of nitrogen exhaust mass emission values from the passenger cars, light-duty trucks, and medium-duty passenger vehicles that are produced and delivered for sale in California each model year by a manufacturer other than a small volume manufacturer shall not exceed:

As Amended: March 22, 2012
Date of Hearing: January 26-27, 2012

FLEET AVERAGE NON-METHANE ORGANIC GAS PLUS OXIDES OF NITROGEN EXHAUST MASS EMISSION REQUIREMENTS FOR PASSENGER CARS, LIGHT-DUTY TRUCKS, AND MEDIUM-DUTY PASSENGER VEHICLES (150,000 mile Durability Vehicle Basis)		
Model Year	*Fleet Average NMOG + NOx (grams per mile)*	
	All PCs; LDTs 0-3750 lbs. LVW	*LDTs 3751 lbs. LVW - 8500 lbs. GVWR; All MDPVs*
2014[1]	0.107	0.128
2015	0.100	0.119
2016	0.093	0.110
2017	0.086	0.101
2018	0.079	0.092
2019	0.072	0.083
2020	0.065	0.074
2021	0.058	0.065
2022	0.051	0.056
2023	0.044	0.047
2024	0.037	0.038
2025+	0.030	0.030

[1] For the 2014 model year, a manufacturer may comply with the fleet average NMOG+NOx values in this table in lieu of complying with the NMOG fleet average values in subsection 1961(a)(b)(1)(A). A manufacturer must either comply with the NMOG+NOx fleet average requirements for both its PC/LDT1 fleet and its LDT2/MDPV fleet or comply with the NMOG fleet average requirements for both its PC/LDT1 fleet and its LDT2/MDPV fleet. A manufacturer must calculate its fleet average NMOG+NOx values using the applicable full useful standards.

1. A manufacturer that selects compliance Option 2 must provide to the Executive Officer separate values for the number of vehicles in each test group produced and delivered for sale in the District of Columbia and for each individual state within the average.

2. *PZEV Anti-Backsliding Requirement*. In the 2018 and subsequent model years, a manufacturer must produce and deliver for sale in California a minimum percentage of its passenger car and light-duty truck fleet that certifies to SULEV30 and SULEV20 standards. This minimum percentage must be equal to the average percentage of PZEVs produced and

deliver for sale in California for that manufacturer for the 2015 through 2017 model year. A manufacturer may calculate this average percentage using the projected sales for these model years in lieu of actual sales.

(B) *Calculation of Fleet Average NMOG + NOx Value.*

1. *Basic Calculation.*

a. Each manufacturer's PC and LDT1 fleet average NMOG + NOx value for the total number of PCs and LDT1s produced and delivered for sale in California shall be calculated as follows:

(Σ [Number of vehicles in a test group excluding off-vehicle charge capable hybrid electric vehicles x applicable emission standard] +
Σ [Number of off-vehicle charge capable hybrid electric vehicles in a test group x HEV NMOG+NOx contribution factor]) ÷
Total Number of PCs plus LDT1s Produced and Delivered for sale in California, Including ZEVs and HEVs

b. Each manufacturer's LDT2 and MDPV fleet average NMOG+NOx value for the total number of LDT2s and MDPVs produced and delivered for sale in California shall be calculated as follows:

(Σ [Number of vehicles in a test group excluding off-vehicle charge capable hybrid electric vehicles x applicable emission standard] +
Σ [Number of off-vehicle charge capable hybrid electric vehicles in a test group x HEV NMOG factor]) ÷
Total Number of LDT2s plus MDPVs Produced and Delivered for sale in California, Including ZEVs and HEVs

c. The applicable emission standards to be used in the above equations are as follows:

Model Year	Emission Category	Emission Standard Value[1] (g/mi)	
		All PCs; LDTs 0-3750 lbs. LVW	**LDTs 3751-5750 lbs. LVW; All MDPVs**
2015 and subsequent model year federally-certified vehicles	All	Sum of the full useful life NMOG and NOx Federal Emission Standards to which Vehicle is Certified	Sum of the full useful life NMOG and NOx Federal Emission Standards to which Vehicle is Certified
Model Year	**Emission Category**	**All PCs; LDTs 0-3750 lbs. LVW**	**LDTs 3751 lbs. LVW - 8500 lbs. GVWR; All MDPVs**
2015 through 2019 model year vehicles certified to the "LEV II" standards in subsection 1961(a)(1); 2015 and subsequent model year vehicles certified to the "LEV III" standards in subsection 1961.2(a)(1)	LEV II LEVs; LEV160s	0.160	0.160
	LEV II ULEVs; LEV125s	0.125	0.125
	ULEV70s	0.070	0.070
	ULEV50s	0.050	0.050
	LEV II SULEVs; SULEV30s	0.030	0.030
	SULEV20s	0.020	0.020
	LEV II LEVs; LEV395s	n/a	0.395
	LEV II ULEVs	n/a	0.343
	ULEV340s	n/a	0.340
	ULEV250s	n/a	0.250
	ULEV200s	n/a	0.200
	SULEV170s	n/a	0.170
	SULEV150s	n/a	0.150

[1] For LEV III vehicle test groups that meet the extended emission warranty requirements in subsection (a)(9), the applicable emission standard value shall be the emission standard value set forth in this table minus 5 mg/mi.

2. *NMOG+NOx Contribution Factor for Off-vehicle Charge Capable HEVs.* The HEV NMOG+NOx contribution factor for light-duty off-vehicle charge capable hybrid electric vehicles is calculated as follows:

LEV160 HEV Contribution Factor = 0.160 - [(Zero-emission VMT Allowance) x 0.035]
ULEV125 HEV Contribution Factor = 0.125 - [(Zero-emission VMT Allowance) x 0.055]
ULEV70 HEV Contribution Factor = 0.070 - [(Zero-emission VMT Allowance) x 0.020]
ULEV50 HEV Contribution Factor = 0.050 - [(Zero-emission VMT Allowance) x 0.020]
SULEV30 HEV Contribution Factor = 0.030 - [(Zero-emission VMT Allowance) x 0.010]
SULEV20 HEV Contribution Factor = 0.020 - [(Zero-emission VMT Allowance) x 0.020]

Where the Zero-emission VMT Allowance for off-vehicle charge capable HEVs is determined in accordance with section C.3 of the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" and the "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," as applicable, except that for the purposes of this subsection (b)(1)(B)2, the maximum allowable Zero-emission VMT Allowance that may be used in these equations is 1.0. This subsection (b)(1)(B)2 shall only apply to off-vehicle charge capable HEVs certified to the LEV III standards set forth in subsection (a)(1).

(C) Phase-In *Requirements for Small Volume Manufacturers*.

1. In the 2015 through 2021 model years, a small volume manufacturer shall not exceed a fleet average NMOG+NOx value of 0.160 g/mi for PCs and LDTs from 0-3750 lbs. LVW or 0.160 g/mi for LDTs from 3751-5750 lbs. LVW calculated in accordance with subsection (b)(1)(B). In 2022 through 2024 model years, a small volume manufacturer shall not exceed a fleet average NMOG+NOx value of 0.125 g/mi for PCs and LDTs from 0-3750 lbs. LVW or 0.125 g/mi for LDTs from 3751 lbs. LVW - 8,500 lbs. GVW and MDPVs calculated in accordance with subsection (b)(1)(B). In 2025 and subsequent model years, a small volume manufacturer shall not exceed a fleet average NMOG+NOx value of 0.070 g/mi for PCs and LDTs from 0-3750 lbs. LVW or 0.070 g/mi for LDTs from 3751 lbs. LVW - 8,500 lbs. GVW and MDPVs calculated in accordance with subsection (b)(1)(B). For the 2015 through 2021 model years, a small volume manufacturer may certify its vehicles to the LEV II exhaust standards in section 1961. All vehicles certified by a small volume manufacturer for the 2022 and subsequent model years must meet the LEV III exhaust standards in this section 1961.2.

2. If a manufacturer's average California sales exceeds 4500 units of new PCs, LDTs, MDVs, heavy-duty vehicles, and heavy-duty engines based on the average number of vehicles sold for the three previous

consecutive model years, the manufacturer shall no longer be treated as a small volume manufacturer. If this is the first time the manufacturer exceeds the 4500 unit sales limit, the manufacturer must comply with the fleet average requirements applicable to a large volume manufacturer, as specified in subsection (b)(1)(A) beginning with the fourth model year after the last of the three consecutive model years. If during this four year lead time period the manufacturer's sales drop below the 4500 unit sales limit and then increase again above the 4500 unit sales limit, the four year lead time period shall be calculated based on the first model year in which the manufacturer again exceeds the 4500 unit sales limit. Except as noted above – i.e., if this is not the first time the manufacturer has exceeded the 4500 unit sales limit – the manufacturer shall comply with the fleet average requirements applicable to larger manufacturers as specified in subsection (b)(1)(A) beginning with the following model year after the last of the three consecutive model years.

3. If a manufacturer's average California sales fall below 4500 units of new PCs, LDTs, MDVs and heavy duty engines based on the average number of vehicles sold for the three previous consecutive model years, the manufacturer shall be treated as a small volume manufacturer and shall be subject to the requirements for small volume manufacturers beginning with the next model year.

(D) *Treatment of ZEVs.* ZEVs classified as LDTs (>3750 lbs. LVW) that have been counted toward the ZEV requirement for PCs and LDTs (0-3750 lbs. LVW) as specified in sections 1962.1 and 1962.2 shall be included as LDT1s in the calculation of a fleet average NMOG value.

(2) *LEV III Phase-In Requirement for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles*. For the 2015 and 2016 model years, the LEV II SULEV emission standards set forth in section 1961(a)(1) that are applicable to PCs, LDTs, and MDPVs shall only apply to those PCs, LDT1s, LDT2s, and MDPVs that certify to SULEV emission standards using "carryover" of emission test data from a previous model year in accordance with U.S. EPA OMS Advisory Circular A/C No. 17F, issued November 16, 1982, and last amended January 21, 1988, incorporated herein by reference. Beginning in the 2017 model year, the LEV II SULEV emission standards set forth in section 1961(a)(1) that are applicable to PCs, LDTs, and MDPVs shall only apply to those PCs, LDT1s, LDT2s, and MDPVs that receive partial ZEV allowances in accordance with the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes." A manufacturer, other than a small volume manufacturer, must certify 100 percent of its PC, LDT, and MDPV fleet to the LEV III standards in subsection (a)(1) in 2020 and subsequent model years. A small volume manufacturer must certify 100 percent of its PC, LDT, and MDPV fleet to the LEV III standards in subsection (a)(1) in 2022 and subsequent model years.

(3) *LEV III Phase-In Requirements for Medium-Duty Vehicles, Other than Medium-Duty Passenger Vehicles*.

(A) A manufacturer of MDVs, other than a small volume manufacturer, shall certify its MDV fleet according to the following phase-in schedule:

Model Year	*Vehicles Certified to §1961.2(a)(1) (%)*				*Vehicles Certified to §1956.8(c) or (h) (%)*
	LEV II LEV; LEV III LEV395 or LEV630	LEV II ULEV; LEV III ULEV340 or ULEV570	LEV III ULEV250 or ULEV400	LEV III SULEV170 or SULEV230	ULEV
2015	40	60	0	0	100
2016	20	60	20	0	100
2017	10	50	40	0	100
2018	0	40	50	10	100
2019	0	30	40	30	100
2020	0	20	30	50	100
2021	0	10	20	70	100
2022 +	0	0	10	90	100

(B) *Requirements for Small Volume Manufacturers*. In the 2015 through 2017 model years, a small volume manufacturer shall certify, produce, and deliver for sale in California vehicles or engines certified to the MDV LEV II LEV standards or to the LEV III LEV395 or LEV III LEV630 standards, as applicable, in a quantity equivalent to 100% of its MDV fleet. In the 2018 through 2021 model years, a small volume manufacturer shall certify, produce, and deliver for sale in California vehicles or engines certified to the MDV LEV II ULEV standards or to the LEV III ULEV340 or LEV III ULEV570 standards, as applicable, in a quantity equivalent to 100% of its MDV fleet. In the 2022 and subsequent model years, a small volume manufacturer shall certify, produce, and deliver for sale in California vehicles or engines certified to the MDV LEV III ULEV250 or LEV III ULEV400 standards, as applicable, in a quantity equivalent to 100% of its MDV fleet. Engines certified to these MDV standards are not eligible for emissions averaging.

(C) *Alternate Phase-In Schedules for LEV III MDVs.* For the 2016 and subsequent model years, a manufacturer, that produces and delivers for sale in California four or fewer medium-duty test groups may comply with the following alternate phase-in schedule for LEV III medium-duty vehicles.

1. A manufacturer that produces and delivers for sale in California four medium-duty test groups may comply with the following alternate phase-in schedule for LEV III medium-duty vehicles.

Model Year	*Number of Test Groups Certified to §1961.2(a)(1)*				*Vehicles Certified to §1956.8(c) or (h) (%)*
	LEV II LEV; LEV III LEV395 or LEV630	LEV II ULEV; LEV III ULEV340 or ULEV570	LEV III ULEV250 or ULEV400	LEV III SULEV170 or SULEV230	ULEV
2016-2017	1	2	1	0	100
2018	0	2	2	0	100
2019	0	1	2	1	100
2020	0	1	1	2	100
2021	0	0	1	3	100
2022 +	0	0	0	4	100

2. A manufacturer that produces and delivers for sale in California three medium-duty test groups may comply with the following alternate phase-in schedule for LEV III medium-duty vehicles.

Model Year	*Number of Test Groups Certified to §1961.2(a)(1)*				*Vehicles Certified to §1956.8(c) or (h) (%)*
	LEV II LEV; LEV III LEV395 or LEV630	LEV II ULEV; LEV III ULEV340 or ULEV570	LEV III ULEV250 or ULEV400	LEV III SULEV170 or SULEV230	ULEV
2016	1	2	0	0	100
2017	0	2	1	0	100
2018	0	1	2	0	100
2019-2020	0	1	1	1	100
2021	0	0	1	2	100
2022 +	0	0	0	3	100

3. A manufacturer that produces and delivers for sale in California two medium-duty test groups may comply with the following alternate phase-in schedule for LEV III medium-duty vehicles.

Model Year	*Number of Test Groups Certified to §1961.2(a)(1)*				*Vehicles Certified to §1956.8(c) or (h) (%)*
	LEV II LEV; LEV III LEV395 or LEV630	LEV II ULEV; LEV III ULEV340 or ULEV570	LEV III ULEV250 or ULEV400	LEV III SULEV170 or SULEV230	ULEV
2016	1	1	0	0	100
2017-2019	0	1	1	0	100
2020-2021	0	0	1	1	100
2022 +	0	0	0	2	100

4. A manufacturer that produces and delivers for sale in California one medium-duty test groups may comply with the following alternate phase-in schedule for LEV III medium-duty vehicles.

Model Year	*Number of Test Groups Certified to §1961.2(a)(1)*				*Vehicles Certified to §1956.8(c) or (h) (%)*
	LEV II LEV; LEV III LEV395 or LEV630	LEV II ULEV; LEV III ULEV340 or ULEV570	LEV III ULEV250 or ULEV400	LEV III SULEV170 or SULEV230	ULEV
2016-2018	0	1	0	0	100
2019-2021	0	0	1	0	100
2022 +	0	0	0	1	100

(D) *Identifying a Manufacturer's MDV Fleet*. Each manufacturer's MDV fleet shall be defined as the total number of California-certified MDVs produced and delivered for sale in California. The percentages shall be applied to the manufacturers' total production of California-certified medium-duty vehicles delivered for sale in California. A manufacturer that elects to certify to the optional medium-duty engine standards in subsections 1956.8(c) or (h) shall not count those engines in the manufacturer's total production of California-certified medium-duty vehicles for purposes of this subsection.

(E) For a manufacturer that elects to certify to the optional medium-duty engine standards in title 13, CCR subsections 1956.8(c) or (h), all such MDVs, including those produced by a small volume manufacturer, shall be subject to the emissions averaging provisions applicable to heavy-duty diesel or Otto-cycle engines as set forth in the "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Otto-Cycle Engines," or the "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel Engines, incorporated by reference in subsections 1956.8(b) or (d), as applicable.

(4) *SFTP Phase-In Requirements*.

(A) *Phase-In Requirement for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.* A test group certifying to LEV III FTP emission categories on a 150,000-mile durability basis shall also certify to SFTP requirements on a 150,000-mile durability basis.

Manufacturers shall have two options for phase in to the SFTP NMOG+NOx and CO emission standards.

1. Under Option 1, beginning with the 2015 model year, a manufacturer shall certify its PCs, LDTs, and MDPVs to the SFTP NMOG+NOx and CO emission standards in subsection (a)(7)(A)1 when the

vehicles are also certifying to a LEV III FTP emission category at 150,000-mile durability.

2. Under Option 2, for 2015 and subsequent model years, a manufacturer shall certify its fleet of PCs, LDTs, and MDPVs such that the manufacturer's sales-weighted fleet-average NMOG+NOx composite emission value does not exceed the composite emission standard in effect for that model year. During the 150,000-mile durability phase-in, the sales-weighted fleet-average NMOG+NOx composite emission value shall be calculated using a combination of carry-over values and new-certification values. Carry-over test groups shall convert values to NMOG+NOx and may use the applicable deterioration factor from the FTP cycle in lieu of deriving a deterioration factor specific to SFTP test cycles. Any vehicle certified to SFTP requirements on a 150,000-mile durability basis shall be subject to the applicable emission standards for the full useful life of that vehicle. Compliance with the CO composite emission standard cannot be demonstrated through fleet averaging.

Beginning with the 2017 model year, a manufacturer shall certify its PCs, LDTs, and MDPVs certifying to LEV III FTP PM emission standards on a 150,000-mile durability basis to the SFTP PM emission standards in subsection (a)(7)(B).

(B) *Phase-In Requirements for Medium-Duty Vehicle Manufacturers.* Phase-in for NMOG+NOx and CO emission standards begins with the 2016 model year. For MDVs 8,501-10,000 lbs. GVWR, for each model year, the percentage of MDVs certified to an SFTP emission category set forth in this section 1961.2 shall be equal to or greater than the total percentage certified to the FTP ULEV250, ULEV200, SULEV170, and SULEV150 emission categories; of these vehicles, the percentage of MDVs certified to an SFTP SULEV emission category shall be equal to or greater than the total percentage certified to both the FTP SULEV170 and SULEV150 emission categories. For MDVs 10,001-14,000 lbs. GVWR, for each model year, the percentage of MDVs certified to an SFTP emission category set forth in this section 1961.2 shall be equal to or greater than the total percentage certified to the FTP ULEV400, ULEV270, SULEV230, and SULEV200 emission categories; of these vehicles, the percentage of MDVs certified to an SFTP SULEV emission category shall be equal to or greater than the total percentage certified to both the FTP SULEV230 and SULEV200 emission categories.

In addition, 2017 and subsequent model MDVs certifying to LEV III FTP PM emission standards on a 150,000-mile durability basis must also certify to the SFTP emission standards set forth in subsection (a)(7)(D).

(C) *Identifying a Manufacturer's Medium-Duty Vehicle Fleet.* For the 2016 and subsequent model years, each manufacturer's MDV fleet shall be defined as the total number of California-certified MDVs, other than MDPVs, produced and delivered for sale in California. For 2016 and subsequent model years, a manufacturer that elects to certify engines to the optional medium-duty engine emission standards in subsections 1956.8(c) or (h) shall not count those engines in the manufacturer's total production of California-certified medium-duty vehicles for purposes of this subparagraph.

(c) *Calculation of NMOG + NOx Credits/Debits*

(1) *Calculation of NMOG+NOx Credits and Debits for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles*.

(A) In 2015 and subsequent model years, a manufacturer shall calculate its credits or debits using the following equation.

[(Fleet Average NMOG+NOx Requirement) - (Manufacturer's Fleet Average NMOG+NOx Value)] x
(Total No. of Vehicles Produced and Delivered for Sale in California, Including ZEVs and HEVs).

(B) In 2015 and subsequent model years, a manufacturer that achieves fleet average NMOG+NOx values lower than the fleet average NMOG+NOx requirement for the corresponding model year shall receive credits in units of g/mi NMOG + NOx . A manufacturer with 2015 and subsequent model year fleet average NMOG+NOx values greater than the fleet average requirement for the corresponding model year shall receive debits in units of g/mi NMOG + NOx equal to the amount of negative credits determined by the aforementioned equation. The total g/mi NMOG+NOx credits or debits earned for PCs and LDTs 0-3750 lbs. LVW, for LDTs 3751-5750 lbs. LVW and for LDTs 3751 lbs. LVW - 8500 lbs. GVWR shall be summed together. The resulting amount shall constitute the g/mi NMOG+NOx credits or debits accrued by the manufacturer for the model year.

(2) *Calculation of Vehicle-Equivalent NMOG + NOx Credits for Medium-Duty Vehicles Other than MDPVs*.

(A) In 2016 and subsequent model years, a manufacturer that produces and delivers for sale in California MDVs, other than MDPVs, in excess of the equivalent requirements for LEV III vehicles certified to the exhaust emission standards set forth in subsection (a)(1), shall receive "Vehicle-Equivalent Credits" (or "VECs") calculated in accordance with the following equation, where the term "produced" means produced and delivered for sale in California:

(1.00) x {[(No. of LEV395s and LEV630s Produced excluding HEVs) +
(No. of LEV395 HEVs x HEV VEC factor for LEV395s) +
(No. of LEV630 HEVs x HEV VEC factor for LEV630s)] –
(No. of LEV395s and LEV630s Required to be Produced)} +

(1.14) x {[(No. of ULEV340s and ULEV570s Produced excluding HEVs) +
(No. of ULEV340 HEVs x HEV VEC factor for ULEV340s) +
(No. of ULEV570 HEVs x HEV VEC factor for ULEV570s)] –
(No. of ULEV340s and ULEV570s Required to be Produced)} +

(1.37) x {[(No. of ULEV250s and ULEV400s Produced excluding HEVs) +
(No. of ULEV250 HEVs x HEV VEC factor for ULEV250s) +
(No. of ULEV400 HEVs x HEV VEC factor for ULEV400s)] -
(No. of ULEV250s and ULEV270s Required to be Produced)} +

(1.49) x {[(No. of ULEV200s and ULEV270s Produced excluding HEVs) +
(No. of ULEV200 HEVs x HEV VEC factor for ULEV200s) +
(No. of ULEV270 HEVs x HEV VEC factor for ULEV270s)] -
(No. of ULEV200s and ULEV270s Required to be Produced)} +

(1.57) x {[(No. of SULEV170s and SULEV230s Produced excluding HEVs) +
(No. of SULEV170 HEVs x HEV VEC factor for SULEV170s) +
(No. of SULEV230 HEVs x HEV VEC factor for SULEV230s)] -
(No. of SULEV170s and SULEV230s Required to be Produced)} +

(1.62) x {[(No. of SULEV150s and SULEV200s Produced excluding HEVs) +
(No. of SULEV150 HEVs x HEV VEC factor for SULEV150s) +
(No. of SULEV200 HEVs x HEV VEC factor for SULEV200s)] -
(No. of SULEV150s and SULEV200s Required to be Produced)} +

[(2.00) x (No. of ZEVs Certified and Produced as MDVs)].

(B) *MDV HEV VEC factor.* The MDV HEV VEC factor is calculated as follows:

For LEV395s:

$$1+\left[\frac{(LEV395\ standard - ULEV340\ standard)\times Zero-emission\ VMT\ Allowance}{LEV395\ standard}\right];$$

For ULEV340s:

$$1+\left[\frac{(ULEV340\ standard - ULEV250\ standard)\times Zero-emission\ VMT\ Allowance}{ULEV340\ standard}\right];$$

For ULEV250s:

$$1+\left[\frac{(ULEV250\ standard - ULEV200\ standard)\times Zero-emission\ VMT\ Allowance}{ULEV250\ standard}\right];$$

For ULEV200s:

$$1+\left[\frac{(ULEV200\ standard - SULEV170\ standard) \times Zero-emission\ VMT\ Allowance}{ULEV3200\ standard}\right];$$

For SULEV170s:

$$1+\left[\frac{(SULEV170\ standard - SULEV150\ standard) \times Zero-emission\ VMT\ Allowance}{SULEV170\ standard}\right];$$

For SULEV150s: $$1+\left[\frac{(SULEV150\ standard - ZEV\ standard) \times Zero-emission\ VMT\ Allowance}{SULEV150\ standard}\right];$$

For LEV630s:

$$1+\left[\frac{(LEV630\ standard - ULEV570\ standard) \times Zero-emission\ VMT\ Allowance}{LEV630\ standard}\right];$$

For ULEV570s:

$$1+\left[\frac{(ULEV570\ standard - ULEV400\ standard) \times Zero-emission\ VMT\ Allowance}{ULEV570\ standard}\right];$$

For ULEV400s:

$$1+\left[\frac{(ULEV400\ standard - ULEV270\ standard) \times Zero-emission\ VMT\ Allowance}{ULEV400\ standard}\right];$$

For ULEV270s:

$$1+\left[\frac{(ULEV270\ standard - SULEV230\ standard) \times Zero-emission\ VMT\ Allowance}{ULEV270\ standard}\right];$$

For SULEV230s:

$$1+\left[\frac{(SULEV230\ standard - SULEV200\ standard) \times Zero-emission\ VMT\ Allowance}{SULEV230\ standard}\right]$$

For SULEV200s: $$1+\left[\frac{(SULEV200\ standard - ZEV\ standard) \times Zero-emission\ VMT\ Allowance}{SULEV200\ standard}\right]$$

where “Zero-emission VMT Allowance” for an HEV is determined in accordance with section C of the “California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes,” incorporated by reference in section 1962.1, or the “California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes,” incorporated by reference in section 1962.2, as applicable, except that for the purposes of this subsection (c)(2)(B), the maximum allowable Zero-emission VMT Allowance that may be used in these equations is 1.0.

(C) A manufacturer that fails to produce and deliver for sale in California the equivalent quantity of MDVs certified to LEV III exhaust emission standards, shall receive “Vehicle-Equivalent Debits” (or “VEDs”) equal to the amount of negative VECs determined by the equation in subsection (c)(2)(A).

(D) Only ZEVs certified as MDVs and not used to meet the ZEV requirement shall be included in the calculation of VECs.

(3) *Procedure for Offsetting Debits.*

(A) A manufacturer shall equalize emission debits by earning g/mi NMOG+NOx emission credits or VECs in an amount equal to the g/mi NMOG+NOx debits or VEDs, or by submitting a commensurate amount of g/mi NMOG+NOx credits or VECs to the Executive Officer that were earned previously or acquired from another manufacturer. A manufacturer shall equalize NMOG+NOx debits for PCs, LDTs, and MDPVs and VEC debits for MDVs within three model years. If emission debits are not equalized within the specified time period, the manufacturer shall be subject to the Health and Safety Code §43211 civil penalty applicable to a manufacturer which 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 emission debits are not equalized by the end of the specified time period. A manufacturer demonstrating compliance under Option 2 in subsection (b)(1)(A)1.a, must calculate the emission debits that are subject to a civil penalty under Health and Safety Code section 43211 separately for California, the District of Columbia, and for each individual state that is included in the fleet average greenhouse gas requirements in subsection (b)(1)(A)1.a. The manufacturer must calculate these emission debits separately for California, the District of Columbia, and each individual state using the formula in subsections (c)(1) and (c)(2), except that the “Total No. of Vehicles Produced and Delivered for Sale in California, Including ZEVs and HEVs” shall be calculated separately for the District of Columbia and each individual state.

For the purposes of Health and Safety Code §43211, the number of passenger cars, light-duty trucks, and medium-duty passenger vehicles not meeting the state board's emission standards shall be determined by dividing the total amount of g/mi NMOG+NOx emission debits for the model year by the g/mi NMOG+NOx fleet average requirement for PCs and LDTs 0-3750 lbs. LVW and for LDTs 3751 lbs. LVW - 8500 lbs. GVW and MDPVs applicable for the model year in which the debits were first incurred; and the number of medium-duty vehicles not meeting the state board's emission standards shall be equal to the amount of VEDs incurred.

(B) The emission credits earned in any given model year shall retain full value through five subsequent model years. Credits will have no value if not used by the beginning of the sixth model year after being earned.

(4) *Changing NMOG Credits and Debits to NMOG+NOx Credits and Debits.* The value of any emission credits that have not been used prior to the start of the 2015 model year and any emission debits that have not been equalized prior to the start of the 2015 model year earned shall be converted to NMOG+NOx credits at the start of the 2015 model year by multiplying their values by a factor of 3.0. These credits and debits are subject to the provisions in subsection 1961(c)(3).

(d) *Test Procedures.* The certification requirements and test procedures for determining compliance with the emission standards in this section are set forth in the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles," as adopted [INSERT DATE OF ADOPTION], the "California Non-Methane Organic Gas Test Procedures," as amended [INSERT DATE OF AMENDMENT], which are incorporated herein by reference. In the case of hybrid electric vehicles and on-board fuel-fired heaters, the certification requirements and test procedures for determining compliance with the emission standards in this section are set forth in the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," incorporated by reference in section 1962.1, and the "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," incorporated by reference in section 1962.2.

(e) *Abbreviations.* The following abbreviations are used in this section 1961.2:

"ALVW" means adjusted loaded vehicle weight.
"ASTM" means American Society of Testing and Materials.
"CO" means carbon monoxide.
"FTP" means Federal Test Procedure.
"g/mi" means grams per mile.
"GVW" means gross vehicle weight.
"GVWR" means gross vehicle weight rating.
"HEV" means hybrid-electric vehicle.
"LDT" means light-duty truck.
"LDT1" means a light-duty truck with a loaded vehicle weight of 0-3750 pounds.

"LDT2" means a light-duty truck with a loaded vehicle weight of 3751 pounds to a gross vehicle weight rating of 8500 pounds.
"LEV" means low-emission vehicle.
"LPG" means liquefied petroleum gas.
"LVW" means loaded vehicle weight.
"MDPV" means medium-duty passenger vehicle.
"MDV" means medium-duty vehicle.
"NMHC" means non-methane hydrocarbons.
"mg/mi" means milligrams per mile.
"NMHC" means non-methane hydrocarbons.
"Non-Methane Organic Gases" or "NMOG" means the total mass of oxygenated and non-oxygenated hydrocarbon emissions.
"NOx" means oxides of nitrogen.
"PC" means passenger car.
"SULEV" means super-ultra-low-emission vehicle.
"ULEV" means ultra-low-emission vehicle.
"VEC" means vehicle-equivalent credits.
"VED" means vehicle-equivalent debits.
"VMT" means vehicle miles traveled.
"ZEV" means zero-emission vehicle.

(f) 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 both this section and this article remains in full force and effect.

Note: Authority cited: Sections 39500, 39600, 39601, 43013, 43018, 43101, 43104, 43105, and 43106, Health and Safety Code. Reference: Sections 39002, 39003, 39667, 43000, 43009.5, 43013, 43018, 43100, 43101, 43101.5, 43102, 43104, 43105, 43106, 43204, and 43205, Health and Safety Code.

7. Adopt new title 13, CCR, section 1961.3 to read as follows: (Note: the entire text of section 1961.3 set forth below is new language proposed to be added to the California Code of Regulations.)

§ 1961.3. Greenhouse Gas Exhaust Emission Standards and Test Procedures - 2017 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles.

Introduction. This section 1961.3 sets the greenhouse gas emission levels from new 2017 and subsequent model year passenger cars, light-duty trucks, and medium-duty passenger vehicles. Light-duty trucks from 3751 lbs. LVW – 8500 lbs. GVW that are certified to the Option 1 LEV II NOx Standard in section 1961(a)(1) are exempt from these greenhouse gas emission requirements, however, passenger cars, light-duty trucks 0-3750 lbs. LVW, and medium-duty passenger vehicles are not eligible for this exemption.

Emergency vehicles may be excluded from these greenhouse gas emission requirements. The manufacturer must notify the Executive Officer that they are making such an election, in writing, prior to the start of the applicable model year or must comply with this section 1961.3.

(a) *Greenhouse Gas Emission Requirements.*

(1) *Fleet Average Carbon Dioxide Requirements for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.* For the purpose of determining compliance with this subsection (a)(1), the applicable fleet average CO_2 mass emission standards for each model year is the sales-weighted average of the calculated CO_2 exhaust mass emission target values for each manufacturer. For each model year, the sales-weighted fleet average CO_2 mass emissions value shall not exceed the sales-weighted average of the calculated CO_2 exhaust mass emission target values for that manufacturer.

(A) *Fleet Average Carbon Dioxide Target Values for Passenger Cars.* The fleet average CO_2 exhaust mass emission target values for passenger cars that are produced and delivered for sale in California each model year shall be determined as follows:

1. For passenger cars with a footprint of less than or equal to 41 square feet, the gram per mile CO_2 target value shall be selected for the appropriate model year from the following table:

Model Year	*CO_2 Target Value (grams/mile)*
2017	195.0
2018	185.0
2019	175.0
2020	166.0
2021	157.0
2022	150.0
2023	143.0
2025	137.0
2025 and subsequent	131.0

2. For passenger cars with a footprint of greater than 56 square feet, the gram per mile CO_2 target value shall be selected for the appropriate model year from the following table:

Model Year	*CO_2 Target Value (grams/mile)*
2017	263.0
2018	250.0
2019	238.0
2020	226.0
2021	215.0
2022	205.0
2023	196.0
2025	188.0
2025 and subsequent	179.0

3. For passenger cars with a footprint that is greater than 41 square feet and less than or equal to 56 square feet, the gram per mile CO_2 target value shall be calculated using the following equation and rounded to the nearest 0.1 grams/mile:

$$\text{Target gCO}_2\text{/mile} = [a \times f] + b$$

Where: *f* is the vehicle footprint and
coefficients *a* and *b* are selected from the following table for the applicable model year.

Model year	*a*	*b*
2017	4.53	8.9
2018	4.35	6.5
2019	4.17	4.2
2020	4.01	1.9
2021	3.84	-0.4
2022	3.69	-1.1
2023	3.54	-1.8
2024	3.4	-2.5
2025 and subsequent	3.26	-3.2

(B) *Fleet Average Carbon Dioxide Target Values for Light-Duty Trucks and Medium-Duty Passenger Vehicles.* The fleet average CO_2 exhaust mass emission target values for light-duty trucks and medium-duty passenger vehicles that are produced and delivered for sale in California each model year shall be determined as follows:

1. For light-duty trucks and medium-duty passenger vehicles with a footprint of less than or equal to 41 square feet, the gram per mile CO_2 target value shall be selected from the following table:

Model Year	*CO_2 Target Value (grams/mile)*
2017	238.0
2018	227.0
2019	220.0
2020	212.0
2021	195.0
2022	186.0
2023	176.0
2025	168.0
2025 and subsequent	159.0

2. For light-duty trucks and medium-duty passenger vehicles with a footprint of greater than 41 square feet and less than or equal to the maximum footprint value specified in the table below for each model year, the gram/mile CO_2 target value shall be calculated using the following equation and rounded to the nearest 0.1 grams/mile:

$$\text{Target gCO}_2\text{/mile} = [a \times f] + b$$

Where: *f* is the vehicle footprint and coefficients *a* and *b* are selected from the following table for the applicable model year.

Model year	*Maximum Footprint*	*a*	*b*
2017	50.7	4.87	38.3
2018	60.2	4.76	31.6
2019	66.4	4.68	27.7
2020	68.3	4.57	24.6
2021	73.5	4.28	19.8
2022	74.0	4.09	17.8
2023	74.0	3.91	16.0
2024	74.0	3.74	14.2
2025 and subsequent	74.0	3.58	12.5

3. For light-duty trucks and medium-duty passenger vehicles with a footprint that is greater than the minimum footprint value specified in the table below and less than or equal to the maximum footprint value specified in the table below for each model year, the gram/mile CO_2 target value shall be calculated using the following equation and rounded to the nearest 0.1 grams/mile:

$$\text{Target gCO}_2\text{/mile} = [a \times f] + b$$

Where: *f* is the vehicle footprint and coefficients *a* and *b* are selected from the following table for the applicable model year.

Model year	*Minimum Footprint*	*Maximum Footprint*	*a*	*b*
2017	50.7	66.0	4.04	80.5
2018	60.2	66.0	4.04	75.0

4. For light-duty trucks and medium-duty passenger vehicles with a footprint that is greater than the minimum value specified in the

table below for each model year, the gram/mile CO_2 target value shall be selected for the applicable model year from the following table:

Model year	*Minimum Footprint*	*CO_2 target value (grams/mile)*
2017	66.0	347.0
2018	66.0	342.0
2019	66.4	339.0
2020	68.3	337.0
2021	73.5	335.0
2022	74.0	321.0
2023	74.0	306.0
2024	74.0	291.0
2025 and subsequent	74.0	277.0

(C) *Calculation of Manufacturer-Specific Carbon Dioxide Fleet Average Standards.* For each model year, each manufacturer must comply with fleet average CO_2 standards for passenger cars and for light-duty trucks plus medium-duty passenger vehicles, as applicable, calculated for that model year as follows. For each model year, a manufacturer must calculate separate fleet average CO_2 values for its passenger car fleet and for its combined light-duty truck plus medium-duty passenger vehicle fleet using the CO_2 target values in subsection (a)(A). These calculated CO_2 values are the manufacturer-specific fleet average CO_2 standards for passenger cars and for light-duty trucks plus medium-duty passenger vehicles, as applicable, which apply for that model year.

1. A CO_2 target value shall be calculated in accordance with subparagraph (a)(1)(A) or (a)(1)(B), as applicable, for each unique combination of model type and footprint value.

2. Each CO_2 target value, determined for each unique combination of model type and footprint value, shall be multiplied by the total production of that model type/footprint combination for the applicable model year.

3. The resulting products shall be summed, and that sum shall be divided by the total production of passenger cars or total combined

production of light-duty trucks and medium-duty passenger vehicles, as applicable, in that model year. The result shall be rounded to the nearest whole gram per mile. This result shall be the applicable fleet average CO_2 standard for the manufacturer's passenger car fleet or its combined light-duty truck and medium-duty passenger vehicle fleet, as applicable.

(2) *Nitrous Oxide (N_2O) and Methane (CH_4) Exhaust Emission Standards for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.* Each manufacturer's fleet of combined passenger automobile, light-duty trucks, and medium-duty passenger vehicles must comply with N_2O and CH_4 standards using either the provisions of subsection (a)(2)(A), subsection (a)(2)(B), or subsection (a)(2)(C). Except with prior approval of the Executive Officer, a manufacturer may not use the provisions of both subsection (a)(2)(A) and subsection (a)(2)(B) in the same model year. For example, a manufacturer may not use the provisions of subsection (a)(2)(A) for their passenger automobile fleet and the provisions of subsection (a)(2)(B) for their light-duty truck and medium-duty passenger vehicle fleet in the same model year. The manufacturer may use the provisions of both subsections (a)(2)(A) and (a)(2)(C) in the same model year. For example, a manufacturer may meet the N_2O standard in subsection (a)(2)(A)1 and an alternative CH_4 standard determined under subsection (a)(2)(C).

(A) *Standards Applicable to Each Test Group.*

1. Exhaust emissions of N_2O shall not exceed 0.010 grams per mile at full useful life, as measured on the FTP (40 CFR, Part 86, Subpart B), as amended by the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures Passenger Cars, Light Duty Trucks, and Medium Duty Vehicles." Manufacturers may optionally determine an alternative N_2O standard under subsection (a)(2)(C).

2. Exhaust emissions of CH_4 shall not exceed 0.030 grams per mile at full useful life, as measured on the FTP (40 CFR, Part 86, Subpart B), as amended by the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles." Manufacturers may optionally determine an alternative CH_4 standard under subsection (a)(2)(C).

(B) *Including N_2O and CH_4 in Fleet Averaging Program.* Manufacturers may elect to not meet the emission standards in subsection (a)(2)(A). Manufacturers making this election shall measure N_2O and CH_4 emissions for each unique combination of model type and footprint value on both the FTP test cycle and the Highway Fuel Economy test cycle at full useful life, multiply the measured N_2O emissions value by 298 and the measured CH_4 emissions value by 25, and include both of these adjusted N_2O and CH_4 full useful life values in the fleet average calculations for passenger automobiles and light-duty trucks plus medium-duty passenger vehicles, as calculated in accordance with subsection (a)(2)(A)(D).

(C) *Optional Use of Alternative N_2O and/or CH_4 Standards.* Manufacturers may select an alternative standard applicable to a test group, for either N_2O or CH_4, or both. For example, a manufacturer may choose to meet the N_2O standard in subsection (a)(2)(A)1 and an alternative CH_4 standard in lieu of the standard in subsection (a)(2)(A)2. The alternative standard for each pollutant must be less stringent than the applicable exhaust emission standard specified in subsection (a)(2)(A). Alternative N_2O and CH_4 standards apply to emissions as measured on the FTP (40 CFR, Part 86, Subpart B), as amended by the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles," for the full useful life, and become the applicable certification and in-use emission standard(s) for the test group. Manufacturers using an alternative standard for N_2O and/or CH_4 must calculate emission debits according to the provisions of subsection (a)(2)(D) for each test group/alternative standard combination. Debits must be included in the calculation of total credits or debits generated in a model year as required under subsection (b)(1)(B). Flexible fuel vehicles (or other vehicles certified for multiple fuels) must meet these alternative standards when tested on all applicable test fuel type.

(D) *CO_2-Equivalent Debits.* CO_2-equivalent debits for test groups using an alternative N_2O and/or CH_4 standard as determined under (a)(2)(C) shall be calculated according to the following equation and rounded to the nearest whole gram per mile:

$$\text{Debits} = \text{GWP} \times (\text{Production}) \times (\text{AltStd} - \text{Std})$$

Where:

Debits = N_2O or CH_4 CO_2-equivalent debits for a test group using an alternative N_2O or CH_4 standard;

GWP = 25 if calculating CH_4 debits and 298 if calculating N_2O debits;

Production = The number of vehicles of that test group produced and delivered for sale in California;

AltStd = The alternative standard (N_2O or CH_4) selected by the manufacturer under (a)(2)(C); and

Std = The exhaust emission standard for N_2O or CH_4 specified in (a)(2)(A).

(3) *Alternative Fleet Average Standards for Manufacturers with Limited U.S. Sales.* Manufacturers meeting the criteria in this subsection (a)(3) may request that the Executive Officer establish alternative fleet average CO_2 standards that would apply instead of the standards in subsection (a)(1).

(A) *Eligibility for Alternative Standards.* Eligibility as determined in this subsection (a)(3) shall be based on the total sales of combined passenger cars, light-duty trucks, and medium-duty passenger vehicles. The terms “sales” and “sold” as used in this subsection (a)(3) shall mean vehicles produced and delivered for sale (or sold) in the states and territories of the United States. For the purpose of determining eligibility the sales of related companies shall be aggregated according to the provisions of section 1900. To be eligible for alternative standards established under this subsection (a)(3), the manufacturer's average sales for the three most recent consecutive model years must remain below 5,000. If a manufacturer's average sales for the three most recent consecutive model years exceeds 4,999, the manufacturer will no longer be eligible for exemption and must meet applicable emission standards as follows.

1. If a manufacturer's average sales for three consecutive model years exceeds 4,999, and if the increase in sales is the result of corporate acquisitions, mergers, or purchase by another manufacturer, the manufacturer shall comply with the emission standards described in subsections (a)(1) and (a)(2), as applicable, beginning with the first model year after the last year of the three consecutive model years.

2. If a manufacturer's average sales for three consecutive model years exceeds 4,999 and is less than 50,000, and if the increase in sales is solely the result of the manufacturer's expansion in vehicle production (not the result of corporate acquisitions, mergers, or purchase by another manufacturer), the manufacturer shall comply with the emission standards described in subsections (a)(1) and (a)(2), as applicable, beginning with the second model year after the last year of the three consecutive model years.

(B) *Requirements for New Entrants into the U.S. Market.* New entrants are those manufacturers without a prior record of automobile sales in the United States and without prior certification to (or exemption from, under 40 CFR §86.1801-12(k)) greenhouse gas emission standards in 40 CFR §86.1818-12 or greenhouse gas standards in section 1961.1. In addition to the eligibility requirements stated in subsection (a)(3)(A), new entrants must meet the following requirements:

1. In addition to the information required under subsection (a)(3)(D), new entrants must provide documentation that shows a clear intent by the company to actually enter the U.S. market in the years for which alternative standards are requested. Demonstrating such intent could include providing documentation that shows the establishment of a U.S. dealer network, documentation of work underway to meet other U.S. requirements (e.g., safety standards), or other information that reasonably establishes intent to the satisfaction of the Executive Officer.

2. Sales of vehicles in the U.S. by new entrants must remain below 5,000 vehicles for the first two model years in the U.S. market and the average sales for any three consecutive years within the first five years of entering the U.S. market must remain below 5,000 vehicles. Vehicles sold in violation of these limits will be considered not covered by the certificate of conformity and the manufacturer will be subject to penalties on an individual-vehicle basis for sale of vehicles not covered by a certificate. In addition, violation of these limits will result in loss of eligibility for alternative standards until such point as the manufacturer demonstrates two consecutive model years of sales below 5,000 automobiles.

3. A manufacturer with sales in the most recent model year of less than 5,000 automobiles, but where prior model year sales were not less than 5,000 automobiles, is eligible to request alternative standards under subsection (a)(3). However, such a manufacturer will be considered a new entrant and subject to the provisions regarding new entrants in this subsection (a)(3), except that the requirement to demonstrate an intent to enter the U.S. market in subsection (a)(3)(B)(1) shall not apply.

(C) *How to Request Alternative Fleet Average Standards.* Eligible manufacturers may petition for alternative standards for up to five consecutive model years if sufficient information is available on which to base such standards.

1. To request alternative standards starting with the 2017 model year, eligible manufacturers must submit a completed application no later than July 30, 2013.

2. To request alternative standards starting with a model after 2017, eligible manufacturers must submit a completed request no later than 36 months prior to the start of the first model year to which the alternative standards would apply.

3. The request must contain all the information required in subsection (a)(3)(D), and must be signed by a chief officer of the

company. If the Executive Officer determines that the content of the request is incomplete or insufficient, the manufacturer will be notified and given an additional 30 days to amend the request.

(D) *Data and Information Submittal Requirements.* Eligible manufacturers requesting alternative standards under subsection (a)(3) must submit the following information to the California Air Resources Board. The Executive Officer may request additional information as s/he deems appropriate. The completed request must be sent to the California Air Resources Board at the following address: Chief, Mobile Source Operations Division, California Air Resources Board, 9480 Telstar Avenue, Suite 4, El Monte, California 91731.

1. *Vehicle Model and Fleet Information*.

a. The model years to which the requested alternative standards would apply, limited to five consecutive model years.

b. Vehicle models and projections of production volumes for each model year.

c. Detailed description of each model, including the vehicle type, vehicle mass, power, footprint, and expected pricing.

d. The expected production cycle for each model, including new model introductions and redesign or refresh cycles.

2. *Technology Evaluation Information*.

a. The CO_2 reduction technologies employed by the manufacturer on each vehicle model, including information regarding the cost and CO_2 -reducing effectiveness. Include technologies that improve air conditioning efficiency and reduce air conditioning system leakage, and any “off-cycle” technologies that potentially provide benefits outside the operation represented by the FTP and the HWFET.

b. An evaluation of comparable models from other manufacturers, including CO_2 results and air conditioning credits generated by the models. Comparable vehicles should be similar, but not necessarily identical, in the following respects: vehicle type, horsepower, mass, power-to-weight ratio, footprint, retail price, and any other relevant factors. For manufacturers requesting alternative standards starting with the 2017 model year, the analysis of comparable vehicles should include vehicles from the 2012 and 2013 model years, otherwise the analysis should at a minimum include vehicles from the most recent two model years.

c. A discussion of the CO_2-reducing technologies employed on vehicles offered outside of the U.S. market but not available in the U.S., including a discussion as to why those vehicles and/or technologies are not being used to achieve CO_2 reductions for vehicles in the U.S. market.

d. An evaluation, at a minimum, of the technologies projected by the California Air Resources Board in the "Staff Report: Initial Statement of Reasons for Proposed Rulemaking, Public Hearing to Consider the "LEV III" Amendments to The California Greenhouse Gas and Criteria Pollutant Exhaust and Evaporative Emission Standards and Test Procedures and to the On-Board Diagnostic System Requirements for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles, and to the Evaporative Emission Requirements for Heavy-Duty Vehicles" and the appendices to this report, released on December 7, 2011, as those technologies likely to be used to meet greenhouse gas emission standards and the extent to which those technologies are employed or projected to be employed by the manufacturer. For any technology that is not projected to be fully employed, the manufacturer must explain why this is the case.

3. *Information Supporting Eligibility*.

a. U.S. sales for the three previous model years and projected sales for the model years for which the manufacturer is seeking alternative standards.

b. Information regarding ownership relationships with other manufacturers, including details regarding the application of the provisions of 40 CFR §86.1838–01(b)(3) and section 1900 regarding the aggregation of sales of related companies.

(E) *Alternative Standards.* Upon receiving a complete application, the Executive Officer will review the application and determine whether an alternative standard is warranted. If the Executive Officer judges that an alternative standard is warranted, the following standards shall apply. For the purposes of this subsection (a)(3)(E), an "ultra-small volume manufacturer" shall mean a manufacturer that meets the requirements of subsection (a)(3).

1. At the beginning of the model year that is three model years prior to the model year for which an alternative standard is requested, each ultra-small volume manufacturer shall identify all vehicle models from

the model year that is four model years prior to the model year for which an alternative standard is requested, certified by a large volume manufacturer that are comparable to that small volume manufacturer's vehicle models for the model year for which an alternative standard is requested, based on model type and footprint value. The ultra-small volume manufacturer shall demonstrate to the Executive Officer the appropriateness of each comparable vehicle model selected. Upon approval of the Executive Officer, s/he shall provide to the ultra-small volume manufacturer the target grams CO_2 per mile for each vehicle model type and footprint value that is approved. The ultra-small volume manufacturer shall calculate its fleet average CO_2 standard in accordance with subsection (a)(1)(C) based on these target grams CO_2 per mile values provided by the Executive Officer.

2. In the 2017 and subsequent model years, an ultra-small volume manufacturer shall either:

a. not exceed its fleet average CO_2 standard calculated in accordance with subsection (a)(1)(C) based on the target grams CO_2 per mile values provided by the Executive Officer; or

b. upon approval of the Executive Officer, if an ultra-small volume manufacturer demonstrates a vehicle model uses an engine, transmission, and emission control system and has a footprint value that are identical to a configuration certified for sale in California by a large volume manufacturer, those ultra-small volume manufacturer vehicle models are exempt from meeting the requirements in paragraph 2.a of this subsection.

(F) *Restrictions on Credit Trading.* Manufacturers subject to alternative standards approved by the Executive Officer under this subsection (a)(3) may not trade credits to another manufacturer. Transfers of credits between a manufacturer's car and truck fleets are allowed.

(4) *Greenhouse Gas Emissions Values for Electric Vehicles, "Plug-In" Hybrid Electric Vehicles, and Fuel Cell Vehicles.*

(A) *Electric Vehicle Calculations.*

1. For each unique combination of model type and footprint value, a manufacturer shall calculate the City CO_2 Value using the following formula:

$$\mathit{City\ CO_2\ Value = (270\ gCO_2e/kWh) * E_{EV}} \;-\; 0.25 * \mathrm{GHG_{target}}$$

Where E_{EV} is measured directly from each cycle for each test vehicle of battery electric vehicle technology in units of kilowatt-hours per mile (per SAE J1634, incorporated herein by reference).

2. For each unique combination of model type and footprint value, a manufacturer shall calculate the Highway CO_2 Value using the following formula:

$$\text{Highway } CO_2 \text{ Value} = \mathit{(270\ gCO_2e/kWh)} * E_{EV} - 0.25 * GHG_{target}$$

Where E_{EV} is measured directly from each cycle for each test vehicle of battery electric vehicle technology in units of kilowatt-hours per mile (per SAE J1634, incorporated herein by reference).

(B) *"Plug-In" Hybrid Electric Vehicle Calculations.* For each unique combination of model type and footprint value, a manufacturer shall calculate the City CO_2 Value and the Highway CO_2 Value using the following formulas:

$$\text{City } CO_2 \text{ Value} = GHG_{urban}$$

and

$$\text{Highway } CO_2 \text{ Value} = GHG_{highway}$$

Where GHG_{urban} and $GHG_{highway}$ are measured in accordance with section G.12 of the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" or the "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," as applicable.

(C) *Fuel Cell Vehicle Calculations.* For each unique combination of model type and footprint value, a manufacturer shall calculate the City CO_2 Value and the Highway CO_2 Value using the following formulas:

$$\text{City } CO_2 = GHG_{FCV} = (9132\ gCO_2e/kg\ H_2) * H_{FCV} - G_{upstream}$$

and

$$\text{Highway } CO_2 = GHG_{FCV} = (9132\ gCO_2e/kg\ H_2) * H_{FCV} - G_{upstream}$$

Where H_{FCV} means hydrogen consumption in kilograms of hydrogen per mile, measured for the applicable test cycle, in accordance with SAE J2572 (published October 2008), incorporated herein by reference.

(5) *Calculation of Fleet Average Carbon Dioxide Value.*

(A) For each unique combination of model type and footprint value, a manufacturer shall calculate a combined city/highway CO_2 exhaust emission value as follows:

$$0.55 \times \text{City } CO_2 \text{ Value} + 0.45 \times \text{Highway } CO_2 \text{ Value}$$

"City" CO_2 exhaust emissions shall be measured using the FTP test cycle (40 CFR, Part 86, Subpart B), as amended by the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures Passenger Cars, Light Duty Trucks, and Medium Duty Vehicles." "Highway" CO_2 exhaust emission shall be measured using the using the Highway Fuel Economy Test (HWFET; 40 CFR 600 Subpart B).

(B) Each combined city/highway CO_2 exhaust emission, determined for each unique combination of model type and footprint value, shall be multiplied by the total production of that model type/footprint combination for the applicable model year.

(C) The resulting products shall be summed, and that sum shall be divided by the total production of passenger cars or total combined production of light-duty trucks and medium-duty passenger vehicles, as applicable, in that model year. The result shall be rounded to the nearest whole gram per mile. This result shall be the manufacturer's actual sales-weighted fleet average CO_2 value for the manufacturer's passenger car fleet or its combined light-duty truck and medium-duty passenger vehicle fleet, as applicable.

(D) For each model year, a manufacturer must demonstrate compliance with the fleet average requirements in section (a)(1) based on one of two options applicable throughout the model year, either:

Option 1: the total number of passenger cars, light-duty trucks, and medium-duty passenger vehicles that are certified to the California exhaust emission standards in section 1961.3, and are produced and delivered for sale in California; or

Option 2: the total number of passenger cars, light-duty trucks, and medium-duty passenger vehicles that are certified to the California exhaust emission standards in this section 1961.3, and are produced and delivered for sale in California, the District of Columbia, and all states that have adopted California's greenhouse gas emission standards for that model year pursuant to Section 177 of the federal Clean Air Act (42 U.S.C. § 7507).

1. A manufacturer that selects compliance Option 2 must notify the Executive Officer of that selection, in writing, prior to the start of the applicable model year or must comply with Option 1. Once a manufacturer has selected compliance Option 2, that selection applies unless the manufacturer selects Option 1 and notifies the Executive Officer of that selection in writing before the start of the applicable model year.

2. When a manufacturer is demonstrating compliance using Option 2 for a given model year, the term "in California" as used in section 1961.3 means California, the District of Columbia, and all states that have adopted California's greenhouse gas emission standards for that model year pursuant to Section 177 of the federal Clean Air Act (42 U.S.C. § 7507).

3. A manufacturer that selects compliance Option 2 must provide to the Executive Officer separate values for the number of vehicles in each model type and footprint value produced and delivered for sale in the District of Columbia and for each individual state within the average and the City CO_2 Value and Highway CO_2 exhaust emission values that apply to each model type and footprint value.

(6) *Credits for Reduction of Air Conditioning Direct Emissions.* Manufacturers may generate A/C Direct Emissions Credits by implementing specific air conditioning system technologies designed to reduce air conditioning direct emissions over the useful life of their vehicles. A manufacturer may only use an A/C Direct Emissions Credit for vehicles within a model type upon approval of the A/C Direct Emissions Credit for that model type by the Executive Officer. The conditions and requirements for obtaining approval of an A/C Direct Emissions Credit are described in (A) through (F), below.

(A) Applications for approval of an A/C Direct Emissions Credit must be organized by model type. The applications must also include:

- vehicle make and
- number of vehicles within the model type that will be equipped with the air conditioning system to which the leakage credit shall apply.

Separate applications must be submitted for any two configurations of an A/C system with differences other than dimensional variation.

(B) To obtain approval of the A/C Direct Emissions Credit, the manufacturer must demonstrate through an engineering evaluation that the A/C system under consideration reduces A/C direct emissions. The demonstration must include all of the following elements:

- the amount of A/C Direct Emissions Credit requested, in grams of CO_2-equivalent per mile (gCO_2e/mi);
- the calculations identified in section (a)(6)(C) justifying that credit amount;
- schematic of the A/C system;
- specifications of the system components with sufficient detail to allow reproduction of the calculation; and
- an explanation describing what efforts have been made to minimize the number of fittings and joints and to optimize the components in order to minimize leakage.

Calculated values must be carried to at least three significant figures throughout the calculations, and the final credit value must be rounded to one tenth of a gram of CO_2-equivalent per mile (gCO_2e/mi).

(C) The calculation of A/C Direct Emissions Credit depends on the refrigerant or type of system, and is specified in paragraphs 1, 2, and 3 of this subsection.

1. HFC-134a vapor compression systems

For A/C systems that use HFC-134a refrigerant, the A/C Direct Emissions Credit is calculated using the following formula:

$$A/C\ Direct\ Credit = Direct\ Credit\ Baseline \times (1 - \frac{LR}{Avg\ LR})$$

Where:

Direct Credit Baseline = 12.6 gCO_2e/mi for passenger cars;
Direct Credit Baseline = 15.6 gCO2e/mi for light-duty trucks and medium-duty passenger vehicles;
Avg LR = 16.6 grams/year for passenger cars;
Avg LR = 20.7 grams/year for light-duty trucks and medium-duty passenger vehicles;

LR = the larger of *SAE LR* or *Min LR*;

Where:

SAE LR = initial leak rate evaluated using SAE International's Surface Vehicle Standard SAE J2727 (Revised August 2008), incorporated by reference, herein;
Min LR = 8.3 grams/year for passenger car A/C systems with belt-driven compressors;
Min LR = 10.4 grams/year for light-duty truck and medium-duty passenger vehicle A/C systems with belt-driven compressors;

Min LR = 4.1 grams/year for passenger car A/C systems with electric compressors;
Min LR = 5.2 grams/year for light-duty truck and medium-duty passenger vehicle A/C systems with electric compressors.

Note: Initial leak rate is the rate of refrigerant leakage from a newly manufactured A/C system in grams of refrigerant per year. The Executive Officer may allow a manufacturer to use an updated version of the August 2008 version of SAE J2727 or an alternate method if s/he determines that the updated SAE J2727 or the alternate method provides more accurate estimates of the initial leak rate of A/C systems than the August 2008 version of SAE J2727 does.

2. Low-GWP vapor compression systems

For A/C systems that use a refrigerant having a GWP of 150 or less, the A/C Direct Emissions Credit shall be calculated using the following formula:

$$A/C\ Direct\ Credit = Low\ GWP\ Credit - High\ Leak\ Penalty$$

Where:

$$Low\ GWP\ Credit = Max\ Low\ GWP\ Credit \times (1 - \frac{GWP}{1{,}430}),$$

and

$$High\ Leak\ Penalty = \begin{cases} Max\ High\ Leak\ Penalty, & \text{if } SAE\ LR > Avg\ LR; \\ Max\ High\ Leak\ Penalty \times \dfrac{SAE\ LR - Min\ LR}{Avg\ LR - Min\ LR}, & \text{if } Min\ LR < SAE\ LR \le Avg\ LR; \\ 0, & \text{if } SAE\ LR \le Min\ LR. \end{cases}$$

Where:

Max Low GWP Credit = 13.8 gCO_2e/mi for passenger cars;
Max Low GWP Credit = 17.2 gCO_2e/mi for light-duty trucks and medium-duty passenger vehicles;
GWP = the global warming potential of the refrigerant over a 100-year horizon, as specified in section (a)(6)(F);
Max High Leak Penalty = 1.8 gCO_2e/mi for passenger cars;
Max High Leak Penalty = 2.1 gCO_2e/mi for light-duty trucks and medium-duty passenger vehicles;
Avg LR = 13.1 g/yr for passenger cars;
Avg LR = 16.6 g/yr for light-duty trucks and medium-duty passenger vehicles;

and where:

SAE LR = initial leak rate evaluated using SAE International's Surface Vehicle Standard SAE J2727 (Revised August 2008);

Min LR = 8.3 g/yr for passenger cars;

Min LR = 10.4 g/yr for light-duty trucks and medium-duty passenger vehicles.

Note: Initial leak rate is the rate of refrigerant leakage from a newly manufactured A/C system in grams of refrigerant per year. The Executive Officer may allow a manufacturer to use an updated version of SAE J2727 or an alternate applicable test method if s/he finds the update or the alternate method provides more accurate estimates of the initial leak rate of A/C systems than the August 2008 version of SAE J2727 does.

3. Other A/C systems

For an A/C system that uses a technology other than vapor compression cycles, an A/C Direct Emissions Credit may be approved by the Executive Officer. The amount of credit requested must be based on demonstration of the reduction of A/C direct emissions of the technology using an engineering evaluation that includes verifiable laboratory test data, and cannot exceed 13.8 gCO_2e/mi for passenger cars and 17.2 gCO_2e/mi for light-duty trucks and medium-duty passenger vehicles.

(D) The total leakage reduction credits generated by the air conditioning system shall be calculated separately for passenger cars, and for light-duty trucks and medium-duty passenger vehicles, according to the following formula:

$$\textit{Total Credits (g/mi)} = \textit{A/C Direct Credit} \times \textit{Production}$$

Where:

A/C Direct Credit is calculated as specified in subsection (a)(6)(C).

Production = The total number of passenger cars or light-duty trucks plus medium-duty passenger vehicles, whichever is applicable, produced and delivered for sale in California, with the air conditioning system to which the *A/D Direct Credit* value from subsection (a)(6)(C) applies.

(E) The results of subsection (a)(6)(D), rounded to the nearest whole gram per mile, shall be included in the manufacturer's credit/debit totals calculated in subsection (b)(1)(B).

(F) The following values for refrigerant global warming potential (GWP), or alternative values as determined by the Executive Officer, shall be used in the calculations of this subsection (a)(6). The Executive Officer shall determine values for refrigerants not included in this subsection (a)(6)(F) upon request by a manufacturer, based on findings by the Intergovernmental Panel on Climate Change (IPCC) or from other applicable research studies.

Refrigerant	*GWP*
HFC–134a	1,430
HFC–152a	124
HFO–1234yf	4
CO_2	1

(7) *Credits for Improving Air Conditioning System Efficiency.* Manufacturers may generate CO_2 credits by implementing specific air conditioning system technologies designed to reduce air conditioning-related CO_2 emissions over the useful life of their passenger cars, light-duty trucks, and/or medium-duty passenger vehicles. Credits shall be calculated according to this subsection (a)(7) for each air conditioning system that the manufacturer is using to generate CO_2 credits. The eligibility requirements specified in subsection (a)(7)(E) must be met before an air conditioning system is allowed to generate credits.

(A) Air conditioning efficiency credits are available for the following technologies in the gram per mile amounts indicated for each vehicle category in the following table:

Air Conditioning Technology	***Passenger Cars (g/mi)***	***Light-Duty Trucks and Medium-Duty Passenger Vehicles (g/mi)***
Reduced reheat, with externally-controlled, variable-displacement compressor (*e.g.* a compressor that controls displacement based on temperature setpoint and/or cooling demand of the air conditioning system control settings inside the passenger compartment).	1.5	2.2
Reduced reheat, with externally-controlled, fixed-displacement or pneumatic variable displacement compressor (*e.g.* a compressor that controls displacement based on conditions within, or internal to, the air conditioning system, such as head pressure, suction pressure, or evaporator outlet temperature).	1.0	1.4
Default to recirculated air with closed-loop control of the air supply (sensor feedback to control interior air quality) whenever the ambient temperature is 75 °F or higher: Air conditioning systems that operated with closed-loop control of the air supply at different temperatures may receive credits by submitting an engineering analysis to the Administrator for approval.	1.5	2.2
Default to recirculated air with open-loop control air supply (no sensor feedback) whenever the ambient temperature is 75 °F or higher. Air conditioning systems that operate with open-loop control of the air supply at different temperatures may receive credits by submitting an engineering analysis to the Administrator for approval.	1.0	1.4
Blower motor controls which limit wasted electrical energy (*e.g.* pulse width modulated power controller).	0.8	1.1
Internal heat exchanger (*e.g.* a device that transfers heat from the high-pressure, liquid-phase refrigerant entering the evaporator to the low-pressure, gas-phase refrigerant exiting the evaporator).	1.0	1.4
Improved condensers and/or evaporators with system analysis on the component(s) indicating a coefficient of performance improvement for the system of greater than 10% when compared to previous industry standard designs).	1.0	1.4
Oil separator. The manufacturer must submit an engineering analysis demonstrating the increased improvement of the system relative to the baseline design, where the baseline component for comparison is the version which a manufacturer most recently had in production on the same vehicle design or in a similar or related vehicle model. The characteristics of the baseline component shall be compared to the new component to demonstrate the improvement.	0.5	0.7

(B) Air conditioning efficiency credits are determined on an air conditioning system basis. For each air conditioning system that is eligible for a credit based on the use of one or more of the items listed in subsection (a)(7)(A), the total credit value is the sum of the gram per mile values listed in subsection (a)(7)(A) for each item that applies to the air conditioning system.

However, the total credit value for an air conditioning system may not be greater than 5.0 grams per mile for any passenger car or 7.2 grams per mile for any light-duty truck or medium-duty passenger vehicle.

(C) The total efficiency credits generated by an air conditioning system shall be calculated separately for passenger cars and for light-duty trucks plus medium-duty passenger vehicles according to the following formula:

$$Total\ Credits\ (g/mi) = Credit \times Production$$

Where:

Credit = the CO_2 efficiency credit value in grams per mile determined in subsection (a)(7)(B) or (a)(7)(E), whichever is applicable.

Production = The total number of passenger cars or light-duty trucks plus medium-duty passenger vehicles, whichever is applicable, produced and delivered for sale in California, with the air conditioning system to which to the efficiency credit value from subsection (a)(7)(B) applies.

(D) The results of subsection (a)(7)(C), rounded to the nearest whole gram per mile, shall be included in the manufacturer's credit/debit totals calculated in subsection (b)(1)(B).

(E) For the purposes of this subsection (a)(7)(E), the AC17 Test Procedure shall mean the AC17 Air Conditioning Efficiency Test Procedure set forth in the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles."

1. For each air conditioning system selected by the manufacturer to generate air conditioning efficiency credits, the manufacturer shall perform the AC17 Test Procedure.

2. Using good engineering judgment, the manufacturer must select the vehicle configuration to be tested that is expected to result in the greatest increased CO_2 emissions as a result of the operation of the air conditioning system for which efficiency credits are being sought. If the air conditioning system is being installed in passenger cars, light-duty trucks, and medium-duty passenger vehicles, a separate determination of the quantity of credits for passenger cars and for light-duty trucks and medium-duty passenger vehicles must be made, but only one test vehicle is required to represent the air conditioning system, provided it represents the worst-case impact of the system on CO_2 emissions.

3. For each air conditioning system selected by the manufacturer to generate air conditioning efficiency credits, the manufacturer shall perform the AC17 Test Procedure according to the following requirements. Each air conditioning system shall be tested as follows:

a. Perform the AC17 test on a vehicle that incorporates the air conditioning system with the credit-generating technologies.

b. Perform the AC17 test on a vehicle which does not incorporate the credit-generating technologies. The tested vehicle must be similar to the vehicle tested under subsection (a)(7)(E)(3)a.

c. Subtract the CO_2 emissions determined from testing under subsection (a)(7)(E)(3)a from the CO_2 emissions determined from testing under subsection (a)(7)(E)(3)b and round to the nearest 0.1 grams/mile. If the result is less than or equal to zero, the air conditioning system is not eligible to generate credits. If the result is greater than or equal to the total of the gram per mile credits determined under subsection (a)(7)(B), then the air conditioning system is eligible to generate the maximum allowable value determined under subsection (a)(7)(B). If the result is greater than zero but less than the total of the gram per mile credits determined under subsection (a)(7)(B), then the air conditioning system is eligible to generate credits in the amount determined by subtracting the CO_2 emissions determined from testing under subsection (a)(7)(E)(3)a from the CO_2 emissions determined from testing under subsection (a)(7)(E)(3)b and rounding to the nearest 0.1 grams/mile.

4. For the first model year for which an air conditioning system is expected to generate credits, the manufacturer must select for testing the highest-selling subconfiguration within each vehicle platform that uses the air conditioning system. Credits may continue to be generated by the air conditioning system installed in a vehicle platform provided that:

a. The air conditioning system components and/or control strategies do not change in any way that could be expected to cause a change in its efficiency;

b. The vehicle platform does not change in design such that the changes could be expected to cause a change in the efficiency of the air conditioning system; and

c. The manufacturer continues to test at least one sub-configuration within each platform using the air conditioning system, in each model year, until all sub-configurations within each platform have been tested.

5. Each air conditioning system must be tested and must meet the testing criteria in order to be allowed to generate credits. Using good engineering judgment, in the first model year for which an air conditioning system is expected to generate credits, the manufacturer must select for testing the highest-selling subconfiguration within each vehicle platform using the air conditioning system. Credits may continue to be generated by an air conditioning system in subsequent model years if the manufacturer continues to test at least one sub-configuration within each platform on annually, as long as the air conditioning system and vehicle platform do not change substantially.

(8) *Off-Cycle Credits.* Manufacturers may generate credits for CO_2-reducing technologies where the CO_2 reduction benefit of the technology is not adequately captured on the FTP and/or the HWFET. These technologies must have a measurable, demonstrable, and verifiable real-world CO_2 reduction that occurs outside the conditions of the FTP and the HWFET. These optional credits are referred to as "off-cycle" credits. Off-cycle technologies used to generate emission credits are considered emission-related components subject to applicable requirements, and must be demonstrated to be effective for the full useful life of the vehicle. Unless the manufacturer demonstrates that the technology is not subject to in-use deterioration, the manufacturer must account for the deterioration in their analysis. The manufacturer must use one of the three options specified in this subsection (a)(8) to determine the CO_2 gram per mile credit applicable to an off-cycle technology. The manufacturer should notify the Executive Officer in its pre-model year report of its intention to generate any credits under this subsection (a)(8).

(A) *Credit available for certain off-cycle technologies*.

1. The manufacturer may generate a CO_2 gram/mile credit for certain technologies as specified in the following table, provided that each technology is applied to the minimum percentage of the manufacturer's total U.S. production of passenger cars, light-duty trucks, and medium-duty passenger vehicles specified in the table in each model year for which credit is claimed. Technology definitions are in subsection (e).

Off-Cycle Technology	Passenger Cars (g/mi)	Light-Duty Trucks and Medium-Duty Passenger Vehicles (g/mi)	Minimum Total Percent of U.S. Production
Active aerodynamics	0.6	1.0	10
High efficiency exterior lighting	1.1	1.1	10
Engine heat recovery	0.7 per 100W of capacity	0.7 per 100W of capacity	10
Engine start-stop (idle-off)	2.9	4.5	10
Active transmission warm-up	1.8	1.8	10
Active engine warm-up	1.8	1.8	10
Electric heater circulation pump	1.0	1.5	n/a
Solar roof panels	3.0	3.0	n/a
Thermal control	≤3.0	≤4.3	n/a

a. Credits may also be accrued for thermal control technologies as defined in subsection (e) in the amounts shown in the following table:

Thermal Control Technology	Credit value: Passenger Cars (g/mi)	Credit Value: Light-Duty Trucks and Medium-Duty Passenger Vehicles (g/mi)
Glass or glazing	≤2.9	≤3.9
Active seat ventilation	1.0	1.3
Solar reflective paint	0.4	0.5
Passive cabin ventilation	1.7	2.3
Active cabin ventilation	2.1	2.8

b. The maximum credit allowed for thermal control technologies is limited to 3.0 g/mi for passenger cars and to 4.3 g/mi for light-duty trucks and medium-duty passenger vehicles. The maximum credit allowed for glass or glazing is limited to 2.9 g/mi for passenger cars and to 3.9 g/mi for light-duty trucks and medium-duty passenger vehicles.

c. Glass or glazing credits are calculated using the following equation:

$$\text{Credit} = \left[Z \times \sum_{i=1}^{n} \frac{T_i \times G_i}{G} \right]$$

Where:

Credit = the total glass or glazing credits, in grams per mile, for a vehicle, which may not exceed 3.0 g/mi for passenger cars or 4.3 g/mi for light-duty trucks and medium-duty passenger vehicles;

Z = 0.3 for passenger cars and 0.4 for light-duty trucks and medium-duty passenger vehicles;

G_i = the measured glass area of window i, in square meters and rounded to the nearest tenth;

G = the total glass area of the vehicle, in square meters and rounded to the nearest tenth;

Ti = the estimated temperature reduction for the glass area of window *i*, determined using the following formula:

$$T_i = 0.3987 \times (Tts_{base} - Tts_{new})$$

Where:

Tts_{new} = the total solar transmittance of the glass, measured according to ISO 13837:2008, “Safety glazing materials – Method for determination of solar transmittance” (incorporated by reference, herein).

Tts_{base} = 62 for the windshield, side-front, side-rear, rear-quarter, and backlite locations, and 40 for rooflite locations.

2. The maximum allowable decrease in the manufacturer’s combined passenger car and light-duty truck plus medium-duty passenger vehicle fleet average CO_2 emissions attributable to use of the default credit values in subsection (a)(8)(A)1 is 10 grams per mile. If the total of the CO_2 g/mi credit values from the table in subsection (a)(8)(A)1 does not exceed 10 g/mi for any passenger automobile or light truck in a manufacturer’s fleet, then the total off-cycle credits may be calculated according to subsection (a)(8)(D). If the total of the CO_2 g/mi credit values from the table in subsection (a)(8)(A)1 exceeds 10 g/mi for any passenger car, light-duty truck, or medium-duty passenger vehicle in a manufacturer’s fleet, then the gram per mile decrease for the combined passenger car and light-duty truck plus medium-duty passenger vehicle fleet must be determined according to subsection (a)(8)(A)2.a to determine whether the 10 g/mi limitation has been exceeded.

a. Determine the gram per mile decrease for the combined passenger car and light-duty truck plus medium-duty passenger vehicle fleet using the following formula:

$$\text{Decrease} = \frac{\mathit{Credits} \times 1{,}000{,}000}{[(\text{Prod}_\text{C} \times 195{,}264) + (\text{Prod}_\text{T} \times 225{,}865)]}$$

Where:

Credits = The total of passenger car and light-duty truck plus medium-duty passenger vehicles credits, in Megagrams, determined according to subsection (a)(8)(D) and limited to those credits accrued by using the default gram per mile values in subsection (a)(8)(A)1.

Prod_C = The number of passenger cars produced by the manufacturer and delivered for sale in the U.S.

Prod_T = The number of light-duty trucks and medium-duty passenger vehicles produced by the manufacturer and delivered for sale in the U.S.

b. If the value determined in subsection (a)(8)(A)2.a is greater than 10 grams per mile, the total credits, in Megagrams, that may be accrued by a manufacturer using the default gram per mile values in subsection (a)(8)(A)1 shall be determined using the following formula:

$$\text{Credit (Megagrams)} = \frac{\left[10 \times \left((\text{Prod}_\text{C} \times 195{,}264) + (\text{Prod}_\text{T} \times 225{,}865)\right)\right]}{1{,}000{,}000}$$

Where:

Prod_C = The number of passenger cars produced by the manufacturer and delivered for sale in the U.S.

Prod_T = The number of light-duty trucks and medium-duty passenger vehicles produced by the manufacturer and delivered for sale in the U.S.

c. If the value determined in subsection (a)(8)(A)2.a is not greater than 10 grams per mile, then the credits that may be accrued by a manufacturer using the default gram per mile values in subsection (a)(8)(A)1 do not exceed the allowable limit, and total credits may be determined for each category of vehicles according to subsection (a)(8)(D).

d. If the value determined in subsection (a)(8)(A)2.a is greater than 10 grams per mile, then the combined passenger car and light-duty truck plus medium-duty passenger vehicle credits, in Megagrams, that may be accrued using the calculations in subsection (a)(8)(D) must not exceed the value determined in subsection (a)(8)(A)2.b. This limitation should generally be done by reducing the amount of credits attributable to the vehicle category that caused the limit to be exceeded such that the total value does not exceed the value determined in subsection (a)(8)(A)2.b.

3. In lieu of using the default gram per mile values specified in subsection (a)(8)(A)1 for specific technologies, a manufacturer may determine an alternative value for any of the specified technologies. An alternative value must be determined using one of the methods specified in subsection (a)(8)(B) or subsection (a)(8)(C).

(B) *Technology demonstration using EPA 5-cycle methodology.* To demonstrate an off-cycle technology and to determine a CO_2 credit using the EPA 5-cycle methodology, the manufacturer shall determine the off-cycle city/highway combined carbon-related exhaust emissions benefit by using the EPA 5-cycle methodology described in 40 CFR Part 600. Testing shall be performed on a representative vehicle, selected using good engineering judgment, for each model type for which the credit is being demonstrated. The emission benefit of a technology is determined by testing both with and without the off-cycle technology operating. Multiple off-cycle technologies may be demonstrated on a test vehicle. The manufacturer shall conduct the following steps and submit all test data to the Executive Officer.

1. Testing without the off-cycle technology installed and/or operating. Determine carbon-related exhaust emissions over the FTP, the HWFET, the US06, the SC03, and the cold temperature FTP test procedures according to the test procedure provisions specified in 40 CFR part 600 subpart B and using the calculation procedures specified in §600.113–08 of this chapter. Run each of these tests a minimum of three times without the off-cycle technology installed and operating and average the per phase (bag) results for each test procedure. Calculate the 5-cycle weighted city/highway combined carbon-related exhaust emissions from the averaged per phase results, where the 5-cycle city value is weighted 55% and the 5-cycle highway value is weighted 45%. The resulting combined city/highway value is the baseline 5-cycle carbon-related exhaust emission value for the vehicle.

2. Testing with the off-cycle technology installed and/or operating. Determine carbon-related exhaust emissions over the US06, the SC03, and the cold temperature FTP test procedures according to the test procedure provisions specified in 40 CFR part 600 subpart B and using the calculation procedures specified in 40 CFR §600.113–08. Run each of these tests a minimum of three times with the off-cycle technology installed and operating and average the per phase (bag) results for each test procedure. Calculate the 5-cycle weighted city/highway combined

carbon-related exhaust emissions from the averaged per phase results, where the 5-cycle city value is weighted 55% and the 5-cycle highway value is weighted 45%. Use the averaged per phase results for the FTP and HWFET determined in subsection (a)(8)(B)1 for operation without the off-cycle technology in this calculation. The resulting combined city/highway value is the 5-cycle carbon-related exhaust emission value showing the off-cycle benefit of the technology but excluding any benefit of the technology on the FTP and HWFET.

3. Subtract the combined city/highway value determined in subsection (a)(8)(B)1 from the value determined in subsection (a)(8)(B)2. The result is the off-cycle benefit of the technology or technologies being evaluated. If this benefit is greater than or equal to three percent of the value determined in subsection (a)(8)(B)1 then the manufacturer may use this value, rounded to the nearest tenth of a gram per mile, to determine credits under subsection (a)(8)(C).

4. If the value calculated in subsection (a)(8)(B)3 is less than two percent of the value determined in subsection (a)(8)(B)1, then the manufacturer must repeat the testing required under subsections (a)(8)(B)1 and (a)(8)(B)2, except instead of running each test three times they shall run each test two additional times. The off-cycle benefit of the technology or technologies being evaluated shall be calculated as in subsection (a)(8)(B)3 using all the tests conducted under subsections (a)(8)(B)1, (a)(8)(B)2, and (a)(8)(B)4. If the value calculated in subsection (a)(8)(B)3 is less than two percent of the value determined in subsection (a)(8)(B)1, then the manufacturer must verify the emission reduction potential of the off-cycle technology or technologies using the EPA Vehicle Simulation Tool, and if the results support a credit value that is less than two percent of the value determined in subsection (a)(8)(B)1 then the manufacturer may use the off-cycle benefit of the technology or technologies calculated as in subsection (a)(8)(B)3 using all the tests conducted under subsections (a)(8)(B)1, (a)(8)(B)2, and (a)(8)(B)4, rounded to the nearest tenth of a gram per mile, to determine credits under subsection (a)(8)(C).

(C) *Review and approval process for off-cycle credits*.

1. *Initial steps required*.

a. A manufacturer requesting off-cycle credits under the provisions of subsection (a)(8)(B) must conduct the testing and/or simulation described in that paragraph.

b. A manufacturer requesting off-cycle credits under subsection (a)(8)(B) must conduct testing and/or prepare engineering analyses that demonstrate the in-use durability of the technology for the full useful life of the vehicle.

2. *Data and information requirements*. The manufacturer seeking off-cycle credits must submit an application for off-cycle credits determined under subsection (a)(8)(B). The application must contain the following:

a. A detailed description of the off-cycle technology and how it functions to reduce CO_2 emissions under conditions not represented on the FTP and HWFET.

b. A list of the vehicle model(s) which will be equipped with the technology.

c. A detailed description of the test vehicles selected and an engineering analysis that supports the selection of those vehicles for testing.

d. All testing and/or simulation data required under subsection (a)(8)(B), as applicable, plus any other data the manufacturer has considered in the analysis.

e. An estimate of the off-cycle benefit by vehicle model and the fleetwide benefit based on projected sales of vehicle models equipped with the technology.

f. An engineering analysis and/or component durability testing data or whole vehicle testing data demonstrating the in-use durability of the off-cycle technology components.

3. R*eview of the off-cycle credit application*. Upon receipt of an application from a manufacturer, the Executive Officer will do the following:

a. Review the application for completeness and notify the manufacturer within 30 days if additional information is required.

b. Review the data and information provided in the application to determine if the application supports the level of credits estimated by the manufacturer.

4. *Decision on off-cycle application.* The Executive Officer will notify the manufacturer in writing of its decision to approve or deny the application within 60 days of receiving a complete application, and if denied, the Executive Officer will provide the reasons for the denial.

(D) *Calculation of total off-cycle credits.* Total off-cycle credits in grams per mile of CO_2 (rounded to the nearest tenth of a gram per mile) shall be calculated separately for passenger cars and light-duty trucks plus medium-duty passenger vehicles according to the following formula:

$$\text{Total Credits (g/mi)} = \text{Credit} \times \text{Production}$$

Where:

Credit = the credit value in grams per mile determined in subsection (a)(8)(A) or subsection (a)(8)(B).

Production = The total number of passenger cars or light-duty trucks plus medium-duty passenger vehicles, whichever is applicable, produced and delivered for sale in California, produced with the off-cycle technology to which to the credit value determined in subsection (a)(8)(A) or subsection (a)(8)(B) applies.

(9) *Credits for certain full-size pickup trucks.* Full-size pickup trucks may be eligible for additional credits based on the implementation of hybrid technologies or on exhaust emission performance, as described in this subsection (a)(9). Credits may be generated under either subsection (a)(9)(A) or subsection (a)(9)(B) for a qualifying pickup truck, but not both.

(A) *Credits for implementation of gasoline-electric hybrid technology.* Full-size pickup trucks that implement hybrid gasoline-electric technologies may be eligible for an additional credit under this subsection (a)(9)(A). Pickup trucks using the credits under this subsection (a)(9)(A) may not use the credits described in subsection (a)(9)(B).

1. Full-size pickup trucks that are mild hybrid gasoline-electric vehicles and that are produced in the 2017 through 2021 model years are eligible for a credit of 10 grams/mile. To receive this credit, the manufacturer must produce a quantity of mild hybrid full-size pickup trucks such that the proportion of production of such vehicles, when compared to the manufacturer's total production of full-size pickup trucks, is not less than the amount specified in the table below for each model year.

Model year	Required minimum percent of full-size pickup trucks
2017	30%
2018	40%
2019	55%
2020	70%
2021	80%

2. Full-size pickup trucks that are strong hybrid gasoline-electric vehicles and that are produced in the 2017 through 2025 model years are eligible for a credit of 20 grams/mile. To receive this credit, the manufacturer must produce a quantity of strong hybrid full-size pickup trucks such that the proportion of production of such vehicles, when compared to the manufacturer's total production of full-size pickup trucks, is not less than 10 percent for each model year.

(B) *Credits for emission reduction performance.* 2017 through 2021 model year full-size pickup trucks that achieve carbon-related exhaust emission values below the applicable target value determined in subsection (a)(1)(B) may be eligible for an additional credit. Pickup trucks using the credits under this subsection (a)(9)(B) may not use the credits described in subsection (a)(9)(A).

1. Full-size pickup trucks that achieve carbon-related exhaust emissions less than or equal to the applicable target value determined in subsection (a)(1)(B) multiplied by 0.85 (rounded to the nearest gram per mile) and greater than the applicable target value determined in subsection (a)(1)(B) multiplied by 0.80 (rounded to the nearest gram per mile) in a model year are eligible for a credit of 10 grams/mile. A pickup truck that qualifies for this credit in a model year may claim this credit for subsequent model years through the 2021 model year if the carbon-related exhaust emissions of that pickup truck do not increase relative to the emissions in the model year in which the pickup truck qualified for the credit. To qualify for this credit in each model year, the manufacturer must produce a quantity of full-size pickup trucks that meet the emission requirements of this subsection (a)(9)(B)1 such that the proportion of production of such vehicles, when compared to the manufacturer's total

production of full-size pickup trucks, is not less than the amount specified in the table below for each model year.

Model year	Required minimum percent of full-size pickup trucks
2017	15%
2018	20%
2019	28%
2020	35%
2021	40%

2. Full-size pickup trucks that achieve carbon-related exhaust emissions less than or equal to the applicable target value determined in subsection (a)(1)(B) multiplied by 0.80 (rounded to the nearest gram per mile) in a model year are eligible for a credit of 20 grams/mile. A pickup truck that qualifies for this credit in a model year may claim this credit for a maximum of five subsequent model years if the carbon-related exhaust emissions of that pickup truck do not increase relative to the emissions in the model year in which the pickup truck first qualified for the credit. This credit may not be claimed in any model year after 2025. To qualify for this credit, the manufacturer must produce a quantity of full-size pickup trucks that meet the emission requirements of subsection (a)(9)(B)1 such that the proportion of production of such vehicles, when compared to the manufacturer's total production of full-size pickup trucks, is not less than 10 percent in each model year.

(C) *Calculation of total full-size pickup truck credits*. Total credits in grams per mile of CO_2 (rounded to the nearest whole gram per mile) shall be calculated for qualifying full-size pickup trucks according to the following formula:

$$\text{Total Credits (g/mi)} = (10 \text{ x Production}_{10}) + (20 \text{ x Production}_{20})$$

Where:

Production$_{10}$ = The total number of full-size pickup trucks produced and delivered for sale in California with a credit value of 10 grams per mile from subsection (a)(9)(A) and subsection (a)(9)(B).

Production$_{20}$ = The total number of full-size pickup trucks produced and delivered for sale in California with a credit value of 20 grams per mile from subsection (a)(9)(A) and subsection (a)(9)(B).

(10) *Greenhouse Gas In-Use Compliance Standards.* The in-use exhaust CO_2 emission standard shall be the combined city/highway exhaust emission value calculated according to the provisions of subsection (a)(5)(A) for the vehicle model type and footprint value multiplied by 1.1 and rounded to the nearest whole gram per mile. For vehicles that are capable of operating on multiple fuels, a separate value shall be determined for each fuel that the vehicle is capable of operating on. These standards apply to in-use testing performed by the manufacturer pursuant to the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles."

(b) *Calculation of Greenhouse Gas Credits/Debits.* Credits that are earned as part of the 2012 through 2016 MY National greenhouse gas program shall not be applicable to California's greenhouse gas program. Debits that are earned as part of the 2012 through 2016 MY National greenhouse gas program shall not be applicable to California's greenhouse gas program.

(1) *Calculation of Greenhouse Gas Credits for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.*

(A) A manufacturer that achieves fleet average CO_2 values lower than the fleet average CO_2 requirement for the corresponding model year shall receive credits for each model year in units of g/mi. A manufacturer that achieves fleet average CO_2 values higher than the fleet average CO_2 requirement for the corresponding model year shall receive debits for each model year in units of g/mi. Manufacturers must calculate greenhouse gas credits and greenhouse gas debits separately for passenger cars and for combined light-duty trucks and medium-duty passenger vehicles as follows:

$$CO_2 \text{ Credits or Debits} = (CO_2 \text{ Standard} - \text{Manufacturer's Fleet Average } CO_2 \text{ Value}) \times (\text{Total No. of Vehicles Produced and Delivered for Sale in California, Including ZEVs and HEVs}).$$

Where:

CO_2 Standard = the applicable standard for the model year as determined in subsection (a)(1)(C);

Manufacturer's Fleet Average CO_2 Value = average calculated according to subsection (a)(5);

(B) A manufacturer's total Greenhouse Gas credits or debits generated in a model year shall be the sum of its CO_2 credits or debits and any of the following credits or debits, if applicable. The manufacturer shall calculate, maintain, and report Greenhouse Gas credits or debits separately for its passenger car fleet and for its light-duty truck plus medium-duty passenger vehicle fleet.

1. Air conditioning leakage credits earned according to the provisions of subsection (a)(6);

2. Air conditioning efficiency credits earned according to the provisions of subsection (a)(7);

3. Off-cycle technology credits earned according to the provisions of subsection (a)(8).

4. CO_2-equivalent debits earned according to the provisions of subsection (a)(2)(D).

(2) A manufacturer with 2017 and subsequent model year fleet average Greenhouse Gas values greater than the fleet average CO_2 standard applicable for the corresponding model year shall receive debits in units of g/mi Greenhouse Gas equal to the amount of negative credits determined by the aforementioned equation. For the 2017 and subsequent model years, the total g/mi Greenhouse Gas credits or debits earned for passenger cars and for light-duty trucks and medium-duty passenger vehicles shall be summed together. The resulting amount shall constitute the g/mi Greenhouse Gas credits or debits accrued by the manufacturer for the model year.

(3) *Procedure for Offsetting Greenhouse Gas Debits.*

(A) A manufacturer shall equalize Greenhouse Gas emission debits by earning g/mi Greenhouse Gas emission credits in an amount equal to the g/mi Greenhouse Gas debits, or by submitting a commensurate amount of g/mi Greenhouse Gas credits to the Executive Officer that were earned previously or acquired from another manufacturer. A manufacturer shall equalize combined Greenhouse Gas debits for passenger cars, light-duty trucks, and medium-duty passenger vehicles within five model years after they are earned. If emission debits are not equalized within the specified time period, the manufacturer shall be subject to the Health and Safety Code section 43211 civil penalty applicable to a manufacturer which 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 emission debits are not equalized by the end of the specified time period. For a manufacturer demonstrating compliance under Option 2 in subsection (a)(5)(D), the emission debits that are subject to a civil penalty under Health and Safety Code section 43211 shall be calculated separately for California, the District of Columbia, and each individual state that is included in the fleet average greenhouse gas requirements in subsection (a)(1). These emission debits shall be calculated for each individual state using the formula in subsections (b)(1) and (b)(2), except that the "Total No. of Vehicles Produced and Delivered for Sale in California, including ZEVs and HEVs" shall be calculated separately for the District of Columbia and each individual state.

For the purposes of Health and Safety Code section 43211, the number of passenger cars not meeting the state board's emission standards shall be determined by dividing the total amount of g/mi Greenhouse Gas emission debits for the model year calculated for California by the g/mi Greenhouse Gas fleet average requirement for passenger car applicable for the model year in which the debits were first incurred. For the purposes of Health and Safety Code section 43211, the number of light-duty trucks and medium-duty passenger vehicles not meeting the state board's emission standards shall be determined by dividing the total amount of g/mi Greenhouse Gas emission debits for the model year calculated for California by the g/mi Greenhouse Gas fleet average requirement for light-duty trucks and medium-duty passenger vehicles, applicable for the model year in which the debits were first incurred.

(B) Greenhouse Gas emission credits earned in the 2017 and subsequent model years shall retain full value through the fifth model year after they are earned, and will have no value if not used by the beginning of the sixth model year after being earned.

(4) *Use of Greenhouse Gas Emission Credits to Offset a Manufacturer's ZEV Obligations.*

(A) For a given model year, a manufacturer that has Greenhouse Gas credits remaining after equalizing all of its Greenhouse Gas debits may use those Greenhouse Gas credits to comply with its ZEV obligations for that model year, in accordance with the provisions set forth in the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," incorporated by reference in section 1962.1, or the "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," incorporated by reference in section 1962.2.

(B) Any Greenhouse Gas credits used by a manufacturer to comply with its ZEV obligations shall retain no value for the purposes of complying with this section 1961.3.

(5) Credits and debits that are earned as part of the 2012 through 2016 MY National Greenhouse Gas Program, shall have no value for the purpose of complying with this section 1961.3.

(c) *Test Procedures.* The certification requirements and test procedures for determining compliance with the emission standards in this section are set forth in the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles," incorporated by reference in section 1961.2. In the case of hybrid electric vehicles, the certification requirements and test procedures for determining compliance with the emission standards in this section are set forth in the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," incorporated by reference in section 1962.1, or the "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," incorporated by reference in section 1962.2, as applicable.

(d) *Abbreviations.* The following abbreviations are used in this section 1961.3:

"CFR" means Code of Federal Regulations.
"CH_4" means methane.
"CO_2" means carbon dioxide.

"FTP" means Federal Test Procedure.
"GHG" means greenhouse gas.
"g/mi" means grams per mile.
"GVW" means gross vehicle weight.
"GVWR" means gross vehicle weight rating.
"GWP" means the global warming potential.
"HEV" means hybrid-electric vehicle.
"HWFET" means Highway Fuel Economy Test (HWFET; 40 CFR 600 Subpart B).
"LDT" means light-duty truck.
"LVW" means loaded vehicle weight.
"MDPV" means medium-duty passenger vehicle.
"mg/mi" means milligrams per mile.
"MY" means model year.
"NHTSA" means National Highway Traffic Safety Administration.
"N_2O" means nitrous oxide.
"ZEV" means zero-emission vehicle.

(e) *Definitions Specific to this Section.* The following definitions apply to this section 1961.3:

(1) "A/C Direct Emissions" means any refrigerant released from a motor vehicle's air conditioning system.

(2) "Active Aerodynamic Improvements" means technologies that are activated only at certain speeds to improve aerodynamic efficiency by a minimum of three percent, while preserving other vehicle attributes or functions.

(3) "Active Cabin Ventilation" means devices that mechanically move heated air from the cabin interior to the exterior of the vehicle.

(4) "Active Transmission Warmup" means a system that uses waste heat from the exhaust system to warm the transmission fluid to an operating temperature range quickly using a heat exchanger in the exhaust system, increasing the overall transmission efficiency by reducing parasitic losses associated with the transmission fluid, such as losses related to friction and fluid viscosity.

(5) "Active Engine Warmup" means a system using waste heat from the exhaust system to warm up targeted parts of the engine so that it reduces engine friction losses and enables the closed-loop fuel control to activate more quickly. It allows a faster transition from cold operation to warm operation, decreasing CO_2 emissions.

(6) "Active Seat Ventilation" means a device that draws air from the seating surface which is in contact with the occupant and exhausts it to a location away from the seat.

(7) "Blower motor controls which limit waste energy" means a method of controlling fan and blower speeds that does not use resistive elements to decrease the voltage supplied to the motor.

(8) "Default to recirculated air mode" means that the default position of the mechanism which controls the source of air supplied to the air conditioning system shall change from outside air to recirculated air when the operator or the automatic climate control system has engaged the air conditioning system (i.e., evaporator is removing heat), except under those conditions where dehumidification is required for visibility (i.e., defogger mode). In vehicles equipped with interior air quality sensors (e.g., humidity sensor, or carbon dioxide sensor), the controls may determine proper blend of air supply sources to maintain freshness of the cabin air and prevent fogging of windows while continuing to maximize the use of recirculated air. At any time, the vehicle operator may manually select the non-recirculated air setting during vehicle operation but the system must default to recirculated air mode on subsequent vehicle operations (i.e., next vehicle start). The climate control system may delay switching to recirculation mode until the interior air temperature is less than the outside air temperature, at which time the system must switch to recirculated air mode.

(9) "Electric Heater Circulation Pump" means a pump system installed in a stop-start equipped vehicle or in a hybrid electric vehicle or plug-in hybrid electric vehicle that continues to circulate hot coolant through the heater core when the engine is stopped during a stop-start event. This system must be calibrated to keep the engine off for 1 minute or more when the external ambient temperature is 30 deg F.

(10) "Emergency Vehicle" means a motor vehicle manufactured primarily for use as an ambulance or combination ambulance-hearse or for use by the United States Government or a State or local government for law enforcement.

(11) "Engine Heat Recovery" means a system that captures heat that would otherwise be lost through the exhaust system or through the radiator and converting that heat to electrical energy that is used to meet the electrical requirements of the vehicle. Such a system must have a capacity of at least 100W to achieve 0.7 g/mi of credit. Every additional 100W of capacity will result in an additional 0.7 g/mi of credit.

(12) "Engine Start-Stop" means a technology which enables a vehicle to automatically turn off the engine when the vehicle comes to a rest and restart the engine when the driver applies pressure to the accelerator or releases the brake.

(13) “EPA Vehicle Simulation Tool" means the "EPA Vehicle Simulation Tool" as incorporated by reference in 40 CFR §86.1 in the Notice of Proposed Rulemaking for EPA’s 2017 and subsequent MY National Greenhouse Gas Program, as proposed November 16, 2011 [Insert Federal Register for the 2017 and subsequent MY National Greenhouse Gas Final Rule as proposed at 76 Fed. Reg. 74854, 75357 (December 1, 2011)], herein.

(14) “Executive Officer” means the Executive Officer of the California Air Resources Board.

(15) “Footprint” means the product of average track width (rounded to the nearest tenth of an inch) and wheelbase (measured in inches and rounded to the nearest tenth of an inch), divided by 144 and then rounded to the nearest tenth of a square foot, where the average track width is the average of the front and rear track widths, where each is measured in inches and rounded to the nearest tenth of an inch.

(16) “Federal Test Procedure” or “FTP” means 40 CFR, Part 86, Subpart B, as amended by the “California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles.”

(17) “Full-size pickup truck” means a light-duty truck that has a passenger compartment and an open cargo box and which meets the following specifications:

1. A minimum cargo bed width between the wheelhouses of 48 inches, measured as the minimum lateral distance between the limiting interferences (pass-through) of the wheelhouses. The measurement shall exclude the transitional arc, local protrusions, and depressions or pockets, if present. An open cargo box means a vehicle where the cargo box does not have a permanent roof. Vehicles sold with detachable covers are considered “open” for the purposes of these criteria.

2. A minimum open cargo box length of 60 inches, where the length is defined by the lesser of the pickup bed length at the top of the body and the pickup bed length at the floor, where the length at the top of the body is defined as the longitudinal distance from the inside front of the pickup bed to the inside of the closed endgate as measured at the cargo floor surface along vehicle centerline, and the length at the floor is defined as the longitudinal distance from the inside front of the pickup bed to the inside of the closed endgate as measured at the cargo floor surface along vehicle centerline.

3. A minimum towing capability of 5,000 pounds, where minimum towing capability is determined by subtracting the gross vehicle weight rating from the gross combined weight rating, or a minimum payload capability of 1,700 pounds, where minimum payload capability is

determined by subtracting the curb weight from the gross vehicle weight rating.

(18) “Greenhouse Gas” means the following gases: carbon dioxide, methane, nitrous oxide, and hydrofluorocarbons.

(19) “GWP” means the global warming potential of the refrigerant over a 100-year horizon, as specified in Intergovernmental Panel on Climate Change (IPCC) 2007: Climate Change 2007 – The Physical Science Basis. S. Solomon et al. (editors), Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, UK and New York, NY, USA, ISBN 0-521-70596-7, or determined by ARB if such information is not available in the IPCC Fourth Assessment Report.

(20) “High Efficiency Exterior Lighting” means a lighting technology that, when installed on the vehicle, is expected to reduce the total electrical demand of the exterior lighting system by a minimum of 60 watts when compared to conventional lighting systems. To be eligible for this credit the high efficiency lighting must be installed in the following components: parking/position, front and rear turn signals, front and rear side markers, stop/brake lights (including the center-mounted location), taillights, backup/reverse lights, and license plate lighting.

(21) “Improved condensers and/or evaporators” means that the coefficient of performance (COP) of air conditioning system using improved evaporator and condenser designs is 10 percent higher, as determined using the bench test procedures described in SAE J2765 ‘‘Procedure for Measuring System COP of a Mobile Air Conditioning System on a Test Bench,’’ when compared to a system using standard, or prior model year, component designs. SAE J2765 is incorporated by reference herein. The manufacturer must submit an engineering analysis demonstrating the increased improvement of the system relative to the baseline design, where the baseline component(s) for comparison is the version which a manufacturer most recently had in production on the same vehicle design or in a similar or related vehicle model. The dimensional characteristics (e.g., tube configuration/thickness/spacing, and fin density) of the baseline component(s) shall be compared to the new component(s) to demonstrate the improvement in coefficient of performance.

(22) “Mild hybrid gasoline-electric vehicle” means a vehicle that has start/stop capability and regenerative braking capability, where the recaptured braking energy over the FTP is at least 15 percent but less than 75 percent of the total braking energy, where the percent of recaptured braking energy is measured and calculated according to 40 CFR §600.108(g).

(23) “Model Type” means a unique combination of car line, basic engine, and transmission class.

(24) “2012 through 2016 MY National Greenhouse Gas Program” means the national program that applies to new 2012 through 2016 model year passenger cars, light-duty-trucks, and medium-duty passenger vehicles as adopted by the U.S. Environmental Protection Agency on April 1, 2010 (75 Fed. Reg. 25324, 25677 (May 7, 2010)).

(25) “Oil separator” means a mechanism that removes at least 50 percent of the oil entrained in the oil/refrigerant mixture exiting the compressor and returns it to the compressor housing or compressor inlet, or a compressor design that does not rely on the circulation of an oil/refrigerant mixture for lubrication.

(26) “Passive Cabin Ventilation” means ducts or devices which utilize convective airflow to move heated air from the cabin interior to the exterior of the vehicle.

(27) “Plug-in Hybrid Electric Vehicle” means “off-vehicle charge capable hybrid electric vehicle” as defined in the “California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes.”

(28) “Reduced reheat, with externally controlled, fixed-displacement or pneumatic variable displacement compressor” means a system in which the output of either compressor is controlled by cycling the compressor clutch off-and-on via an electronic signal, based on input from sensors (e.g., position or setpoint of interior temperature control, interior temperature, evaporator outlet air temperature, or refrigerant temperature) and air temperature at the outlet of the evaporator can be controlled to a level at 41°F, or higher.

(29) “Reduced reheat, with externally-controlled, variable displacement compressor” means a system in which compressor displacement is controlled via an electronic signal, based on input from sensors (e.g., position or setpoint of interior temperature control, interior temperature, evaporator outlet air temperature, or refrigerant temperature) and air temperature at the outlet of the evaporator can be controlled to a level at 41°F, or higher.

(30) “SC03” means the SC03 test cycle as set forth in the “California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures Passenger Cars, Light Duty Trucks, and Medium Duty Vehicles.”

(31) “Solar Reflective Paint” means a vehicle paint or surface coating which reflects at least 65 percent of the impinging infrared solar energy, as

determined using ASTM standards E903-96 (Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres, DOI: 10.1520/E0903-96 (Withdrawn 2005)), E1918-06 (Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field, DOI: 10.1520/E1918-06), or C1549-09 (Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer, DOI: 10.1520/C1549-09). These ASTM standards are incorporated by reference, herein.

(32) "Solar Roof Panels" means the installation of solar panels on an electric vehicle or a plug-in hybrid electric vehicle such that the solar energy is used to provide energy to the electric drive system of the vehicle by charging the battery or directly providing power to the electric motor with the equivalent of at least 50 Watts of rated electricity output.

(33) "Strong hybrid gasoline-electric vehicle" means a vehicle that has start/stop capability and regenerative braking capability, where the recaptured braking energy over the Federal Test Procedure is at least 75 percent of the total braking energy, where the percent of recaptured braking energy is measured and calculated according to 40 CFR §600.108(g).

(34) "Subconfiguration" means a unique combination within a vehicle configuration of equivalent test weight, road load horsepower, and any other operational characteristics or parameters which is accepted by USEPA.

(35) "US06" means the US06 test cycle as set forth in the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures Passenger Cars, Light Duty Trucks, and Medium Duty Vehicles."

(36) "Worst-Case" means the vehicle configuration within each test group that is expected to have the highest CO_2-equivalent value, as calculated in section (a)(5).

(f) 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 both this section and this article remains in full force and effect.

Note: Authority cited: Sections 39500, 39600, 39601, 43013, 43018, 43018.5, 43101, 43104 and 43105, Health and Safety Code. Reference: Sections 39002, 39003, 39667, 43000, 43009.5, 43013, 43018, 43018.5, 43100, 43101, 43101.5, 43102, 43104, 43105, 43106, 43204, 43205, and 43211, Health and Safety Code.

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8. Amend title 13, CCR, section 1965 to read as follows:

§1965. Emission Control, Smog Index, and Environmental Performance Labels - 1979 and Subsequent Model-Year Motor Vehicles.

In addition to all other requirements, emission control labels are required by the California certification procedures contained in the "California Motor Vehicle Emission Control and Smog Index Label Specifications for 1978 through 2003 Model Year Motorcycles, Light-, Medium- And Heavy-Duty Engines And Vehicles," adopted March 1, 1978, as last amended September 5, 2003, which is incorporated herein by reference, the "California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and ~~for~~ 2009 through 2016 ~~and Subsequent~~ Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles," incorporated by reference in §1961(d), the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles," incorporated by reference in title 13, CCR section 1961.2(d), the "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel-Engines and Vehicles," incorporated by reference in §1956.8(b), the "California Interim Certification Procedures for 2004 and Subsequent Model Hybrid-Electric Vehicle Classes," incorporated by reference in §1956.8(b) and (d), and the "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Otto-Cycle Engines," incorporated by reference in §1956.8(d). Smog index labels for passenger cars and light-duty trucks shall conform to the "California Smog Index Label Specifications for 2004 through 2009 Model Year Passenger Cars and Light-Duty Trucks," adopted September 5, 2003, as last amended May 2, 2008, which is incorporated herein by reference. Environmental Performance labels for passenger cars, light-duty trucks, and medium-duty passenger vehicles shall conform to the "California Environmental Performance Label Specifications for 2009 and Subsequent Model Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles," adopted May 2, 2008, as last amended [INSERT DATE OF AMENDMENT], which is incorporated herein by reference. Motorcycles shall meet the requirements of Title 40 Code of Federal Regulations section 86.413-78, as last amended October 28, 1977, which is incorporated herein by reference.

NOTE: Authority cited: Sections 39600, 39601, 43200, and 43200.1, Health and Safety Code. Reference: Sections 39002, 39003, 43000, 43013, 43018.5, 43100, 43101, 43102, 43104, 43107, 43200, and 43200.1, Health and Safety Code.

9. Amend title 13, CCR, section 1968.2 to read as follows:

§1968.2. Malfunction and Diagnostic System Requirements – 2004 and Subsequent Model-Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines.

* * * *

(c) ***Definitions.***

* * * *

"Calculated load value" refers to an indication of the percent engine capacity that is being used and is defined in Society of Automotive Engineers (SAE) J1979 "E/E Diagnostic Test Modes~~— Equivalent to ISO/DIS 15031-5:April 30, 2002~~", ~~April 2002~~ (SAE J1979), incorporated by reference (section (g)(1.4)[1]). For diesel applications, in lieu of the definition in SAE J1979, the calculated load value ~~is~~ may alternatively be determined by the ratio of current output torque to maximum output torque at current engine speed as defined by suspect parameter number (SPN) 92 of SAE J1939 "Recommended Practice for a Serial Control and Communications Vehicle Network" (SAE J1939), incorporated by reference.

* * * *

"Fueled engine operation" is the state where any fuel is introduced into the engine for the purpose of combustion.

* * * *

"Hybrid vehicle" refers to a vehicle (including a plug-in hybrid electric vehicle) that can draw propulsion energy from either or 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.

* * * *

"*Plug-in hybrid electric vehicle*" refers to a hybrid vehicle that has 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.

* * * *

"Propulsion system active" is the state where the powertrain (e.g., engine, electric machine) is enabled by the driver (e.g., after ignition on for

conventional vehicles, after power button pushed for some hybrid vehicles, or after remote start activation) such that the vehicle is ready to be used (e.g., vehicle is ready to be driven, ready to be shifted from "park" to "drive", heating, ventilation, and air conditioning (HVAC) turned on to condition cabin prior to driving). For purposes of this definition, "the state where the powertrain is enabled" does not include activations that are not driver-initiated (e.g., conditions where portions of the vehicle system wake up to perform OBD II monitoring or off-board charging).

* * * *

"Warm-up cycle" means a driving cycle with sufficient vehicle operation such that the coolant temperature has risen by at least 40 degrees Fahrenheit from engine starting and reaches a minimum temperature of at least 160 degrees Fahrenheit (140 degrees Fahrenheit for applications with diesel engines). Alternatively, manufacturers may define warm-up cycle as a driving cycle with vehicle operation in which the criteria specified in sections (d)(2.5.2)(B)(iii)a., b., and c. are met.

* * * *

(d) General Requirements.

Section (d) sets forth the general requirements of the OBD II system. Specific performance requirements for components and systems that shall be monitored are set forth in sections (e) and (f) below.

* * * *

(2) *MIL and Fault Code Requirements.*

* * * *

(2.5) Erasing a permanent fault code. The OBD system shall erase a permanent fault code under the following conditions:

(2.5.1) If the OBD II system is commanding the MIL on, the OBD II system shall erase a permanent fault code only if the OBD II system itself determines that the malfunction that caused the permanent fault code to be stored is no longer present and is not commanding the MIL on, pursuant to the requirements of section (d)(2.3) (which for purposes of this section shall apply to all monitors). Erasure of the permanent fault code shall occur in conjunction with extinguishing the MIL or no later than the start of the first driving cycle that begins with the MIL commanded off.

(2.5.2) If all fault information in the on-board computer other than the permanent fault code has been cleared (i.e., through the use of a scan tool or battery disconnect) and the OBD II system is not commanding the MIL on:

(A) Except as provided for in sections (d)(2.5.2)(C) through (E), if the monitor of the malfunction that caused the permanent fault code to be stored is subject to the minimum ratio requirements of section (d)(3.2) (e.g., catalyst monitor, comprehensive component input component rationality monitors), the OBD II system shall erase the permanent fault code at the end of a driving cycle if the monitor has run and made one or more determinations during a driving cycle that the malfunction of the component or the system is not present and has not made any determinations within the same driving cycle that the malfunction is present.

(B) Except as provided for in sections (d)(2.5.2)(D) and (E), if the monitor of the malfunction that caused the permanent fault code to be stored is not subject to the minimum ratio requirements of section (d)(3.2) (e.g., gasoline misfire monitor, fuel system monitor, comprehensive component circuit continuity monitors), the OBD II system shall erase the permanent fault code at the end of a driving cycle if:

(i) The monitor has run and made one or more determinations during a driving cycle that the malfunction of the component or the system is not present and has not made any determinations within the same driving cycle that the malfunction is present;

(ii) The monitor has not made any determinations that the malfunction is present subsequent to the most recent driving cycle in which the criteria of section (d)(2.5.2)(B)(i) are met; and

(iii) The following criteria are satisfied on any single driving cycle (which may be a different driving cycle than that in which the criteria of section (d)(2.5.2)(B)(i) are satisfied):

a. <u>Except as provided in section (d)(2.5.2)(B)(iii)f. below,</u> <u>c</u>~~C~~umulative time since engine start is greater than or equal to 600 seconds;

b. Except as provided in section (d)(2.5.2)(B)(iii)e. below, cumulative vehicle operation at or above 25 miles per hour occurs for greater than or equal to 300 seconds (medium-duty vehicles with diesel engines certified on an engine dynamometer may use cumulative operation at or above 1150 rpm in lieu of at or above 25 miles per hour for purposes of this criteria);

c. Continuous vehicle operation at idle (i.e., accelerator pedal released by driver and either vehicle speed less than or equal to one mile per hour or engine speed less than or equal to 200 rpm above normal warmed-up idle (as determined in the drive position for vehicles equipped with an automatic transmission)) for greater than or equal to 30 seconds; and

d. For 2013 and subsequent model year engines, the monitor has not made any determination that the malfunction is present.

e. For 2004 through 2012 model year medium-duty vehicles with diesel engines certified on an engine dynamometer, manufacturers may use diesel engine operation at or above 15 percent calculated load in lieu of 1150 rpm for the criterion in section (d)(2.5.2)(B)(iii)b. above.

f. For hybrid vehicles, manufacturers shall use "cumulative propulsion system active time" in lieu of "cumulative time since engine start" for the criterion in section (d)(2.5.2)(B)(iii)a.

(iv) Monitors required to use "similar conditions" as defined in section (c) to store and erase pending and confirmed fault codes may not require that the similar conditions be met prior to erasure of the permanent fault code.

(C) For monitors subject to section (d)(2.5.2)(A), the manufacturer may choose to erase the permanent fault code using the criteria under section (d)(2.5.2)(B) in lieu of the criteria under section (d)(2.5.2)(A).

(D) For 2009 and 2010 model year vehicles meeting the permanent fault code requirements of section (d)(2.2.5), manufacturers may request Executive Officer approval to use alternate criteria to erase the permanent fault code. The Executive Officer shall approve alternate criteria that:

(i) Will not likely require driving conditions that are longer and more difficult to meet than those required under section (d)(2.5.2)(B), and

(ii) Do not require access to enhanced scan tools (i.e., tools that are not generic SAE J1978 scan tools) to determine conditions necessary to erase the permanent fault code.

(E) If alternate criteria to erase the permanent fault code are approved by the Executive Officer under section (d)(2.5.2)(D), a manufacturer may continue to use the approved alternate criteria for 2011 model year vehicles previously certified in the 2009 or 2010 model year to the alternate criteria and carried over to the 2011 model year.

* * * *

(3) *Monitoring Conditions*.

Section (d)(3) sets forth the general monitoring requirements while sections (e) and (f) set forth the specific monitoring requirements as well as identify which of the following general monitoring requirements in section (d)(3) are applicable for each monitored component or system identified in sections (e) and (f).

* * * *

(3.2) As specifically provided for in sections (e) and (f), manufacturers shall define monitoring conditions in accordance with the criteria in sections (d)(3.2.1) through (3.2.3). The requirements of section (d)(3.2) shall be phased in as follows: 30 percent of all 2005 model year vehicles, 60 percent of all 2006 model year vehicles, and 100 percent of all 2007 and subsequent model year vehicles. Manufacturers may use an alternate phase-in schedule in lieu of the required phase-in schedule if the alternate phase-in schedule provides for equivalent compliance volume as defined in section (c) with the exception that 100 percent of 2007 and subsequent model year vehicles shall comply with the requirements. Small volume manufacturers shall meet the requirements on 100 percent of 2007 and subsequent model year vehicles but shall not be required to meet the specific phase-in requirements for the 2005 and 2006 model years.

(3.2.1) Manufacturers shall define monitoring conditions that, in addition to meeting the criteria in section (d)(3.1), ensure that the monitor yields an in-use performance ratio (as defined in section (d)(4)) that meets or exceeds the minimum acceptable in-use monitor performance ratio on in-use vehicles. For purposes of this regulation, except as provided below in section (d)(3.2.1)(D), the minimum acceptable in-use monitor performance ratio is:

(A) 0.260 for secondary air system monitors and other cold start related monitors utilizing a denominator incremented in accordance with section (d)(4.3.2)(E);

(B) For evaporative system monitors:

(i) 0.260 for monitors designed to detect malfunctions identified in section (e)(4.2.2)(C) (i.e., 0.020 inch leak detection); and

(ii) 0.520 for monitors designed to detect malfunctions identified in section (e)(4.2.2)(A) and (B) (i.e., purge flow and 0.040 inch leak detection);

(C) 0.336 for catalyst, oxygen sensor, EGR, VVT system, and all other monitors specifically required in sections (e) and (f) to meet the monitoring condition requirements of section (d)(3.2);

(D) For introductory years:

(i) through the 2007 model year, for the first three years a vehicle is certified to the in-use performance ratio monitoring requirements of section (d)(3.2), 0.100 for all monitors specified in section (d)(3.2.1)(A) through (C) above. For example, the 0.100 ratio shall apply to the 2004, 2005, and 2006 model years for vehicles first certified in the 2004 model year and to the 2007, 2008, and 2009 model years for vehicles first certified in the 2007 model year.

(ii) through the 2014 model year, for fuel system air-fuel ratio cylinder imbalance monitors, 0.100;

(iii) through the 2011 model year, for secondary exhaust gas sensor monitors specified in (e)(7.2.2)(C), 0.100;

(iv) through the 2012 model year, for vehicles subject to the monitoring requirements of section (f), 0.100 for all monitors specified in section (d)(3.2.1)(C) above~~.~~;

(v) through the 2016 model year for plug-in hybrid electric vehicles, 0.100 for all monitors specifically required in sections (e) and (f) to meet the monitoring condition requirements of section (d)(3.2) and that are for systems or components that require engine operation.

*   *   *   *

(4) *In-Use Monitor Performance Ratio Definition.*

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(4.3) Denominator Specifications

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(4.3.2) Specifications for incrementing:

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(B) Except as provided for in sections (d)(4.3.2)(H), (J), and (K), t~~T~~he denominator for each monitor shall be incremented within ten seconds if and only if the following criteria are satisfied on a single driving cycle:

(i) Cumulative time since engine start is greater than or equal to 600 seconds while at an elevation of less than 8,000 feet above sea level and at an ambient temperature of greater than or equal to 20 degrees Fahrenheit;

(ii) Except as provided in section (d)(4.3.2)(B)(iv) below, cumulative vehicle operation at or above 25 miles per hour occurs for greater than or equal to 300 seconds while at an elevation of less than 8,000 feet above sea level and at an ambient temperature of greater than or equal to 20 degrees Fahrenheit (medium-duty vehicles with diesel engines certified on an engine dynamometer may use cumulative operation at or above 1150 rpm in lieu of at or above 25 miles per hour for purposes of this criteria);

(iii) Continuous vehicle operation at idle (i.e., accelerator pedal released by driver and either vehicle speed less than or equal to one mile per hour or engine speed less than or equal to 200 rpm above normal warmed-up idle (as determined in the drive position for vehicles equipped with an automatic transmission)) for greater than or equal to 30 seconds while at an elevation of less than 8,000 feet above sea level and at an ambient temperature of greater than or equal to 20 degrees Fahrenheit.

(iv) For 2004 through 2012 model year medium-duty vehicles with diesel engines certified on an engine dynamometer, manufacturers may use diesel engine operation at or above 15 percent calculated load in lieu of 1150 rpm for the criterion in section (d)(4.3.2)(B)(ii) above.

*   *   *   *

(D) Except as provided for in sections (d)(4.3.2)(D)(iv) and (d)(4.3.2)(L), ~~In addition to the requirements of section (d)(4.3.2)(B) above,~~ the evaporative system monitor denominator(s) shall be incremented if and only if:

(i) The requirements of section (d)(4.3.2)(B) have been met ~~Cumulative time since engine start is greater than or equal to 600 seconds while at an ambient temperature of greater than~~

~~or equal to 40 degrees Fahrenheit but less than or equal to 95 degrees Fahrenheit; and~~;

(ii) Cumulative time since engine start is greater than or equal to 600 seconds while at an ambient temperature of greater than or equal to 40 degrees Fahrenheit but less than or equal to 95 degrees Fahrenheit; and ~~Engine cold start occurs with engine coolant temperature at engine start greater than or equal to 40 degrees Fahrenheit but less than or equal to 95 degrees Fahrenheit and less than or equal to 12 degrees Fahrenheit higher than ambient temperature at engine start.~~

(iii) Engine cold start occurs with engine coolant temperature at engine start greater than or equal to 40 degrees Fahrenheit but less than or equal to 95 degrees Fahrenheit and less than or equal to 12 degrees Fahrenheit higher than ambient temperature at engine start.

(iv) For plug-in hybrid electric vehicles, manufacturers may choose to increment the evaporative system denominator(s) using the criteria under section (d)(4.3.2)(L) in lieu of the criteria under sections (d)(4.3.2)(D)(i) through (iii) above.

* * * *

(F) In addition to the requirements of section (d)(4.3.2)(B) above, the denominator(s) for the following monitors of output components (except those operated only at engine start-up and subject to the requirements of the previous section (d)(4.3.2)(E)) shall be incremented if and only if the component is commanded to function (e.g., commanded “on”, “open”, “closed”, “locked”, etc.) on two or more occasions for greater than two seconds during the driving cycle or for a cumulative time greater than or equal to ten seconds, whichever occurs first:

(i) Air conditioning system (section (e)(12))

(ii) Variable valve timing and/or control system (sections (e)(13) and (f)(13))

(iii) “Other emission control or source device” (sections (e)(16) and (f)(16))

(iv) Comprehensive component output component (sections (e)(15) and (f)(15)) (e.g., turbocharger waste-gates, variable length manifold runners, torque converter clutch lock-up solenoids, etc.)

(v) PM sensor heater (section (f)(5.2.4)(A))

* * * *

(H) For monitors of the following components, the manufacturer may request Executive Officer approval to use alternate or additional criteria to that set forth in section (d)(4.3.2)(B) above for incrementing the denominator. Executive Officer approval of the proposed criteria shall be based on the equivalence of the proposed criteria in measuring the frequency of monitor operation relative to the amount of vehicle operation in accordance with the criteria in section (d)(4.3.2)(B) above:

(i) Engine cooling system input components (sections (e)(10) and (f)(11))

(ii) Air conditioning system input components (section (e)(12))

(iii) Direct ozone reduction systems (section (e)(14))

(iv) "Other emission control or source devices" (sections (e)(16) and (f)(16))

(v) Comprehensive component input components that require extended monitoring evaluation (sections (e)(15) and (f)(15)) (e.g., stuck fuel level sensor rationality)

(vi) Comprehensive component input component temperature sensor rationality monitors (sections (e)(15) and (f)(15)) (e.g, intake air temperature sensor, ambient temperature sensor, fuel temperature sensor)

(vii) PM filter frequent regeneration (section (f)(9.2.2))

<u>(viii) PM sensor monitoring capablity monitor (section (f)(5.2.2)(D))</u>

* * * *

(J) For ~~hybrid vehicles,~~ vehicles that employ alternate engine start hardware or strategies (e.g., integrated starter and generators)~~,~~ or alternate fuel vehicles (e.g., dedicated, bi-fuel, or dual-fuel applications), the manufacturer may request Executive Officer approval to use alternate criteria to that set forth in section (d)(4.3.2)(B) above for incrementing the denominator. In general, the Executive Officer shall not approve alternate criteria for vehicles that only employ engine shut off at or near idle/vehicle stop conditions. Executive Officer approval of the alternate criteria shall be based on the equivalence of the alternate criteria to determine the amount of vehicle operation relative to the measure of conventional vehicle operation in accordance with the criteria in section (d)(4.3.2)(B) above.

<u>(K) For 2014 and subsequent model year hybrid vehicles, in lieu of the criteria in section (d)(4.3.2)(B) above, the denominator for each monitor shall be incremented within ten seconds if and only if the following criteria are satisfied on a single driving cycle:</u>

<u>(i) Cumulative propulsion system active time is greater than or equal to 600 seconds while at an elevation of less than 8,000 feet above sea level and at an ambient temperature of greater than or equal to 20 degrees Fahrenheit;</u>

<u>(ii) Cumulative vehicle operation at or above 25 miles per hour occurs for greater than or equal to 300 seconds while at an elevation of less than 8,000 feet above sea level and at an ambient temperature of greater than or equal to 20 degrees Fahrenheit (medium-duty vehicles with diesel engines certified on an engine dynamometer may use cumulative operation at or above 1150 rpm in lieu of at or above 25 miles per hour for</u>

purposes of this criteria);

(iii) Continuous vehicle operation at idle (i.e., accelerator pedal released by driver and either vehicle speed less than or equal to one mile per hour or engine speed less than or equal to 200 rpm above normal warmed-up idle (as determined in the drive position for vehicles equipped with an automatic transmission)) for greater than or equal to 30 seconds while at an elevation of less than 8,000 feet above sea level and at an ambient temperature of greater than or equal to 20 degrees Fahrenheit; and

(iv) Cumulative fueled engine operation for greater than or equal to 10 seconds while at an elevation of less than 8,000 feet above sea level and at an ambient temperature of greater than or equal to 20 degrees Fahrenheit.

(L) For 2015 and subsequent model year plug-in hybrid electric vehicles, in addition to the requirements of sections (d)(4.3.2)(K)(i) through (iii) above, the evaporative system monitor denominator(s) shall be incremented if and only if:

(i) Cumulative propulsion system active time is greater than or equal to 600 seconds while at an ambient temperature of greater than or equal to 40 degrees Fahrenheit but less than or equal to 95 degrees Fahrenheit;

(ii) Engine coolant temperature at the start of propulsion system active is greater than or equal to 40 degrees Fahrenheit but less than or equal to 95 degrees Fahrenheit; and

(iii) Continuous time while the vehicle is not in the state of 'propulsion system active' during the period immediately preceding the start of the driving cycle is greater than or equal to 6 hours.

* * * *

(5) *Standardized tracking and reporting of monitor performance.*

* * * *

(5.5) Ignition cycle counter

(5.5.1) Definition:

(A) The ignition cycle counter is defined as a counter that indicates the number of ignition cycles a vehicle has experienced as defined in section(s) (d)(5.5.2)(B) and (C).

(B) Except as required in section (d)(5.5.1)(C) below, the OBD II system shall report one ignition cycle counter (as defined in section (d)(5.5.2)(B)) ~~The ignition cycle counter shall be reported in accordance with the specifications in section (g)(5.2.1)~~.

(C) For 2014 and subsequent model year plug-in hybrid electric vehicles, the OBD II system shall report two ignition cycle counters (as defined in sections (d)(5.5.2)(B) and (C)).

(D) The ignition cycle counter(s) shall be reported in accordance with the specifications in section (g)(5.2.1).

(5.5.2) Specifications for incrementing:

(A) The ignition cycle counter<u>(s)</u>, when incremented, shall be incremented by an integer of one. The ignition cycle counter<u>(s)</u> may not be incremented more than once per driving cycle.

(B) The ignition cycle counter shall be incremented within ten seconds if and only if <u>the following criteria are met:</u>

<u>(i) Except as required in section (d)(5.5.2)(B)(ii) below,</u> the vehicle meets the engine start definition (see section (c)) for at least two seconds plus or minus one second.

<u>(ii) For hybrid vehicles, the vehicle meets the propulsion system active definition (see section (c)) for at least two seconds plus or minus one second.</u>

(C) <u>In addition to the counter described in section (d)(5.5.2)(B) above, 2014 and subsequent model year plug-in hybrid electric vehicles shall track and report a second ignition cycle counter that shall be incremented within ten seconds if and only if the vehicle has met the fueled engine operation definition (see section (c)) for at least two seconds plus or minus one second</u> ~~The OBD II system shall disable further incrementing of the ignition cycle counter within ten seconds if a malfunction of any component used to determine if the criteria in section (d)(5.5.2)(B) are satisfied (i.e., engine speed or time of operation) has been detected and the corresponding pending fault code has been stored. The ignition cycle counter may not be disabled from incrementing for any other condition. Incrementing of the ignition cycle counter shall resume within ten seconds when the malfunction is no longer present (e.g., pending code erased through self-clearing or by a scan tool command)~~.

<u>(D) The OBD II system shall disable further incrementing of the ignition cycle counter(s) within ten seconds if a malfunction of any component used to determine if the criteria in section (d)(5.5.2)(B) and (C) are satisfied (e.g., engine speed or time of operation) has been detected and the corresponding pending fault code has been stored. The ignition cycle counter(s) may not be disabled from incrementing for any other condition. Incrementing of the ignition cycle counter(s) shall resume within ten seconds when the malfunction is no longer present (e.g., pending code erased through self-clearing or by a scan tool command).</u>

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(e) *Monitoring Requirements for Gasoline/Spark-Ignited Engines.*

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(3) *Misfire Monitoring*

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(3.3) Monitoring Conditions:

(3.3.1) Manufacturers shall continuously monitor for misfire under the following conditions:

(A) Except as provided in section (e)(3.3.6) below, f~~F~~rom no later than the end of the second crankshaft revolution after engine start,

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(3.3.6) For engines that employ engine shutoff strategies that do not require the vehicle operator to restart the engine to continue driving (e.g., hybrid vehicle with engine shutoff at idle), a manufacturer shall request Executive Officer approval of the monitoring conditions under which misfire monitoring occurs after engine fueling begins for the initial start and after each time fueling resumes. Executive Officer approval of the monitoring conditions shall be based on the equivalence of the conditions to those specified in section (e)(3.3.1)(A) above.

*   *   *   *

(f) ***Monitoring Requirements for Diesel/Compression-Ignition Engines.***

(1) *Non-Methane Hydrocarbon (NMHC) Converting Catalyst Monitoring*

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(1.2) Malfunction Criteria:

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(1.2.3) Other Aftertreatment Assistance Functions. Additionally, for 2010 and subsequent model year vehicles, the catalyst(s) shall be monitored for other aftertreatment assistance functions:

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(B) For 201~~0~~5 and subsequent model year passenger cars, light-duty trucks, and MDPVs certified to a chassis dynamometer tailpipe emission standard and 201~~3~~5 and subsequent model year medium-duty vehicles (including MDPVs) certified to an engine dynamometer tailpipe emission standard, for catalysts used to generate a feedgas constituency to assist SCR systems (e.g., to increase NO_2 concentration upstream of an SCR system), the OBD II system shall detect a malfunction when the catalyst is unable to generate the necessary feedgas constituents for proper SCR system operation.

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(9) *Particulate Matter (PM) Filter Monitoring*

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(9.2) Malfunction Criteria:

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(9.2.4) NMHC conversion: For 201~~0~~5 and subsequent model year passenger cars, light-duty trucks, and MDPVs certified to a chassis dynamometer tailpipe emission standard and 201~~3~~5 and subsequent model year medium-duty vehicles (including MDPVs) certified to an engine dynamometer tailpipe emission standard with catalyzed PM filters that convert NMHC emissions, the OBD II system shall monitor the catalyst function of the PM filter and detect a malfunction when the NMHC conversion capability decreases to the point that NMHC emissions exceed the applicable emission levels specified in section (f)(9.2.2)(A). If no failure or deterioration of the NMHC conversion capability could result in a vehicle's NMHC emissions exceeding these emission levels, the OBD II system shall detect a malfunction when the system has no detectable amount of NMHC conversion capability.

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(15) *Comprehensive Component Monitoring*

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(15.2) Malfunction Criteria:

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(15.2.2) Output Components/Systems:

* * * *

(F) For ~~2013~~2015 and subsequent model year vehicles that utilize fuel control system components (e.g., injectors, fuel pump) that have tolerance compensation features implemented in hardware or software during production or repair procedures (e.g., individually coded injectors for flow characteristics that are programmed into an electronic control unit to compensate for injector to injector tolerances, fuel pumps that use in-line resistors to correct for differences in fuel pump volume output), the components shall be monitored to ensure the proper compensation is being used. The system shall detect a fault if the compensation being used by the control system does not match the compensation designated for the installed component (e.g., the flow characteristic coding designated on a specific injector does not match the compensation being used by the fuel control system for that injector). If a manufacturer demonstrates that a single component (e.g., injector) using the wrong compensation cannot cause a measurable increase in emissions during any reasonable driving condition, the manufacturer shall detect a malfunction for the minimum number of components using the wrong compensation needed to cause an emission increase. Further, the stored fault code shall identify the specific component that does not match the compensation.

* * * *

(17) *Exceptions to Monitoring Requirements*

(17.1) Except as provided in sections (f)(17.1.1) through (17.1.4) below, upon request of a manufacturer or upon the best engineering judgment of the ARB, the Executive Officer may revise the emission threshold for a malfunction on any diagnostic required in section (f) for medium-duty vehicles if the most reliable monitoring method developed requires a higher threshold to prevent significant errors of commission in detecting a malfunction. Additionally, for 2007 through ~~2009~~2013 model year light-duty vehicles and 2007 through ~~2012~~ 2013 model year medium-duty vehicles, the Executive Officer may revise the PM filter malfunction criteria of section (f)(9.2.1) to exclude detection of specific failure modes (e.g., combined failure of partially melted and partially cracked substrates) if the most reliable monitoring method developed requires the exclusion of specific failure modes to prevent significant errors of commission in detecting a malfunction.

* * * *

(g) ***Standardization Requirements***

(1) *Reference Documents:*

The following Society of Automotive Engineers (SAE) and International Organization for Standardization (ISO) documents are incorporated by reference into this regulation:

* * * *

(1.4) SAE J1979 "E/E Diagnostic Test Modes", May 2007 (SAE J1979).

<u>(1.4.1) SAE J1979-DA, “Digital Annex of E/E Diagnostic Test Modes”, October 2011.</u>

* * * *

(4) *Required Emission Related Functions:*

The following standardized functions shall be implemented in accordance with the specifications in SAE J1979 to allow for access to the required information by a scan tool meeting SAE J1978 specifications:

* * * *

(4.2) Data Stream: The following signals shall be made available on demand through the standardized data link connector in accordance with SAE J1979 specifications. The actual signal value shall always be used instead of a default or limp home value.

* * * *

(4.2.6) Additionally, for all 2013 and subsequent model year vehicles so equipped:

(A) EGR temperature, variable geometry turbo control status (e.g., open loop, closed loop), reductant level (e.g., urea tank fill level), alcohol fuel percentage, ~~type of fuel currently being used,~~ NOx adsorber regeneration status, NOx adsorber deSOx status, hybrid battery pack remaining charge; and

(B) ~~PM sensor output and~~ distance traveled while low/empty SCR reductant driver warning/inducement active.

<u>(4.2.7) Additionally, for all 2015 and subsequent model year vehicles: type of fuel currently being used.</u>

(4.3) Freeze Frame.

* * * *

(4.3.2) “Freeze frame” conditions must include the fault code which caused the data to be stored and all of the signals required in section (g)(4.2.1) except number of stored confirmed fault codes, OBD requirements to which the engine is certified, MIL status, and absolute throttle position in accordance with (g)(4.3.3). Freeze frame conditions shall also include all of the signals required on the vehicle in sections (g)(4.2.2) through (g)(4.2.5)(D), (g)(4.2.5)(F), ~~and~~ (g)(4.2.6)(A), and (g)(4.2.7) that are used for diagnostic or control purposes in the specific diagnostic or emission-critical powertrain control unit that stored the fault code except: oxygen sensor output, air/fuel ratio sensor output, catalyst temperature, evaporative system vapor pressure, glow plug lamp status, PM sensor output, NOx sensor output, monitor status since last engine shut off, distance traveled while MIL activated, distance traveled since fault memory last cleared, and number of warm-up cycles since fault memory last cleared.

* * * *

(k) ***Deficiencies***

* * * *

(2) Manufacturers of non-complying systems are subject to fines pursuant to section 43016 of the California Health and Safety Code. Except as allowed in section (k)(7) for light-duty and medium-duty diesel vehicles, the specified fines apply to the third and subsequently identified deficiencies, with the exception that fines shall apply to all monitoring system deficiencies wherein a required monitoring strategy is completely absent from the OBD system.

* * * *

(4) Manufacturers must re-apply for Executive Officer approval of a deficiency each model year. In considering the request to carry-over a deficiency, the Executive Officer shall consider the factors identified in section (k)(1) including the manufacturer's progress towards correcting the deficiency. For all deficiencies except for deficiencies associated with PM filter monitoring section (f)(9.2.1)(A), t~~T~~he Executive Officer may not allow manufacturers to carry over monitoring system deficiencies for more than two model years unless it can be demonstrated that substantial vehicle hardware modifications and additional lead time beyond two years would be necessary to correct the deficiency, in which case the Executive Officer shall allow the deficiency to be carried over for three model years. For deficiencies associated with PM filter monitoring section (f)(9.2.1)(A), if the manufacturer can demonstrate that substantial vehicle hardware modifications and additional lead time would be necessary to correct the deficiency, the Executive shall allow the deficiency to be carried over up to and including the 2013 model year.

* * * *

(7) Exceptions to Fines Requirements.

(7.1) For 2007 through 2009 model year light-duty and 2007 through 2012 model year medium-duty diesel vehicles, in cases where one or more of the deficiencies is for the aftertreatment monitoring requirements of sections (f)(1), (2), (8), or (9) and the deficient monitor is properly able to detect all malfunctions prior to emissions exceeding twice the required monitor threshold (e.g., before emissions exceed 10 times the standard for NMHC if the threshold is 5.0 times the standard for NMHC), the specified fines shall apply to the fourth and subsequently identified deficiencies in lieu of the third and subsequently identified deficiencies. If none of the deficiencies are for the requirements of sections (f)(1), (2), (8), or (9) or if the deficient aftertreatment monitor exceeds twice the required monitor threshold, the specified fines shall apply to the third and subsequently identified deficiencies. In all cases, the exception that fines shall apply to all monitoring system deficiencies wherein a required monitoring strategy is completely absent from the OBD system still applies.

(7.2) For 2013 through 2014 model year light-duty and medium-duty diesel vehicles that utilize PM sensors for PM filter filtering performance monitoring (section (f)(9.2.1)(A)), in cases where the deficiency is for a monitor required to detect malfunctions of the PM filter filtering performance (section (f)(9.2.1)(A)), the PM sensor (section (f)(5.2.2)), or the PM sensor heater (section (f)(5.2.4)), the deficiency shall be exempt from the specified fines of section (k)(3) and the deficiency shall not be included in the count of deficiencies used in (k)(2) to determine the number of deficiencies subject to fines.

* * * *

NOTE: Authority cited: Sections 39600, 39601, 43000.5, 43013, 43018, 43100, 43101, 43104, 43105, 43105.5 and 43106, Health and Safety Code. Reference: Sections 39002, 39003, 39010, 39018, 39021.5, 39024, 39024.5, 39027, 39027.3, 39028, 39029, 39031, 39032, 39032.5, 39033, 39035, 39037.05, 39037.5, 39038, 39039, 39040, 39042, 39042.5, 39046, 39047, 39053, 39054, 39058, 39059, 39060, 39515, 39600-39601, 43000, 43000.5, 43004, 43006, 43013, 43016, 43018, 43100, 43101, 43102, 43104, 43105, 43105.5, 43106, 43150, 43151, 43152, 43153, 43154, 43155, 43156, 43204, 43211, and 43212, Health and Safety Code.

10. Amend title 13, CCR, section 1968.5 to read as follows:

§1968.5. Enforcement of Malfunction and Diagnostic System Requirements for 2004 and Subsequent Model-Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines.

* * * *

(b) ***Testing Procedures***

* * * *

(6) *Finding of Nonconformance after Enforcement Testing.* After conducting enforcement testing pursuant to section (b)(4) above, the Executive Officer shall make a finding of nonconformance of the OBD II system in the identified motor vehicle class if:

* * * *

(B) *OBD II Ratio Testing*.

(i) For monitors specified in sections (b)(6)(B)(i)a. through e. below, the data collected from the vehicles in the test sample indicate either that the average in-use monitor performance ratio for one or more of the monitors in the test sample group is less than 0.100 or that 66.0 percent or more of the vehicles in the test sample group have an in-use monitor performance ratio of less than 0.100 for the same monitor:

a. monitors on 2004 through ~~2014~~<u>2016</u> model year vehicles certified to a ratio of 0.100 in accordance with title 13, CCR section 1968.2(d)(3.2.1)-(D),

b. monitors specified in title 13, CCR section 1968.2(e) on 2007 through 2012 model year vehicles for the first three model years the monitor is certified to the in-use performance ratio monitoring requirements of title 13, CCR sections 1968.2(d)(3.2.1)(A) through (C),

c. the fuel system air-fuel ratio cylinder imbalance monitor specified in title 13, CCR section 1968.2(e)(6.2.1)(C) on 2015 through 2017 model year vehicles,

d. the secondary exhaust gas sensor monitor specified in title 13, CCR section 1968.2(e)(7.2.2)(C) on 2012 through 2014 model year vehicles, and

e. monitors specified in title 13, CCR section 1968.2(f) on 2013 through 2015 model year vehicles.

(ii) For monitors that are certified to the ratios in title 13, CCR sections 1968.2(d)(3.2.1)(A) through (C) and are not described in sections (b)(6)(B)(i)b. through e. above, the data collected from the vehicles in the test sample indicate either that 66.0 percent or more of the vehicles in the test sample group have an in-use monitor performance ratio of less than the required minimum ratio defined in title 13, CCR section 1968.2(d)(3.2.1) for the same monitor or that the average in-use monitor performance ratio for one or more of the monitors in the motor vehicle class is less than the required minimum ratio defined in title 13, CCR section 1968.2(d)(3.2.1) as defined by determining the average in-use monitor performance ratio for one or more of the monitors in the test sample group is less than:

a. 0.230 for secondary air system monitors and other cold start related monitors utilizing a denominator incremented in accordance with title 13, CCR section 1968.2(d)(4.3.2)(E) (e.g., cold start strategy monitors, etc.);

b. For evaporative system monitors:

   1. 0.230 for monitors designed to detect malfunctions identified in title 13, CCR section 1968.2(e)(4.2.2)(C) (i.e., 0.020 inch leak detection);

   2. 0.460 for monitors designed to detect malfunctions identified in title 13, CCR section 1968.2(e)(4.2.2)(A) and (B) (i.e., purge flow and 0.040 inch leak detection);

c. 0.297 for catalyst, oxygen sensor, EGR, VVT system, and all other monitors specifically required in section title 13, CCR sections 1968.2(e) and (f) to meet the monitoring condition requirements of title 13, CCR section 1968.2(d)(3.2).

*   *   *   *

(c) ***Remedial Action***

*   *   *   *

(3) *Ordered Remedial Action-Mandatory Recall.*

(A) Except as provided in sections (c)(3)(B) below, the Executive Officer shall order the recall and repair of all vehicles in a motor vehicle class that have been determined to be equipped with a nonconforming OBD II system if enforcement testing conducted pursuant to section (b) above or information received from the manufacturer indicates that:

(i) For monitors on 2007 and subsequent model year vehicles certified to the ratios in title 13, CCR sections 1968.2(d)(3.2.1)(A) through (C), the average in-use monitor performance ratio for one or more of the major monitors in the test sample group is less than or equal to 33.0 percent of the applicable required minimum ratio established in title 13, CCR section 1968.2(d)(3.2.1) (e.g., if the required ratio is 0.336, less than or equal to a ratio of 0.111) or 66.0 percent or more of the vehicles in the test sample group have an in-use monitor performance ratio of less than or equal to 33.0 percent of the applicable required minimum ratio established in title 13, CCR section 1968.2(d)(3.2.1) for the same major monitor. For monitors on 2004 through ~~2014~~2016 model year vehicles certified to the 0.100 ratio in title 13, CCR section 1968.2(d)(3.2.1)(D), the Executive Officer shall determine the remedial action for nonconformances regarding the in-use monitor performance ratio in accordance with section (c)(4) below.

* * * *

NOTE: Authority cited: Sections 39600, 39601, 43000.5, 43013, 43018, 43100, 43101, 43104, 43105, 43105.5 43106, 43154, 43211, and 43212, Health and Safety Code. Reference: Sections 39002, 39003, 39010, 39018, 39021.5, 39024, 39024.5, 39027, 39027.3, 39028, 39029, 39031, 39032, 39032.5, 39033, 39035, 39037.05, 39037.5, 39038, 39039, 39040, 39042, 39042.5, 39046, 39047, 39053, 39054, 39058, 39059, 39060, 39515, 39600-39601, 43000, 43000.5, 43004, 43006, 43013, 43016, 43018, 43100, 43101, 43102, 43104, 43105, 43105.5, 43106, 43150, 43151, 43152, 43153, 43154, 43155, 43156, 43204, 43211, and 43212, Health and Safety Code.

11. Amend title 13, CCR, section 1976 to read as follows:

§ 1976. Standards and Test Procedures for Motor Vehicle Fuel Evaporative Emissions.

(a) *[Fuel evaporative emission standards for 1970 through 1977 model passenger cars and light-duty trucks. No change.]*

(b)(1) Evaporative emissions for 1978 and subsequent model gasoline-fueled, 1983 and subsequent model liquefied petroleum gas-fueled, and 1993 and subsequent model alcohol-fueled motor vehicles and hybrid electric vehicles subject to exhaust emission standards under this article, except petroleum-fueled diesel vehicles, compressed natural gas-fueled vehicles, hybrid electric vehicles that have sealed fuel systems which can be demonstrated to have no evaporative emissions, and motorcycles, shall not exceed the following standards:

(A) *[Evaporative emission standards for 1978 through 1994 model motor vehicles. No change.]*

(B) *[Evaporative emission standards on the three-day diurnal test for 1995 through 2005 model motor vehicles. No change.]*

(C) *[Evaporative emission standards on the supplemental two-day diurnal test for 1995 through 2005 model motor vehicles. No change.]*

(D) *[Zero-emission vehicle evaporative requirements. No change.]*

(E) For 2001 through 2014 model year vehicles, ~~T~~the optional zero-fuel evaporative emission standards for the three-day and two-day diurnal-plus-hot-soak tests are 0.35 grams per test for passenger cars, 0.50 grams per test for light-duty trucks 6,000 lbs. GVWR and under, and 0.75 grams per test for light-duty trucks from 6,001 to 8,500 lbs. GVWR, to account for vehicle non-fuel evaporative emissions (resulting from paints, upholstery, tires, and other vehicle sources). Vehicles demonstrating compliance with these evaporative emission standards shall also have zero (0.0) grams of fuel evaporative emissions per test for the three-day and two-day diurnal-plus-hot-soak tests. The “useful life” shall be 15 years or 150,000 miles, whichever occurs first. In lieu of demonstrating compliance with the zero (0.0) grams of fuel evaporative emissions per test over the three-day and two-day diurnal-plus-hot-soak tests, the manufacturer may submit for advance Executive Officer approval a test plan to demonstrate that the vehicle has zero (0.0) grams of fuel evaporative emissions throughout its useful life.

Additionally, in the case of a SULEV vehicle for which a manufacturer is seeking a partial ZEV credit, the manufacturer may prior to certification elect to have measured fuel evaporative emissions reduced by a specified value in all certification and in-use testing of the vehicle as long as measured mass exhaust emissions of NMOG for the vehicle are increased in all certification and in-use testing. The measured fuel evaporative emissions shall be reduced in increments of 0.1 gram per test, and the measured mass exhaust emissions of NMOG from the vehicle shall be increased by a gram per mile factor, to be determined by the Executive Officer, for every 0.1 gram per test by which the measured fuel evaporative emissions are reduced. For the purpose of this calculation, the evaporative emissions shall be measured, in grams per test, to a minimum of three significant figures.

(F) For the 2004 ~~and subsequent~~ through 2014 model motor vehicles identified below, tested in accordance with the test procedures described in Title 40, Code of Federal Regulations, sections 86.130-78 through 86.143-90 as they existed July 1, 1989 and as modified by the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" incorporated by reference in section 1976(c), the evaporative emission standards are:

Vehicle Type	*Hydrocarbon[1] Standards[2][3][4]*		
	Running Loss (grams per mile)	*Three Day Diurnal + Hot Soak (grams per test)*	*Two-Day Diurnal + Hot Soak (grams per test)*
Passenger cars	0.05	0.50	0.65
Light-duty trucks (under 8,501 lbs. GVWR)			
6,000 lbs. GVWR and under	0.05	0.65	0.85
6,001 - 8,500 lbs. GVWR	0.05	0.90	1.15
Medium-duty vehicles (8,501 - 14,000 lbs. GVWR)	0.05	1.00	1.25
Heavy-duty vehicles (over 14,000 lbs. GVWR)	0.05	1.00	1.25

[1] Organic Material Hydrocarbon Equivalent for alcohol-fueled vehicles.

[2] For all vehicles certified to these standards, the "useful life" shall be 15 years or 150,000 miles, whichever first occurs. Approval of vehicles which are not exhaust emission tested using a chassis dynamometer pursuant to section 1960.1 or 1961, title 13, California Code of Regulations shall be based on an engineering evaluation of the system and data submitted by the applicant.

[3] (a) These evaporative emission standards shall be phased-in beginning with the 2004 model year. Each manufacturer, except small volume manufacturers, shall certify at a minimum the specified percentage of its vehicle fleet to the evaporative emission standards in this table or

the optional zero-evaporative emission standards in section 1976(b)(1)(E) according to the schedule set forth below. For purposes of this paragraph (a), each manufacturer's vehicle fleet consists of the total projected California sales of the manufacturer's gasoline-fueled, liquefied petroleum-fueled and alcohol-fueled passenger cars, light-duty trucks, medium-duty vehicles, and heavy-duty vehicles.

Model Year	*Minimum Percentage of Vehicles Certified to the Standards in §§1976(b)(1)(F) and (b)(1)(E)*
2004	40
2005	80
2006 and subsequent	100

A small volume manufacturer shall certify 100 percent of its 2006 and subsequent model vehicle fleet to the evaporative emission standards in the table or the optional zero-evaporative emission standards in section 1976(b)(1)(E).

All 2004 through 2005 model-year motor vehicles which are not subject to these standards or the standards in section 1976(b)(1)(E) pursuant to the phase-in schedule shall comply with the requirements of sections 1976(b)(1)(B) and (C).

(b) A manufacturer may use an "Alternative or Equivalent Phase-in Schedule" to comply with the phase-in requirements. An "Alternative Phase-in" is one that achieves at least equivalent emission reductions by the end of the last model year of the scheduled phase-in. Model-year emission reductions shall be calculated by multiplying the percent of vehicles (based on the manufacturer's projected California sales volume of the applicable vehicle fleet) meeting the new requirements per model year by the number of model years implemented prior to and including the last model year of the scheduled phase-in. The "cumulative total" is the summation of the model-year emission reductions (e.g., the three model-year 40/80/100 percent phase-in schedule would be calculated as: (40%*3 years) + (80%*2 years) + (100%*1 year) =380). The required cumulative total for the phase-in of these standards is 380 emission reductions. Any alternative phase-in that results in an equal or larger cumulative total than the required cumulative total by the end of the last model year of the scheduled phase-in shall be considered acceptable by the Executive Officer only if all vehicles subject to the phase-in comply with the respective requirements in the last model year of the required phase-in schedule. A manufacturer shall be allowed to include vehicles introduced before the first model year of the scheduled phase-in (e.g., in the previous example, 10 percent introduced one year before the scheduled phase-in begins would be calculated as: (10%*4 years)=40) and added to the cumulative total.

(c) These evaporative emission standards do not apply to zero-emission vehicles.

[4] In-use compliance whole vehicle testing shall not begin until the motor vehicle is at least one year from the production date and has accumulated a minimum of 10,000 miles. For vehicles introduced prior to the 2007 model year, in-use compliance standards of 1.75 times the "Three-Day Diurnal + Hot-Soak" and "Two-Day Diurnal + Hot-Soak" gram per test standards shall apply for only the first three model years of an evaporative family certified to a new standard.

(G) For 2015 and subsequent model motor vehicles, the following evaporative emission requirements apply:

1. A manufacturer must certify all vehicles subject to this section to the emission standards specified in either Option 1 or Option 2 below.

a. *Option 1*. The evaporative emissions from 2015 and subsequent model motor vehicles, tested in accordance with the test procedure sequence described in the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles," incorporated by reference in section 1976(c), shall not exceed:

Vehicle Type	*Hydrocarbon[1] Emission Standards[2]*		
	Running Loss (grams per mile)	*Three-Day Diurnal + Hot Soak and Two-Day Diurnal + Hot Soak*	
		Whole Vehicle (grams per test)	*Fuel Only[3] (grams per test)*
Passenger cars	0.05	0.350	0.0
Light-duty trucks 6,000 lbs. GVWR and under	0.05	0.500	0.0
Light-duty trucks 6,001 - 8,500 lbs. GVWR	0.05	0.750	0.0
Medium-duty passenger vehicles	0.05	0.750	0.0
Medium-duty vehicles (8,501 - 14,000 lbs. GVWR);	0.05	0.750	0.0
Heavy-duty vehicles (over 14,000 lbs. GVWR)	0.05	0.750	0.0

1 Organic Material Hydrocarbon Equivalent for alcohol-fueled vehicles.

2 For all vehicles certified to these standards, the "useful life" shall be 15 years or 150,000 miles, whichever occurs first. Approval of vehicles that are not exhaust emission tested using a chassis dynamometer pursuant to section 1961, title 13, California Code of Regulations shall be based on an engineering evaluation of the system and data submitted by the applicant.

3 In lieu of demonstrating compliance with the fuel-only emission standard (0.0 grams per test) over the three-day and two-day diurnal plus hot soak tests, a manufacturer may, with advance Executive Officer approval, demonstrate compliance through an alternate test plan.

b. *Option 2*. The evaporative emissions from 2015 and subsequent model motor vehicles, tested in accordance with the test procedure sequence described in the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles," incorporated by reference in section 1976(c), shall not exceed:

Vehicle Type	*Hydrocarbon[1] Emission Standards[2]*		
	Running Loss (grams per mile)	*Highest Whole Vehicle Diurnal + Hot Soak[3][4][5] (grams per test)*	*Canister Bleed[6] (grams per test)*
Passenger cars; and Light-duty trucks 6,000 lbs. GVWR and under, and 0 - 3,750 lbs. LVW	0.05	0.300	0.020
Light-duty trucks 6,000 lbs. GVWR and under, and 3,751 – 5,750 lbs. LVW	0.05	0.400	0.020
Light-duty trucks 6,001 - 8,500 lbs. GVWR; and Medium-duty passenger vehicles	0.05	0.500	0.020
Medium-duty vehicles (8,501 - 14,000 lbs. GVWR); and Heavy-duty vehicles (over 14,000 lbs. GVWR)	0.05	0.600	0.030

1 Organic Material Hydrocarbon Equivalent for alcohol-fueled vehicles.

2 For vehicles certified to the running loss and the highest whole vehicle diurnal plus hot soak emission standards, the "useful life" shall be 15 years or 150,000 miles, whichever occurs first. Approval of vehicles that are not exhaust emission tested using a chassis dynamometer pursuant to section 1961, title 13, California Code of Regulations shall be based on an engineering evaluation of the system and data submitted by the applicant. The canister bleed emission standard does not have a useful life requirement.

3 The manufacturer shall determine compliance by selecting the highest whole vehicle diurnal plus hot soak emission value of the Three-Day Diurnal Plus Hot Soak Test and of the Two-Day Diurnal Plus Hot Soak Test.

4 *Fleet-Average Option for the Highest Whole Vehicle Diurnal Plus Hot Soak Emission Standard Within Each Emission Standard Category.* A manufacturer may optionally comply with the highest whole vehicle diurnal plus hot soak emission standards by using fleet-average hydrocarbon emission values. To participate, a manufacturer must utilize the fleet-average option for all of its emission standard categories and calculate a separate fleet-average hydrocarbon emission value for each emission standard category. The emission standard categories are as follows: (1) passenger cars and light-duty trucks 6,000 pounds GVWR and under, and 0 - 3,750 pounds LVW; (2) light-duty trucks 6,000 pounds GVWR and under, and 3,751 – 5,750 pounds LVW; (3) light-duty trucks 6,001 - 8,500 pounds GVWR and

medium-duty passenger vehicles; and (4) medium-duty and heavy-duty vehicles. The fleet-average hydrocarbon emission value for each emission standard category shall be calculated as follows:

$$\frac{\sum_{i=1}^{n} [(\text{number of vehicles in the evaporative family})_i \times (\text{family emission limit})_i]}{\sum_{i=1}^{n} (\text{number of vehicles in the evaporative family})_i}$$

where "n" = a manufacturer's total number of Option 2 certification evaporative families within an emission standard category for a given model year;

"number of vehicles in the evaporative family" = the number of vehicles produced and delivered for sale in California in the evaporative family;

"family emission limit" = the numerical value selected by the manufacturer for the evaporative family that serves as the emission standard for the evaporative family with respect to all testing, instead of the emission standard specified in this section 1976 (b)(1)(G)1.b. The family emission limit shall not exceed 0.500 grams per test for passenger cars; 0.650 grams per test for light duty trucks 6,000 pounds GVWR and under; 0.900 grams per test for light-duty trucks 6,001 - 8,500 pounds GVWR; and 1.000 grams for medium-duty passenger vehicles, medium-duty vehicles, and heavy-duty vehicles. In addition, the family emission limit shall be set in increments of 0.025 grams per test.

5 *Calculation of Hydrocarbon Credits or Debits for the Fleet-Average Option*.

(1) *Calculation of Hydrocarbon Credits or Debits*. For each emission standard category in the model year, a manufacturer shall calculate the hydrocarbon credits or debits, as follows:

[(Applicable Hydrocarbon Emission Standard for the Emission Standard Category) – (Manufacturer's Fleet-Average Hydrocarbon Emission Value for the Emission Standard Category)] X (Total Number of Affected Vehicles)

where "Total Number of Affected Vehicles" = the total number of vehicles in the evaporative families participating in the fleet-average option, which are produced and delivered for sale in California, for the emission standard category of the given model year.

A negative number constitutes hydrocarbon debits, and a positive number constitutes hydrocarbon credits accrued by the manufacturer for the given model year. Hydrocarbon credits earned in a given model year shall retain full value through the fifth model year after they are earned. At the beginning of the sixth model year, the hydrocarbon credits will have no value.

(2) *Procedure for Offsetting Hydrocarbon Debits*. A manufacturer shall offset hydrocarbon debits with hydrocarbon credits for each emission standard category within three model years after the debits have been incurred. If total hydrocarbon debits are not equalized within three model years after they have been incurred, the manufacturer shall be subject to the Health and Safety Code section 43211 civil penalties applicable to a manufacturer which 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 hydrocarbon debits are not equalized 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 emission

standards shall be determined by dividing the total amount of hydrocarbon debits for the model year in the emission standard category by the applicable hydrocarbon emission standard for the model year in which the debits were first incurred.

Additionally, to equalize the hydrocarbon debits that remain at the end of the three model year offset period: (1) hydrocarbon credits may be exchanged between passenger cars and light-duty trucks 6,000 pounds GVWR and under and 0-3,750 pounds LVW, and light-duty trucks 6,000 pounds GVWR and under and 3,751-5,750 pounds LVW and (2) hydrocarbon credits may be exchanged between light-duty trucks 6,001-8,500 pounds GVWR and medium-duty passenger vehicles, and medium-duty vehicles and heavy-duty vehicles.

6 *Vehicle Canister Bleed Emission*. Compliance with the canister bleed emission standard shall be determined based on the Bleed Emission Test Procedure described in the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles," incorporated by reference in section 1976(c), and demonstrated on a stabilized canister system. Vehicles with a non-integrated refueling canister-only system are exempt from the canister bleed emission standard.

2. *Phase-In Schedule*. For each model year, a manufacturer shall certify, at a minimum, the specified percentage of its vehicle fleet to the evaporative emission standards set forth in section 1976(b)(1)(G)1.a. or section 1976(b)(1)(G)1.b., according to the schedule set forth below. For the purpose of this section 1976(b)(1)(G)2., the manufacturer's vehicle fleet consists of the vehicles produced and delivered for sale by the manufacturer in California that are subject to the emission standards in section 1976(b)(1)(G)1. All 2015 through 2022 model motor vehicles that are not subject to these standards pursuant to the phase-in schedule shall comply with the requirements for 2004 through 2014 model motor vehicles, as described in section 1976(b)(1)(F).

Model Years	*Minimum Percentage of Vehicle Fleet* [(1)(2)]
2015, 2016, and 2017	Average of vehicles certified to section 1976(b)(1)(E) in model years 2012, 2013, and 2014[(3)(4)]
2018 and 2019	60
2020 and 2021	80
2022 and subsequent	100

1 For the 2018 through 2022 model years only, a manufacturer may use an alternate phase-in schedule to comply with the phase-in requirements. An alternate phase-in schedule must achieve equivalent compliance volume by the end of the last model year of the scheduled phase-in (2022). The compliance volume is the number calculated by multiplying the percent of vehicles (based on the manufacturer's projected sales volume of all vehicles) meeting the new requirements in each model year by the number of years implemented prior to and including the last model year of the scheduled phase-in, then summing these yearly results to determine a cumulative total. The cumulative total of the five year (60/60/80/80/100) scheduled phase-in set forth above is calculated as follows: (60*5 years) + (60*4 years) +

(80*3 years) + (80*2 years) + (100*1 year) = 1040. Accordingly, the required cumulative total for any alternate phase-in schedule of these emission standards is 1040. The Executive Officer shall consider acceptable any alternate phase-in schedule that results in an equal or larger cumulative total by the end of the last model year of the scheduled phase-in (2022).

[2] Small volume manufacturers are not required to comply with the phase-in schedule set forth in this table. Instead, they shall certify 100 percent of their 2022 and subsequent model year vehicle fleet to the evaporative emission standards set forth in section 1976(b)(1)(G)1.a. or section 1976(b)(1)(G)1.b.

[3] The percentage of vehicle fleet averaged across the 2015, 2016, and 2017 model years shall be used to determine compliance with this requirement.

[4] The minimum percentage required in the 2015, 2016, and 2017 model years is determined by averaging the percentage of vehicles certified to the emission standards in section 1976(b)(1)(E) in each of the manufacturer's 2012, 2013, and 2014 model year vehicle fleets. For the purpose of calculating this average, a manufacturer shall use the percentage of vehicles produced and delivered for sale in California for the 2012, 2013, and 2014 model years. A manufacturer may calculate this average percentage using the projected sales for these model years in lieu of actual sales.

3. *Carry-Over of 2014 Model-Year Evaporative Families Certified to the Zero-Fuel Evaporative Emission Standards*. A manufacturer may carry over 2014 model motor vehicles certified to the zero-fuel (0.0 grams per test) evaporative emission standards set forth in section 1976(b)(1)(E) through the 2018 model year and be considered compliant with the requirements of section 1976(b)(1)(G)1. If the manufacturer chooses to participate in the fleet-average option for the highest whole vehicle diurnal plus hot soak emission standard, the following family emission limits are assigned to these evaporative families for the calculation of the manufacturer's fleet-average hydrocarbon emission value.

Vehicle Type	*Highest Whole Vehicle Diurnal + Hot Soak (grams per test)*
Passenger cars	0.300
Light-duty trucks 6,000 lbs. GVWR and under, and 0 - 3,750 lbs. LVW	0.300
Light-duty trucks 6,000 lbs. GVWR and under, and 3,751 – 5,750 lbs. LVW	0.400
Light-duty trucks 6,001 - 8,500 lbs. GVWR	0.500

4. *Pooling Provision*. The following pooling provision applies to the fleet-average option for the Highest Whole Vehicle Diurnal Plus Hot Soak Emission Standard in section 1976(b)(1)(G)1.b. and to the phase-in requirements in section 1976(b)(1)(G)2.

a. For the fleet-average option set forth in section 1976(b)(1)(G)1.b., a manufacturer must demonstrate compliance, for each model year, based on one of two options applicable throughout the model year, either:

Pooling Option 1: the total number of passenger cars, light-duty trucks, medium-duty passenger vehicles, medium-duty vehicles, and heavy-duty vehicles that are certified to the California evaporative emission standards in section 1976(b)(1)(G)1.b., and are produced and delivered for sale in California; or

Pooling Option 2: the total number of passenger cars, light-duty trucks, medium-duty passenger vehicles, medium-duty vehicles, and heavy-duty vehicles that are certified to the California evaporative emission standards in section 1976(b)(1)(G)1.b., and are produced and delivered for sale in California, the District of Columbia, and all states that have adopted California's evaporative emission standards set forth in section 1976(b)(1)(G)1. for that model year pursuant to section 177 of the federal Clean Air Act (42 U.S.C. § 7507).

b. For the phase-in requirements in section 1976(b)(1)(G)2., a manufacturer must demonstrate compliance, for each model year, based on one of two options applicable throughout the model year, either:

Pooling Option 1: the total number of passenger cars, light-duty trucks, medium-duty passenger vehicles, medium-duty vehicles, and heavy-duty vehicles that are certified to the California evaporative emission standards in section 1976(b)(1)(G)1., and are produced and delivered for sale in California; or

Pooling Option 2: the total number of passenger cars, light-duty trucks, medium-duty passenger vehicles, medium-duty vehicles, and heavy-duty vehicles that are certified to the California evaporative emission standards in section 1976(b)(1)(G)1., and are produced and delivered for sale in California, the District of Columbia, and all states that have adopted California's evaporative emission standards set forth in section 1976(b)(1)(G)1. for that model year pursuant to section 177 of the federal Clean Air Act (42 U.S.C. § 7507).

c. A manufacturer that selects Pooling Option 2 must notify the Executive Officer of that selection in writing before the start of the applicable model year or must comply with Pooling Option 1. Once a manufacturer has selected compliance Option 2, that selection applies unless the manufacturer selects Option 1 and notifies the Executive Officer of that selection in writing before the start of the applicable model year.

d. When a manufacturer is demonstrating compliance using Pooling Option 2 for a given model year, the term "in California" as used in section 1976(b)(1)(G) means California, the District of Columbia, and all states that have adopted California's evaporative emission standards for that model year pursuant to Section 177 of the federal Clean Air Act (42 U.S.C. § 7507).

e. A manufacturer that selects Pooling Option 2 must provide to the Executive Officer separate values for the number of vehicles in each evaporative family produced and delivered for sale in the District of Columbia and for each individual state within the average.

5. Optional Certification for 2014 Model Motor Vehicles. A manufacturer may optionally certify its 2014 model motor vehicles to the evaporative emission standards set forth in section 1976(b)(1)(G)1.

(b)(2) *[Evaporative emission standards for gasoline-fueled motorcycles. No change.]*

(c) The test procedures for determining compliance with the standards in subsection (b) above applicable to 1978 through 2000 model year vehicles are set forth in "California Evaporative Emission Standards and Test Procedures for 1978-2000 Model Motor Vehicles," adopted by the state board on April 16, 1975, as last amended August 5, 1999, which is incorporated herein by reference. The test procedures for determining compliance with standards applicable to 2001 and subsequent model year vehicles are set forth in the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles," adopted by the state board on August 5, 1999, and as last amended ~~September 27, 2010~~ [INSERT DATE OF AMENDMENT], which is incorporated herein by reference.

(d) *[Motorcycle requirements. No change.]*

(e) *[Motorcycle requirements. No change.]*

(f) *Definitions Specific to this Section.*

(1) and (2) *[No change].*

As Amended: March 22, 2012
Date of Hearing: January 26-27, 2012

(3) “Non-integrated refueling emission control system” is defined in 40 Code of Federal Regulations §86.1803-01.

(4) “Non-integrated refueling canister-only system” means a subclass of a non-integrated refueling emission control system, where other non-refueling related evaporative emissions from the vehicle are stored in the fuel tank, instead of in a vapor storage unit(s).

Note: Authority cited: Sections 39500, 39600, 39601, 39667, 43013, 43018, 43101, 43104, 43105, 43106 and 43107, Health and Safety Code. Reference: Sections 39002, 39003, 39500, 39667, 43000, 43009.5, 43013, 43018, 43100, 43101, 43101.5, 43102, 43104, 43105, 43106, 43107, 43204 and 43205 Health and Safety Code.

12. Amend title 13, CCR, section 1978 to read as follows:

§1978. Standards and Test Procedures for Vehicle Refueling Emissions.

(a)(1) Vehicle refueling emissions for 1998 and subsequent model gasoline-fueled, alcohol-fueled, diesel-fueled, liquefied petroleum gas-fueled, fuel-flexible, and hybrid electric passenger cars, light-duty trucks, and medium-duty vehicles with a gross vehicle weight rating less than 8501 pounds, ~~shall not exceed the following standards.~~ and 2015 and subsequent model gasoline-fueled, alcohol-fueled, diesel-fueled, liquefied petroleum gas-fueled, fuel-flexible, and hybrid electric medium-duty vehicles with a gross vehicle weight rating between 8,501 and 14,000 pounds, shall not exceed the following standards. Natural gas-fueled vehicles are exempt from meeting these refueling standards, but the refueling receptacles on natural gas-fueled vehicles must comply with the receptacle provisions of the American National Standards Institute/American Gas Association Standard for Compressed Natural Gas Vehicle Fueling Connection Devices, ANSI/AGA NGV1 standard-1994, which is incorporated herein by reference. The standards apply equally to certification and in-use vehicles.

Hydrocarbons (for gasoline-fueled, diesel-fueled, and hybrid electric vehicles): 0.20 grams per gallon of fuel dispensed.

Organic Material Hydrocarbon Equivalent (for alcohol-fueled, fuel-flexible, and hybrid electric vehicles): 0.20 grams per gallon of fuel dispensed.

Hydrocarbons (for liquefied petroleum gas-fueled vehicles): 0.15 gram per gallon of fuel dispensed.

(2) Vehicles powered by diesel fuel are not required to conduct testing to demonstrate compliance with the refueling emission standards set forth above, provided that all of the following provisions are met:

(A) The manufacturer can attest to the following evaluation: “Due to the low vapor pressure of diesel fuel and the vehicle tank temperatures, hydrocarbon vapor concentrations are low and the vehicle meets the 0.20 grams/gallon refueling emission standard without a control system.”

(B) The certification requirement described in paragraph (A) is provided in writing and applies for the full useful life of the vehicle, as defined in section 2112.

In addition to the above provisions, the ARB reserves the authority to require testing to enforce compliance and to prevent noncompliance with the refueling emission standard.

Vehicles certified to the refueling emission standard under this provision shall not be counted in the phase-in sales percentage compliance determinations.

(3) Through model year 2014, the~~The~~ manufacturer shall adhere to the following phase-in schedule, as determined by projected vehicle sales throughout the United States, with the exception of small volume manufacturers.

	ORVR Model Year Phase-In Schedule		
Class of Vehicle	*40% Fleet*	*80% Fleet*	*100% Fleet*
Passenger Cars	1998	1999	2000
Light-Duty Trucks 0-6,000 lbs. GVWR	2001	2002	2003
Light-Duty Trucks/ Medium-Duty Vehicles (6,001-8,500 lbs. GVWR)	2004	2005	2006

(A) Prior to the 2001 model year, small volume manufacturers are defined for purposes of this section as any vehicle manufacturer with California actual sales less than or equal to 3000 new vehicles per model year based on the average number of vehicles sold by the manufacturer in the previous three consecutive years.

(B) Small volume manufacturers of passenger cars, as defined in subsection (a)(3)(A), are exempt from the implementation schedule in subsection (a)(3) for model year 1998 and 1999. For small volume manufacturers of passenger cars, the standards of subsection (a)(1), and the associated test procedures, shall not apply until model year 2000, when 100 percent compliance with the standards of this section is required. Small volume manufacturers of light-duty trucks and medium-duty vehicles are not exempt from the implementation schedule in subsection (a)(3).

(4) Beginning with model year 2015, all vehicles subject to the refueling emission standards in section 1978(a)(1) shall demonstrate compliance except incomplete vehicles of 14,000 pounds gross vehicle weight rating or less that are certified as incomplete vehicles for the purposes of evaporative emissions testing as set forth in the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles," incorporated by reference in section 1976.

(5) *Carry-Over of 2014 Model Year Families:* 2014 model year motor vehicles certified to the refueling emission standards of section 1978(a)(1) may carry over to the 2015 through 2018 model years and be considered compliant.

(b) The test procedures for determining compliance with standards applicable to 1998 through 2000 gasoline, alcohol, diesel, and hybrid electric passenger cars, light-duty trucks, and medium-duty vehicles are set forth in the "California Refueling Emission Standards and Test Procedures for 1998-2000 Model Year Motor Vehicles," as amended August 5, 1999, which is incorporated herein by reference. The test procedures for determining compliance with standards applicable to 2001 and subsequent gasoline, alcohol, diesel, and hybrid electric passenger cars, light-duty trucks, and medium-duty vehicles are set forth in the "California Refueling Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles," adopted August 5, 1999, and last amended ~~September 27, 2010~~ ~~]~~[insert date of amendment for this rulemaking], which is incorporated herein by reference.

NOTE: Authority cited: Sections 39500, 39600, 39601, 39667, 43013, 43018, 43101, 43104, 43105, and 43106, Health and Safety Code. Reference: Sections 39002, 39003, 39500, 39667, 43000, 43009.5, 43013, 43018, 43100, 43101, 43101.5, 43102, 43104, 43105, 43106, 43204 and 43205, Health and Safety Code.

13. Amend title 13, CCR, section 2037 to read as follows:

§2037. Defects Warranty Requirements for 1990 and Subsequent Model Passenger Cars, Light-Duty Trucks, Medium-Duty Vehicles, and Motor Vehicle Engines Used in Such Vehicles.

* * * *

(g) Prior to the 2001 model year, each manufacturer shall submit the documents required by sections (c)(5), (e), and (f) with the manufacturer's preliminary application for new vehicle or engine certification for approval by the Executive Officer. For 2001 and subsequent model years, each manufacturer shall submit the documents required by section (c)(5), (e), and (f) with the Part 2 Application for Certification pursuant to the "California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and ~~for~~ 2009 through 2016 ~~and Subsequent~~ Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles," incorporated by reference in title 13, CCR section 1961(d), or the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles," incorporated by reference in title 13, CCR section 1961.2(d), as applicable. The Executive Officer may reject or require modification of any of the documents required by sections (c), (e), and (f) for, among other reasons, incompleteness and lack of clarity. Approval by the Executive Officer of the documents required by sections (c), (e), and (f) shall be a condition of certification. The Executive Officer shall approve or disapprove the documents required by sections (c), (e), and (f) within 90 days of the date such documents are received from the manufacturer. Any disapproval shall be accompanied by a statement of the reasons thereof. In the event of disapproval, the manufacturer may petition the Board to review the decision of the Executive Officer.

* * * *

NOTE: Authority cited: Sections 39600 and 39601, Health and Safety Code. Reference: Sections 43106, 43204, 43205, 44004, 44010, 44011, 44012, 44015, and 44017, Health and Safety Code.

14. Amend title 13, CCR, section 2038, to read as follows:

§2038. Performance Warranty Requirements for 1990 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles, and Motor Vehicle Engines Used in Such Vehicles

* * * *

(c) *Written Instructions.*

* * * *

(3) For 2001 and subsequent model years, each vehicle or engine manufacturer shall submit the documents required by section (c)(1) with the Part 2 Application for Certification pursuant to the “California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and ~~for~~ 2009 through 2016 ~~and Subsequent~~ Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles,” incorporated by reference in title 13, CCR section 1961(d), or the “California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles,” incorporated by reference in title 13, CCR section 1961.2(d), as applicable.

* * * *

NOTE: Authority cited: Sections 39600 and 39601, Health and Safety Code. Reference: Sections 43106, 43204, 43205, 44004, 44010, 44011, 44012, 44014, and 44015, Health and Safety Code.

15. Amend title 13, CCR, section 2062 to read as follows:

§2062. Assembly-Line Test Procedures - 1998 and Subsequent Model Years.

New 1998 through 2000 model-year passenger cars, light-duty trucks, and medium-duty vehicles, subject to certification and manufactured for sale in California, except for zero-emission vehicles and medium-duty vehicles certified according to the optional standards and test procedures of Section 1956.8, Title 13, California Code of Regulations, shall be tested in accordance with the "California Assembly-Line Test Procedures for 1998 through 2000 Model-Year Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles," adopted June 24, 1996, as last amended August 5, 1999, which is incorporated herein by reference. New 2001 and subsequent model-year passenger cars, light-duty trucks, and medium-duty vehicles, subject to certification and manufactured for sale in California, except for zero-emission vehicles and medium-duty vehicles certified according to the optional standards and test procedures of Section 1956.8, Title 13, California Code of Regulations, shall be tested in accordance with the "California Assembly-Line Test Procedures for 2001 and Subsequent Model-Year Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles." adopted August 5, 1999, which is incorporated herein by reference. These test procedures shall also apply to federally certified light-duty motor vehicles, except as provided in "Guidelines for Certification of 1983 ~~and Subsequent~~ Through 2002 Model-Year Federally Certified Light-Duty Motor Vehicles for Sale in California," adopted July 20, 1982, as last amended ~~July 12, 1991~~ July 30, 2002, and the "Guidelines for Certification of 2003 and Subsequent Model-Year Federally Certified Light-Duty Motor Vehicles for Sale in California," adopted July 30, 2002, which ~~is~~ are incorporated herein by reference.

NOTE: Authority cited: Sections 39515, 39600, 39601, 43013, 43018, 43101, 43104 and 43210, Health and Safety Code. Reference: Sections 39002, 39003, 39500, 43000, 43013, 43018, 43100, 43101, 43101.5, 43102, 43104, 43105, 43106, 43204, 43210, 43211, and 43212, Health and Safety Code.

16. Amend Title 13, CCR, section 2112 to read as follows:

§2112. Definitions.

* * * *

(b) “Correlation factor” means a pollutant-specific multiplicative factor calculated by a manufacturer for an engine family or test group which establishes a relationship between chassis exhaust emission data, as determined from the test procedures specified in section 1960.1, ~~or~~ 1961, or 1961.2, Title 13, California Code of Regulations, and engine exhaust emission data, as determined from the test procedures specified in section 1956.8, Title 13, California Code of Regulations.

* * * *

(l)(9) For 2001 ~~and subsequent~~ through 2019 model year medium-duty low-emission, ultra-low-emission and super-ultra-low-emission vehicles certified to the primary standards in section 1961(a)(1), and motor vehicle engines used in such vehicles, a period of use of ten years or 120,000 miles, whichever occurs first. For 2001 ~~and subsequent~~ through 2019 medium-duty low-emission, ultra-low-emission and super-ultra-low-emission vehicles certified to the optional 150,000 mile standards in section 1961(a)(1), and motor vehicle engines used in such vehicles, a period of use of fifteen years or 150,000 miles, whichever occurs first. For all other 1995 and subsequent model-year medium-duty vehicles, and motor vehicle engines used in such vehicles, and 1992 through 1994 model-year medium-duty low-emission, and ultra-low-emission vehicles certified to the standards in Section 1960.1(h)(2), and motor vehicle engines used in such vehicles, a period of use of eleven years or 120,000 miles, whichever occurs first.

* * * *

(l)(18) For those passenger cars, light-duty trucks, and medium-duty vehicles certified to the standards in section 1961.2 or 1961.3, the useful life shall be fifteen years or 150,000 miles, whichever occurs first.

[renumber subsections (l)(18) through (l)(23) as (l)(19) through (l)(24)]

* * * *

NOTE: Authority cited: Sections 39600, 39601, 43013, 43018, 43101, 43104, 43105, and 43806, Health and Safety Code; and Section 28114, Vehicle Code. Reference: Sections 39002, 39003, 39500, 43000, 43009.5, 43013, 43018, 43100, 43101, 43101.5, 43102, 43104, 43105, 43106, 43107, 43202, 43204-43205.5, 43206, 43210, 43211, 43212, 43213, and 43806, Health and Safety Code; and Section 28114, Vehicle Code.

17. Amend title 13, CCR, section 2139 to read as follows:

§2139. Testing.

After the vehicles have been accepted and restorative maintenance, if any, has been performed, the ARB or its designated laboratory shall perform the applicable emission tests pursuant to the following:

(a) For passenger cars and light-duty trucks, in-use compliance emission tests shall be performed pursuant to section 1960.1, ~~or~~ 1961, 1961.2, or 1961.3, Title 13, California Code of Regulations, as applicable.

(b) For medium-duty vehicles certified according to the chassis standards and test procedures specified in section 1960.1, ~~or~~ 1961, 1961.2, or 1961.3, Title 13, California Code of Regulations and the documents incorporated by reference therein, in-use compliance emission tests shall be performed pursuant to section 1960.1, ~~or~~ 1961, 1961.2, or 1961.3, Title 13, California Code of Regulations, as applicable.

(c) For medium-duty engines and vehicles certified according to the optional engine test procedures specified in section 1956.8, Title 13, California Code of Regulations and the documents incorporated by reference therein, in-use compliance emission tests shall be performed pursuant to one of the following procedures:

* * * *

(2) Medium-duty vehicles may be tested according to the chassis test procedures specified in section 1960.1(k), ~~or~~ 1961, or 1961.2, as applicable, if a manufacturer develops correlation factors which establish the relationship between engine and chassis testing for each engine family or test group and submits these correlation factors within one year after the beginning of production. The correlation factors shall be applied to the measured in-use engine exhaust emission data to determine the in-use engine exhaust emission levels. All correlation factors and supporting data included in a manufacturer's application must be submitted to and approved by the Executive Officer in advance of their use by a manufacturer. Correlation factors intended to apply to a specific engine family or test group shall be applicable for each vehicle model incorporating that specific engine. Manufacturers shall submit test data demonstrating the applicability of the correlation factors for vehicle models comprising a minimum of 80 percent of their engine sales for that specific engine family or test group. The correlation factors for the remaining fleet may be determined through an engineering evaluation based upon a comparison with similar vehicle models. The Executive Officer shall approve a submitted correlation factor if it accurately corresponds to other established empirical and

theoretical correlation factors and to emission test data available to the Executive Officer.

A manufacturer may choose to use the results from the chassis in-use testing as a screening test. If an engine family or test group does not demonstrate compliance with any of the applicable in-use engine standards, as determined from the chassis test data and the applied correlation factors, the manufacturer shall be subject to the requirements and cost of in-use compliance engine testing, as specified in section 2139(c)(1). The manufacturer shall be subject to engine testing for any non-complying engine family or test group for each subsequent year until compliance with the engine emission standards is demonstrated.

Subsequent to approval of the correlation factors, the Executive Officer may make a determination that the original correlation factors are not valid. Such a determination may be based upon in-use emission data, including chassis and engine testing. Upon determination that the correlation factors for a specific engine family or test group are not valid, the manufacturer of the engine family or test group shall be subject to the enforcement testing requirements and costs of in-use compliance engine testing, as specified in section 2139(c)(1).

* * * *

NOTE: Authority cited: Sections 39600, 39601, 43013, 43018, 43101, 43104 and 43105, Health and Safety Code. Reference: Sections 39002, 39003, 43000, 43009.5, 43013, 43018, 43100, 43101, 43101.5, 43102, 43103, 43104, 43105, 43106, 43107, 43204-43205.5, and 43211-43213 Health and Safety Code.

18. Amend title 13, CCR, section 2140 to read as follows:

§2140. Notification and Use of Test Results.

* * * *

(b) If the results of the in-use vehicle emission tests conducted pursuant to Section 2139 indicate that the average emissions of the test vehicles for any pollutant exceed the applicable emission standards specified in Title 13, California Code of Regulations, Section 1960.1, 1961, <u>1961.2,</u> <u>1961.3,</u> 1956.8, 1958, 2412, 2423, or 2442, the entire vehicle population so represented shall be deemed to exceed such standards. The Executive Officer shall notify the manufacturer of the test results and upon receipt of the notification, the manufacturer shall have 45 days to submit an influenced recall plan in accordance with Sections 2113 through 2121, Title 13, California Code of Regulations. If no such recall plan is submitted, the Executive Officer may order corrective action including recall of the affected vehicles in accordance with Sections 2122 through 2135, Title 13, California Code of Regulations.

NOTE: Authority cited: Sections 39600, 39601, 43013, 43018 and 43105, Health and Safety Code. Reference: Sections 43000, 43009.5, 43013, 43018, 43101, 43104, 43105, 43106, 43107, 43204-43205.5 and 43211-43213, Health and Safety Code.

19. Amend title 13, CCR, section 2145 to read as follows:

§2145. Field Information Report.

* * * *

(b) All field information reports shall be submitted to the Chief, Mobile Source Operations Division, 9528 Telstar Avenue, El Monte, CA 91731, and shall contain the following information in substantially the format outlined below:

* * * *

(3) A description of each class or category of California-certified vehicles or engines affected including make, model, model-year, engine family or test group and such other information as may be required to identify the vehicles or engines affected. The description shall include those engine families or test groups related to the affected engine family or test group through common certification test data allowed under ~~Title 40, Code of Federal Regulations, Section 86.085-24(f), as amended December 10, 1984 or~~ Title 40 Code of Federal Regulations, Section 86.1839-01, as ~~adopted May 4, 1999~~ amended January 17, 2006 (“carry-over” and “carry-across” engine families or test groups).

* * * *

NOTE: Authority cited: Sections 39600, 39601 and 43105, Health and Safety Code. Reference: Sections 43000, 43009.5, 43018, 43101, 43104, 43105, 43106, 43107 and 43204-43205.5, Health and Safety Code.

20. Amend title 13, CCR, section 2147 to read as follows:

§2147. Demonstration of Compliance with Emission Standards.

* * * *

(b) A manufacturer may test properly maintained in-use vehicles with the failed emission-related component pursuant to the applicable certification emission tests specified in Title 13, California Code of Regulations, Section 1960.1, ~~or~~ 1961, 1961.2, or 1961.3, as applicable, for passenger cars, light-duty trucks, and medium-duty vehicles, Section 1956.8 for heavy-duty engines and vehicles, Section 1958 for motorcycles, and Section 2442 for sterndrive/inboard marine engines. The emissions shall be projected to the end of the vehicle's or engine's useful life using in-use deterioration factors. The in-use deterioration factors shall be chosen by the manufacturer from among the following:

* * * *

(3) subject to approval by the Executive Officer, a manufacturer-generated deterioration factor. The Executive Officer shall approve such deterioration factor if it is based on in-use data generated from certification emission tests performed on properly maintained and used vehicles in accordance with the procedures set forth in Section 1960.1, ~~or~~ 1961, or 1961.2, of Title 13 of the California Code of Regulations, as applicable, for passenger cars, light-duty trucks, and medium-duty vehicles; Section 1956.8 of Title 13 of the California Code of Regulations for heavy duty vehicles and engines; and Section 1958 of Title 13 of the California Code of Regulations for motorcycles, and if the vehicles from which it was derived are representative of the in-use fleet with regard to emissions performance and are equipped with similar emission control technology as vehicles with the failed component.

* * * *

NOTE: Authority cited: Sections 39600, 39601 and 43105, Health and Safety Code. Reference: Sections 43000, 43009.5, 43018, 43101, 43104, 43105, 43106, 43107 and 43204-43205.5, Health and Safety Code.

21. Amend title 13, CCR, section 2235 to read as follows:

§ 2235. Requirements.

New 1977 ~~and subsequent~~ through 2014 model-year gasoline-fueled motor vehicles and 1993 ~~and subsequent~~ through 2014 model-year methanol-fueled passenger cars, light-duty trucks, medium-duty vehicles and heavy-duty vehicles shall not be sold, offered for sale or registered in California unless such vehicles comply with the Air Resources Board's "Specifications for Fill Pipes and Openings of 1977 through 2014 Model Motor Vehicle Fuel Tanks," dated March 19, 1976 as last amended ~~January 22, 1990~~ [INSERT DATE OF AMENDMENT] or, in the case of motorcycles, are exempted pursuant to Chapter 1, Article 2, Section 1976(b). New 2015 and subsequent model-year gasoline and alcohol fueled passenger cars, light trucks, medium-duty vehicles, and heavy-duty vehicles shall not be sold, offered for sale, or registered in California unless such vehicles comply with the "Specifications for Fill Pipes and Openings of 2015 and Subsequent Model Motor Vehicle Fuel Tanks," dated [INSERT DATE OF ADOPTION]. Motorcycles are exempted pursuant to Chapter 1, Article 2, Section 1976(b).

NOTE: Authority cited: Sections 39600, 39601, 43013, 43018, 43101, 43104, 43107, and 43835, Health and Safety Code. Reference: Sections 39003, 43000, 43013, 43018, 43101, 43104, 43106, 43204, and 43835, Health and Safety Code; and Sections 28111 and 28112, Vehicle Code.

22. Amend title 13, CCR, section 2317 to read as follows:

§ 2317. Satisfaction of Designated Clean Fuels Requirements with a Substitute Fuel.

(a) Any person may petition the state board to designate by regulation a substitute fuel which may be used instead of a primary designated clean fuel to satisfy any requirements in this chapter pertaining to a designated clean fuel. The state board shall designate such a substitute fuel if it is satisfied that the petitioner has demonstrated all of the following:

(1) That use of the fuel in low-emission vehicles certified on the primary designated clean fuel will result in emissions of NMOG (on a reactivity-adjusted basis), NOx, and CO no greater than the corresponding emissions from such vehicles fueled with the primary designated clean fuel, as determined pursuant to the procedures set forth in the "California Test Procedure for Evaluating Substitute Fuels and New Clean Fuels through 2014," as ~~adopted November 2, 1993~~ amended [INSERT DATE OF AMENDMENT] or the "California Test Procedure for Evaluating Substitute Fuels and New Clean Fuels in 2015 and Subsequent Years," as adopted [INSET DATE OF AMENDMENT], as applicable, which ~~is~~ are incorporated herein by reference.

(2) That use of the fuel in low-emission vehicles certified on the primary designated clean fuel will result in potential health risks from exposure to benzene, 1,3-butadiene, formaldehyde, and acetadehyde in the aggregate no greater than the corresponding potential health risks for such vehicles fueled with the primary designated clean fuel, as determined pursuant to the procedures set forth in the "California Test Procedure for Evaluating Substitute Fuels and New Clean Fuels through 2014" or the "California Test Procedure for Evaluating Substitute Fuels and New Clean Fuels in 2015 and Subsequent Years," as applicable. ~~," as adopted November 2, 1993,~~ which ~~is~~ are incorporated herein by reference.

(3) That if the proposed substitute fuel may be used to fuel any motor vehicle other than low-emission vehicles certified on the primary designated clean fuel:

(A) Use of the substitute fuel in such other motor vehicles would not increase emissions of NMOG (on a reactivity-adjusted basis), NOx, and CO as determined pursuant to the procedures set forth in the "California Test Procedure for Evaluating ~~the Emission Impacts of~~ Substitute Fuels ~~or~~ and New Clean Fuels through 2014" or the "California Test Procedure for Evaluating Substitute Fuels and New Clean Fuels in 2015 and Subsequent Years," as applicable,~~" as adopted November 2, 1993,~~ which ~~is~~ are incorporated herein by reference; and

(B) Use of the substitute fuel in such other motor vehicles would result in potential health risks from exposure to benzene, 1,3-butadiene, formaldehyde, and acetadehyde in the aggregate no greater than the corresponding potential health risk from the emissions from such vehicles when operating on their customary fuel, as determined pursuant to the procedures set forth in the “California Test Procedure for Evaluating ~~the Emission Impacts of~~ Substitute Fuels ~~or~~ and New Clean Fuels through 2014” or the “California Test Procedure for Evaluating Substitute Fuels and New Clean Fuels in 2015 and Subsequent Years,” as applicable,~~” as adopted November 2, 1993,~~ which ~~is~~ are incorporated herein by reference; and

(C) Use of the substitute fuel in such other motor vehicles would not result in increased deterioration of the emission control system on the vehicle and would not void the warranties of any such vehicles.

*   *   *   *

NOTE: Authority cited: Sections 39600, 39601, 39667, 43013, 43018 and 43101, Health and Safety Code; and Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District , 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975). Reference: Sections 39000, 39001, 39002, 39003, 39500, 39515, 39516, 39667, 43000, 43013, 43018 and 43101, Health and Safety Code; and Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District , 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975).

ATTACHMENT A-10

State of California
AIR RESOURCES BOARD

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

Adopted:	December 12, 2002
Amended:	July 24, 2003
Amended:	September 1, 2006
Amended:	July 26, 2007
Amended:	October 17, 2007
Amended:	October 14, 2008
Amended:	September 27, 2010
Amended:	October 12, 2011
Amended:	March 22, 2012

Note: The proposed amendments to this document are shown in underline to indicate additions and ~~strikeout~~ to indicate deletions compared to the test procedures as last amended September 27, 2010. [No change] indicates proposed federal provisions that are also proposed for incorporation herein without change. Existing intervening text that is not amended in this rulemaking is indicated by "* * * *".

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

The following provisions of Subparts A, I, N, S, and T, Part 86, and of Subparts A through K, Part 1065, Title 40, Code of Federal Regulations, as adopted or amended by the U.S. Environmental Protection Agency on the date set forth next to the applicable section listed below, and only to the extent they pertain to the testing and compliance of exhaust emissions from heavy-duty diesel engines and vehicles, are adopted and incorporated herein by this reference as the "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel Engines and Vehicles," except as altered or replaced by the provisions set forth below.

PART 86 – CONTROL OF EMISSIONS FROM NEW AND IN-USE HIGHWAY VEHICLES AND ENGINES

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

* * * *

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

* * * *

2. Definitions. [§86.xxx-2]

A. Federal Provisions.

1. **§86.004-2** January 18, 2001. [All federal definitions apply, except as otherwise noted below. Definitions specific to other requirements are contained in separate documents.]

<u>2. **§86.010-2** April 30, 2010. [All federal definitions apply, except as otherwise noted below. Definitions specific to other requirements are contained in separate documents.]</u>

* * * *

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

* * * *

B. California provisions.

* * * *

5. **Standards for Medium-Duty Engines.**

5.1 **Requirements Specific to Heavy-Duty Engines Used in Medium-Duty Vehicles 8,501 to 10,000 pounds GVW.** For the 2004 through 2019 model years, a~~A~~ manufacturer of heavy-duty engines used in medium-duty vehicles 8,501 to 10,000 pounds GVW may choose to comply with the following standards as an alternative to the primary emission standards and test procedures specified in title 13, CCR, §1961 or §1961.2, as applicable. A manufacturer that chooses to comply with these optional heavy-duty standards and test procedures shall specify, in the application for certification, an in-use compliance test procedure, as provided in title 13, CCR, §2139(c). For the 2020 and subsequent model years, a manufacturer of heavy-duty engines used in medium-duty vehicles 8,501 to 10,000 pounds GVW must comply with the primary emission standards and test procedures specified in title 13, CCR, §1961.2.

5.2 **Requirements Specific to Heavy-Duty Engines Used in Medium-Duty Vehicles 10,001 to 14,000 pounds GVW.** For the 2004 and subsequent model years, a manufacturer of heavy-duty engines used in medium-duty vehicles 10,001 to 14,000 pounds GVW may choose to comply with the following standards as an alternative to the primary emission standards and test procedures specified in title 13, CCR, §1961 or §1961.2, as applicable. A manufacturer that chooses to comply with these optional heavy-duty standards and test procedures shall specify, in the application for certification, an in-use compliance test procedure, as provided in title 13, CCR, §2139(c).

5.3 **Exhaust Emission Standards for Medium-Duty Engines.** The exhaust emissions from new 2004 through 2019 model heavy-duty diesel engines used in ultra-low emission and super-ultra-low emission medium-duty diesel vehicles 8,501 to 10,000 pounds GVW and 2004 and subsequent model heavy-duty diesel engines used in ultra-low emission and super-ultra-low emission medium-duty diesel vehicles 10,001 to 14,000 pounds GVW shall not exceed:

Exhaust Emission Standards for 2004 – through 2006 Model Medium-Duty ULEVs and SULEVs					
Vehicle Emission Category	NOx + NMHC		CO	PM	HCHO
ULEV[1] Option A	2.5 (with a 0.5 cap on NMHC)		14.4	0.10	0.050
ULEV[1]; Option B	2.4		14.4	0.10	0.050
Exhaust Emission Standards for 2007 through 2019 Model Medium-Duty ULEVs and SULEVs 8,501-10,000 lbs. GVW and 2007 and Subsequent Model Medium-Duty ULEVs and SULEVs 10,001-14,000 lbs. GVW					
Vehicle Emission Category	NOx	NMHC or NMHCE	CO	PM	HCHO
ULEV[1]	0.20	0.14	15.5	0.01	0.050
SULEV[1]	0.10	0.07	7.7	0.005	0.025

[1] Emissions averaging may be used to meet these standards using the requirements for participation averaging, banking and trading programs, as set forth in Section I.15 of these test procedures.

5.4 **Optional Standards for Complete Heavy-Duty Vehicles.** Manufacturers may request to group complete heavy-duty vehicles into the same test group as vehicles certifying to the LEV III exhaust emission standards and test procedures specified in title 13, CCR, §1961.2, so long as those complete heavy-duty diesel vehicles meet the most stringent LEV III standards to which any vehicle within that test group certifies.

* * * *

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

A. Federal provisions.

* * * *

2. **§86.007-21** ~~July 13, 2005~~ August 30, 2006. Amend as follows:

* * * *

2.6 Subparagraph (q). [No change.]

* * * *

23. Required data. [§86.xxx-23]

A. Federal provisions.

1. **§86.098-23**. ~~October 21, 1997~~ April 30, 2010.

* * * *

2. **§86.001-23.** October 21, 1997. [No change, except that the amendments indicated for §86.098-23 above still apply.]

3. **§86.007-23.** ~~January 18, 2001~~ October 30, 2009. [No change, except that the amendments indicated for §86.098-23 above still apply.]

* * * *

26. Mileage and service accumulation; emission measurements. [§86.004-26] ~~October 6, 2000~~ July 13, 2005.

* * * *

28. Compliance with emission standards. [§86.xxx-28] January 18, 2001.

A. Federal provisions.

1. **§86.004-28**. ~~January 18, 2001~~ August 30, 2006. Amend as follows:

* * * *

30. Certification. [§86.xxx-30]

A. Federal provisions

1. **§86.004-30**. ~~October 21, 1997~~ October 6, 2000. Amend as follows:

* * * *

2. **§86.007-30**. February 24, 2009. Amend as follows:

1.1 Subparagraphs (a) through (a)(2). [No change.]

1.2 Add the following sentence to subparagraph (a)(3)(i). For heavy-duty engines certified under the provisions of section I.11.B.4 of these test procedures two certificates will be issued, one for each fueling mode. [No change to remainder of paragraph.]

1.3 Subparagraphs (a)(3)(ii) through (b)(2). [No change.]

1.4 Subparagraph (b)(3). Add the following sentence: If, after a review of the request and supporting data, the Executive Officer finds that the request raises a substantial factual issue, he shall provide the manufacturer a hearing in accordance with title 17, CCR, §60040, et seq., with respect to such issue.

1.5 Subparagraph (b)(4). [No change.]

1.6 Subparagraph (b)(4)(i). Add the following phrase at the beginning of the paragraph: Request a hearing under title 17, CCR, §60040, et seq.; or…

1.7 Subparagraph (b)(4)(ii) through (b)(5). [No change.]

1.8 Subparagraph (b)(5)(i). Add the following phrase at the beginning of the paragraph: Request a hearing under title 17, CCR, §60040, et seq.; or…

1.9. Subparagraph (b)(5)(ii) through (c)(5). [No change.]

1.10 Subparagraph (c)(5)(i). Add the following phrase at the beginning of the paragraph: Be made only after the manufacturer concerned has been offered an opportunity for a hearing conducted in accordance with title 17, CCR, §60040, et seq. hereof; and …

1.11 Subparagraph (c)(5)(ii). [No change.]

1.12 Subparagraph (c)(6). Add the following sentence: The manufacturer may request in the form and manner specified in paragraph (b)(3) of this section that any determination made by the Executive Officer under paragraph (c)(1) of this section to withhold or deny certification be reviewed in a hearing conducted in accordance with title 17, CCR, §60040, et seq. If the Executive Officer finds, after a review of the request and supporting data, that the request raises a substantial factual issue, he will grant the request with respect to such issue.

1.13 Subparagraphs (d) through (e). [No change.]

1.14 Delete subparagraph (f) and replace with the following: All medium-duty diesel cycle engines used in vehicles up to 14,000 pounds GVW must have an on-board diagnostic system as required in title 13, CCR §1968 et seq, as applicable.

* * * *

38. Maintenance instructions. [§86.xxx-38]

A. Federal provisions

1. **§86.004-38** ~~October 21, 1997~~ June 27, 2003.

1.1 Subparagraphs (a) through (f). [No change.]

1.2 Amend subparagraph (g)(1) as follows: (g) Emission control diagnostic service information:

(1) Manufacturers shall furnish or cause to be furnished to any person engaged in the repairing or servicing of motor vehicles or motor vehicle engines, or the Administrator upon request, any and all information needed to make use of the on-board diagnostic system and such other information, including instructions for making emission-related diagnosis and repairs, including, but not limited to, service manuals, technical service bulletins, recall service information, data stream information, bi-directional control information, and training information, unless such information is protected by section 208(c) of the Act or California

Government Code Section 6250, as a trade secret. No such information may be withheld under section 208(c) of the Act or California Government Code Section 6250 if that information is provided (directly or indirectly) by the manufacturer to franchised dealers or other persons engaged in the repair, diagnosing, or servicing of motor vehicles or motor vehicle engines.

1.3 Subparagraphs (g)(2) through (h). [No change.]

2. **§86.007-38** ~~January 18, 2001~~ June 29, 2004.

2.1 Subparagraphs (a) through (h). [No change, except as amended in §86.004-38, above.]

2.2 Amend subparagraph (i) as follows: For each new diesel-fueled engine subject to the standards prescribed in title 13, CCR §1956.8(a), §1956.8(h), and Sec. 86.007-11, as applicable, the manufacturer shall furnish or cause to be furnished to the ultimate purchaser a statement that "This engine must be operated only with low sulfur diesel fuel (that is, diesel fuel meeting ARB specifications for highway diesel fuel, including a 15 ppm sulfur cap)."

3. **§86.010-38** April 30, 2010.

3.1 Subparagraphs (a) through (f). [No change.]

3.2 Subparagraph (g). Delete; replace with: Manufacturers of heavy-duty diesel engines used in vehicles weighing 14,000 pounds GVW and less must comply with the motor vehicle service information requirements set forth in title 13, CCR §1969.

3.3 Subparagraph (h). [No change.]

3.4 Amend subparagraph (i) as follows: For each new diesel-fueled engine subject to the standards prescribed in title 13, CCR §1956.8(a), §1956.8(h), and Sec. 86.007-11, as applicable, the manufacturer shall furnish or cause to be furnished to the ultimate purchaser a statement that "This engine must be operated only with low sulfur diesel fuel (that is, diesel fuel meeting ARB specifications for highway diesel fuel, including a 15 ppm sulfur cap)."

3.5 Subparagraph (j). Delete; replace with: Manufacturers of heavy-duty diesel engines used in vehicles over 14,000 pounds GVW must comply with the motor vehicle service information requirements set forth in title 13, CCR §1969.

* * * *

40. Heavy-duty engine rebuilding practices. [§86.xxx-40]

A. Federal Provisions.

1. **§86.004-40** ~~October 21, 1997~~ January 18, 2001.

1.1 Add the following sentence to the introductory paragraph: Any deviation from the provisions contained in this section is also a prohibited act under California Vehicle Code section 27156, et seq.

1.2 Subparagraphs (a) through (e). [No change.]

II. TEST PROCEDURES

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

* * * *

86.884-8 Dynamometer and engine equipment. ~~September 5, 1997~~ July 13, 2005.

* * * *

86.884-10 Information. ~~September 5, 1997~~ July 13, 2005.
86.884-11 Instrument checks. December 1~~1~~0, 1984.
86.884-12 Test run. ~~December 16, 1987~~ July 13, 2005.

* * * *

86.884-14 Calculations. ~~September 5, 1997~~ January 15, 2004.

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

* * * *

86.1305-2010 Introduction; structure of subpart. ~~July 13, 2005~~ September 15, 2011.

* * * *

~~86.1321-90 Hydrocarbon analyzer calibration. July 13, 2005.~~

* * * *

86.1333-90 Transient test cycle generation. ~~May 4, 1998~~ February 18, 2000.
86.1333-2010 Transient test cycle generation. ~~July 13, 2005~~ June 30, 2008.

* * * *

~~86.1337-90 Engine dynamometer test run. April 11, 1989.~~
86.1337-96 Engine dynamometer test run. September 5, 1997.

* * * *

86.1360-2007 Supplemental emission test; test cycle and procedures. ~~July 13, 2005~~ June 30, 2008.

A. Federal provisions.

* * * *

4. Subparagraph (c). [~~Reserve~~ No change.]

5. Subparagraph (d). Determining the control area. [No change.]

6. Subparagraph (e). [Reserve.]

* * * *

86.1362-2007 Steady-state testing with a ramped-modal cycle. ~~July 13, 2005~~ June 30, 2008.

86.1363-2007 Steady-state testing with a discrete-mode cycle. ~~July 13, 2005~~ June 30, 2008.

* * * *

Subpart S – General Compliance Provisions for Control of Air Pollution From New and In-Use Light-Duty Vehicles, Light-Duty Trucks, and Complete Otto-Cycle Heavy-Duty Vehicles.

86.1863-07 Optional chassis certification for diesel vehicles. ~~June 17, 2003~~ September 15, 2011.

1. Amend subparagraph (a) as follows: For the 2004 through 2014 model years, aA manufacturer may optionally certify heavy-duty diesel vehicles weighing 14,000 pounds GVWR or less to the emission standards specified in title 13, CCR, §1961. Such vehicles must meet all applicable requirements of the "California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and ~~for~~ 2009 through 2016 ~~and Subsequent~~ Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles," as incorporated by reference in title 13, CCR, §1961(d). For the 2015 through 2019 model years, a manufacturer may optionally certify heavy-duty diesel vehicles weighing 8,500 to 10,000 pounds GVWR or less to the emission standards specified in title 13, CCR, §1961 or §1961.2, as applicable. Such vehicles must meet all applicable requirements of the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles," incorporated by reference in section 1961.2, title 13, CCR. For the 2015 and subsequent model years, a manufacturer may optionally certify heavy-duty diesel vehicles weighing 10,001 to 14,000 pounds GVWR or less to the emission standards specified in title 13, CCR, §1961.2. Such vehicles must meet all applicable requirements of the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles," incorporated by reference in section 1961.2, title 13, CCR. For the 2020 and subsequent model years, heavy-duty diesel vehicles 8,501 to 10,000 pounds GVW must certify to the primary emission standards and test procedures for complete vehicles specified in section 1961.2, title 13, CCR.

* * * *

4. Subparagraphs (h) and (i). [n/a]

PART 1065 – ENGINE-TESTING PROCEDURES.

Subpart A – Applicability and General Provisions

1065.1 Applicability. ~~July 13, 2005~~ September 15, 2011.

1. Amend subparagraph (a) as follows:

1.1. Introductory paragraph. [No change.]

1.2. Subparagraphs (a)(1). [n/a]

1.~~2~~3. Amend subparagraph (a)(~~1~~2) as follows: Model year 2010 and later heavy-duty highway engines we regulate under title 13, CCR, §1956.8. For earlier model years, manufacturers may use the test procedures in this part or those specified in 40 CFR part 86, subpart N, according to §1065.10, as modified by these test procedures.

1.~~3~~4. Subparagraphs (a)(~~2~~3) through (a)(~~4~~8). [n/a]

2. Subparagraph (b). [n/a]

3. Subparagraph (c) through (g). [No change.]

1065.2 Submitting information to EPA under this part. ~~July 13, 2005~~ April 30, 2010.

1. Subparagraphs (a) through (d). [No change.]

2. Amend subparagraph (e) as follows: See title 13, CCR, section 91011 for provisions related to confidential information. Note that according to this section, emission data shall not be identified as confidential.

3. Subparagraph (f). [No change.]

1065.5 Overview of this part 1065 and its relationship to the standard-setting part. ~~July 13, 2005~~ October 30, 2009.

1065.10 Other procedures. ~~July 13, 2005~~ April 30, 2010.

1065.12 Approval of alternate procedures. ~~July 13, 2005~~ June 30, 2008.

1065.15 Overview of procedures for laboratory and field testing. ~~July 13, 2005~~ September 15, 2011.

1065.20 Units of measure and overview of calculations. ~~July 13, 2005~~ September 15, 2011.

1065.25 Recordkeeping. July 13, 2005.

Subpart B – Equipment Specifications

1065.101 Overview. ~~July 13, 2005~~ June 30, 2008.

1065.110 Work inputs and outputs, accessory work, and operator demand. ~~July 13, 2005~~ June 30, 2008.

1065.120 Fuel properties and fuel temperature and pressure. ~~July 13, 2005~~ June 30, 2008.

1065.122 Engine cooling and lubrication. ~~July 13, 2005~~ June 30, 2008.

1065.125 Engine intake air. ~~July 13, 2005~~ September 15, 2011.

1065.127 Exhaust gas recirculation. July 13, 2005.
1065.130 Engine exhaust. ~~July 13, 2005~~ June 30, 2008.
1065.140 Dilution for gaseous and PM constituents. *~~July 13, 2005~~* ~~November 8, 2010~~ September 15, 2011.
1065.145 Gaseous and PM probes, transfer lines, and sampling system components. ~~July 13, 2005~~ April 30, 2010.
1065.150 Continuous sampling. July 13, 2005.
1065.170 Batch sampling for gaseous and PM constituents. ~~July 13, 2005~~ September 15, 2011.
1065.190 PM-stabilization and weighing environments for gravimetric analysis. ~~July 13, 2005~~ September 15, 2011.
1065.195 PM-stabilization environment for in-situ analyzers. ~~July 13, 2005~~ June 30, 2008.

Subpart C – Measurement Instruments

1065.201 Overview and general provisions. ~~July 13, 2005~~ April 30, 2010.
1065.202 Data updating, recording, and control. July 13, 2005.
1065.205 Performance specifications for measurement instruments. ~~July 13, 2005~~ September 15, 2011.

Measurement of Engine Parameters and Ambient Conditions

1065.210 Work input and output sensors. ~~July 13, 2005~~ June 30, 2008.
1065.215 Pressure transducers, temperature sensors, and dewpoint sensors. ~~July 13, 2005~~ June 30, 2008.

Flow-Related Measurements

1065.220 Fuel flow meter. ~~July 13, 2005~~ June 30, 2008.
1065.225 Intake-air flow meter. ~~July 13, 2005~~ September 15, 2011.
1065.230 Raw exhaust flow meter. July 13, 2005.
1065.240 Dilution air and diluted exhaust flow meters. ~~July 13, 2005~~ April 30, 2010.
1065.245 Sample flow meter for batch sampling. July 13, 2005.
1065.248 Gas divider. July 13, 2005.

CO and CO_2 Measurements

1065.250 Nondispersive infra-red analyzer. ~~July 13, 2005~~ September 15, 2011.

Hydrocarbon Measurements

1065.260 Flame ionization detector. ~~*July 13, 2005*~~ ~~November 8, 2010~~ September 15, 2011.
1065.265 Nonmethane cutter. ~~July 13, 2005~~ September 15, 2011.
1065.267 Gas chromatograph. ~~July 13, 2005~~ September 15, 2011.

NOx Measurements

1065.270 Chemiluminescent detector. ~~July 13, 2005~~ September 15, 2011.
1065.272 Nondispersive ultraviolet analyzer. ~~July 13, 2005~~ September 15, 2011.
1065.275 N_2O measurement devices. September 15, 2011.

O_2 Measurements

1065.280 Paramagnetic and magnetopneumatic O_2 detection analyzers. ~~July 13, 2005~~ September 15, 2011.

Air-to Fuel Ratio Measurements

1065.284 Zirconia (ZrO_2) analyzer. ~~July 13, 2005~~ September 15, 2011.

PM Measurements

1065.290 PM gravimetric balance. ~~*July 13, 2005*~~ November 8, 2010.
1065.295 PM inertial balance for field-testing analysis. ~~*July 13, 2005*~~ ~~November 8, 2010~~ September 15, 2011.

Subpart D – Calibrations and Verifications

1065.301 Overview and general provisions. July 13, 2005.
1065.303 Summary of required calibration and verifications. ~~July 13, 2005~~ September 15, 2011.
1065.305 Verifications for accuracy, repeatability, and noise. ~~July 13, 2005~~ April 30, 2010.
1065.307 Linearity verification. ~~*July 13, 2005*~~ ~~November 8, 2010~~ September 15, 2011.
1065.308 Continuous gas analyzer system-response and updating-recording verification. ~~July 13, 2005~~ October 8, 2008.
1065.309 Continuous gas analyzer uniform response verification. ~~July 13, 2005~~ April 30, 2010.

Measurement of Engine Parameters and Ambient Conditions

1065.310 Torque calibration. ~~July 13, 2005~~ June 30, 2008.
1065.315 Pressure, temperature, and dewpoint calibration. ~~July 13, 2005~~ April 30, 2010.

Flow-Related Measurements

1065.320 Fuel-flow calibration. July 13, 2005.
1065.325 Intake-flow calibration. July 13, 2005.
1065.330 Exhaust-flow calibration. July 13, 2005.
1065.340 Diluted exhaust flow (CVS) calibration. ~~*July 13, 2005*~~ ~~November 8, 2010~~ September 15, 2011.
1065.341 CVS and batch sampler verification (propane check). ~~July 13, 2005~~ September 15, 2011.
1065.342 Sample dryer verification. April 30, 2010.
1065.345 Vacuum-side leak verification. ~~July 13, 2005~~ April 30, 2010.

CO and CO_2 Measurements

1065.350 H_2O interference verification for CO_2 NDIR analyzers. ~~July 13, 2005~~ September 15, 2011.
1065.355 H_2O and CO_2 interference verification for CO NDIR analyzers. ~~July 13, 2005~~ April 30, 2010.

Hydrocarbon Measurements

1065.360 FID optimization and verification. ~~July 13, 2005~~ September 15, 2011.
1065.362 Non-stoichiometric raw exhaust FID O2 interference verification. ~~July 13, 2005~~ June 30, 2008.
1065.365 Nonmethane cutter penetration fractions. ~~July 13, 2005~~ October 30, 2009.

NOx Measurements

1065.370 CLD CO_2 and H_2O quench verification. ~~July 13, 2005~~ September 15, 2011.
1065.372 NDUV analyzer HC and H_2O interference verification. ~~July 13, 2005~~ September 15, 2011.
1065.376 Chiller NO_2 penetration. ~~July 13, 2005~~ June 30, 2008.
1065.378 NO_2-to-NO converter conversion verification. ~~July 13, 2005~~ September 15, 2011.

PM Measurements

1065.390 PM balance verifications and weighing process verification. ~~*July 13, 2005*~~ November 8, 2010.
1065.395 Inertial PM balance verifications. July 13, 2005.

Subpart E – Engine Selection, Preparation, and Maintenance

1065.401 Test engine selection. July 13, 2005.
1065.405 Test engine preparation and maintenance. ~~July 13, 2005~~ June 30, 2008.
1065.410 Maintenance limits for stabilized test engines. ~~July 13, 2005~~ June 30, 2008.
1065.415 Durability demonstration. ~~July 13, 2005~~ June 30, 2008.

Subpart F – Performing an Emission Test in the Laboratory

1065.501 Overview. ~~July 13, 2005~~ April 30, 2010.
1065.510 Engine mapping. ~~July 13, 2005~~ September 15, 2011.
1065.512 Duty cycle generation. ~~July 13, 2005~~ October 8, 2008.
1065.514 Cycle-validation criteria. ~~July 13, 2005~~ September 15, 2011.
1065.520 Pre-test verification procedures and pre-test data collection. ~~July 13, 2005~~ September 15, 2011.
1065.525 Engine starting, restarting, and shutdown. ~~*July 13, 2005*~~ ~~November 8, 2010~~ September 15, 2011.
1065.526 Repeating void modes or test intervals. November 8, 2010.
1065.530 Emission test sequence. ~~July 13, 2005~~ September 15, 2011.
1065.545 Validation of proportional flow control for batch sampling. ~~July 13, 2005~~ April 30, 2010.
1065.546 Validation of minimum dilution ratio for PM batch sampling and drift correction. September 15, 2011.
1065.550 Gas analyzer range validation, drift validation, and drift correction. ~~*July 13, 2005*~~ ~~November 8, 2010~~ September 15, 2011.
1065.590 PM sample preconditioning and tare weighing. ~~July 13, 2005~~ June 30, 2008.
1065.595 PM sample post-conditioning and total weighing. ~~July 13, 2005~~ June 30, 2008.

Subpart G – Calculations and Data Requirements

1065.601 Overview. ~~July 13, 2005~~ April 30, 2010.
1065.602 Statistics. ~~July 13, 2005~~ September 15, 2011.
1065.610 Duty cycle generation. ~~July 13, 2005~~ September 15, 2011.
1065.630 1980 international gravity formula. July 13, 2005.

1065.640 Flow meter calibration calculations. ~~*July 13, 2005*~~ ~~November 8, 2010~~ September 15, 2011.
1065.642 SSV, CFV, and PDP molar flow rate calculations. ~~*July 13, 2005*~~ ~~November 8, 2010~~ September 15, 2011.
1065.645 Amount of water in an ideal gas. ~~July 13, 2005~~ September 15, 2011.
1065.650 Emission calculations. ~~July 13, 2005~~ September 15, 2011.
1065.655 Chemical balances of fuel, intake air, and exhaust. ~~July 13, 2005~~ September 15, 2011.
1065.659 Removed water correction. ~~July 13, 2005~~ September 15, 2011.
1065.660 THC and NMHC determination. ~~*July 13, 2005*~~ ~~November 8, 2010~~ September 15, 2011.
1065.665 THCE and NMHCE determination. ~~July 13, 2005~~ June 30, 2008.
1065.667 Dilution air background emission correction. ~~July 13, 2005~~ September 15, 2011.
1065.670 NOx intake-air humidity and temperature corrections. ~~July 13, 2005~~ September 15, 2011.
1065.672 Drift correction. ~~July 13, 2005~~ April 30, 2010.
1065.675 CLD quench verification calculations. ~~July 13, 2005~~ September 15, 2011.
1065.690 Buoyancy correction for PM sample media. ~~July 13, 2005~~ April 30, 2010.
1065.695 Data requirements. ~~July 13, 2005~~ June 30, 2008.

Subpart H – Engine Fluids, Test Fuels, Analytical Gases and Other Calibration Standards

1065.701 General requirements for test fuels. ~~July 13, 2005~~ April 30, 2010.

A. Federal provisions.

1. Subparagraph (a). [No change.]

2. Amend subparagraph (b) as follows: *Fuels meeting alternative specifications.* We may allow you to use a different test fuel if you show us and we find that using it does not affect your ability to comply with all applicable emission standards using commercially available fuels.

3. Subparagraph (c). [No change.]

4. Amend subparagraph (d) as follows: *Fuel specifications*. The fuel parameters specified in this subpart depend on measurement procedures that are incorporated by reference.

5. Subparagraph (e). [No change.]

6. Subparagraph (f). [No change.]

B. California provisions.

* * * *

3. **Identification of New Clean Fuels to be Used in Certification Testing.**

Any person may petition the state board to establish by regulation certification testing specifications for a new clean fuel for which specifications for the new clean fuel are not specifically set forth in paragraph §86.1313-98 as amended herein. Prior to adopting such specifications, the state board shall consider the relative cost-effectiveness of use of the fuel in reducing emissions compared to the use of other fuels. Whenever the state board adopts specifications for a new clean fuel for certification testing, it shall also establish by regulation specifications for the fuel as it is sold commercially to the public.

(a) If the proposed new clean fuel may be used to fuel existing motor vehicles, the state board shall not establish certification specifications for the fuel unless the petitioner has demonstrated that:

(1) Use of the new clean fuel in such existing motor vehicles would not increase emissions of NMHC, NOx, and CO, and the potential risk associated with toxic air contaminants, as determined pursuant to the procedures set forth in the "California Test Procedures for Evaluating Substitute Fuels and New Clean Fuels through 2014," as ~~adopted September 17, 1993~~ amended [INSERT DATE OF AMENDMENT] or the "California Test Procedures for Evaluating Substitute Fuels and New Clean Fuels in 2015 and Subsequent Years," as adopted [INSERT DATE OF ADOPTION], as applicable. In the case of fuel-flexible vehicles or dual-fuel vehicles that were not certified on the new clean fuel but are capable of being operated on it, exhaust and evaporative emissions from the use of the new clean fuel shall not increase compared to exhaust and evaporative emissions from the use of gasoline that complies with Title 13, Division 3, Chapter 5, Article 1, California Code of Regulations.

(2) Use of the new clean fuel in such existing motor vehicles would not result in increased deterioration of the vehicle and would not void the warranties of any such vehicles.

(b) Whenever the state board designates a new clean fuel pursuant to this section, the state board shall also establish by regulation required specifications for the new clean fuel sold commercially in California.

1065.703 Distillate diesel fuel. ~~July 13, 2005~~ April 30, 2010.

* * * *

1065.705 Residual fuel. June 30, 2008. [~~Reserved~~ No change.]
1065.710 Gasoline. ~~July 13, 2005~~ June 30, 2008. [n/a]
1065.715 Natural gas. ~~July 13, 2005~~ June 30, 2008.

* * * *

2. Subparargraph~~s~~ (b) through (d). [No change.]

* * * *

1065.720 Liquefied petroleum gas. July 13, 2005.

* * * *

2. Subparagraphs (b) through (d). [No change.]

1065.740 Lubricants. July 13, 2005.
1065.745 Coolants. July 13, 2005.
1065.750 Analytical gases. ~~*July 13, 2005*~~ ~~November 8, 2010~~ September 15, 2011.
1065.790 Mass standards. ~~July 13, 2005~~ September 15, 2011.

Subpart I –Testing with Oxygenated Fuels

1065.801 Applicability. July 13, 2005.
1065.805 Sampling system. ~~July 13, 2005~~ June 30, 2008.
1065.845 Response factor determination. ~~July 13, 2005~~ April 30, 2010.
1065.850 Calculations. July 13, 2005.

Subpart J – Field Testing and Portable Emission Measurement Systems

1065.901 Applicability. ~~July 13, 2005~~ June 30, 2008.
1065.905 General provisions. ~~*July 13, 2005*~~ November 8, 2010.
1065.910 PEMS auxiliary equipment for field testing. ~~July 13, 2005~~ April 30, 2010.
1065.915 PEMS instruments. ~~*July 13, 2005*~~ ~~November 8, 2010~~ September 15, 2011.
1065.920 PEMS calibrations and verifications. ~~*July 13, 2005*~~ November 8, 2010.
1065.925 PEMS preparation for field testing. ~~*July 13, 2005*~~ ~~November 8, 2010~~ September 15, 2011.
1065.930 Engine starting, restarting, and shutdown. July 13, 2005.
1065.935 Emission test sequence for field testing. ~~July 13, 2005~~ June 30, 2008.
1065.940 Emission calculations. ~~*July 13, 2005*~~ November 8, 2010.

Subpart K – Definitions and Other Reference Information

1065.1001 Definitions. ~~July 13, 2005~~ September 15, 2011.

1. Amend the definition of "Designated Compliance Officer" as follows:
Designated Compliance Officer means the Executive Officer of the Air Resources Board or a designee of the Executive Officer.

1065.1005 Symbols, abbreviations, acronyms, and units of measure. ~~July 13, 2005~~ September 15, 2011.

1065.1010 Reference materials. ~~July 13, 2005~~ September 15, 2011.

ATTACHMENT A-11

State of California
AIR RESOURCES BOARD

CALIFORNIA ENVIRONMENTAL PERFORMANCE LABEL SPECIFICATIONS FOR 2009 AND SUBSEQUENT MODEL YEAR PASSENGER CARS, LIGHT-DUTY TRUCKS, AND MEDIUM-DUTY PASSENGER VEHICLES

Adopted: May 2, 2008
Amended: March 22, 2012

Note: The proposed amendments to this document are shown in underline to indicate additions and ~~strikeout~~ to indicate deletions compared to the test procedures as last adopted May 2, 2008.

State of California
AIR RESOURCES BOARD

California Environmental Performance Label Specifications

1. Prohibition.

(a) The sale and registration in this state of any certified new 2009 and subsequent model passenger car, light-duty truck, and medium-duty passenger vehicle manufactured on or after January 1, 2009 to which an Environmental Performance label has not been affixed in accordance with these procedures is prohibited. Affixing the Environmental Performance (EP) label to a vehicle manufactured before January 1, 2009 in lieu of the Smog Index Label is optional, however, each such label optionally affixed and not meeting all specifications herein, is prohibited.

(b) Affixing the Federal Fuel Economy and Environment Label in accordance to 40 CFR Parts 85, 86, and 600 as promulgated on July 6, 2011 is deemed compliant with the Environmental Performance label requirements.

(c) Neighborhood electric vehicles (NEVs) are not permitted to affix a Federal Fuel Economy and Environment Label. NEVs are not required to have an Environmental Performance label, however the EP label can be optionally affixed to a NEV.

2. Requirements.

(a) Environmental Performance Label:

(1) Except as provided in paragraph 2.(a)(5) or 2.(b), a stand-alone Environmental Performance label made of paper or plastic must be securely affixed in a location specified in section 43200 of the Health and Safety Code.
(2) The Environmental Performance label must display the global warming score for the vehicle, as specified in paragraph **3. Global Warming Score** of these specifications.
(3) The Environmental Performance label must display the smog score for the vehicle, as specified in paragraph **4. Smog Score** of these specifications.
(4) The Environmental Performance label may be expanded to include bar coding information, if and only if all requirements for the Environmental

Performance label are maintained and the bar coding information is placed outside the 4 x 6 inch label perimeter.

(5) The Environmental Performance label may instead be placed on labeling feedstock that displays stock numbers and other vehicle related consumer information. If exercising this option, the following color ranges of green, as selected from the Pantone Formula Guide, product #GP1201 (2007), which is incorporated by reference herein, must not be used on the label feedstock within a 2-inch perimeter outside the label's border:

(A) PMS 320 (C or U) through PMS 378 (C or U)
(B) PMS 3242 (C or U) through PMS 3435 (C or U)
(C) PMS 560 (C or U) through PMS 562 (C or U)
(D) PMS 567 (C or U) through PMS 569 (C or U)

(6) The Environmental Performance label must take the form as set forth in paragraph **6. Environmental Performance Label Format Requirements** and Attachment A of these specifications.

(b) Alternate Environmental Performance Label: An alternate Environmental Performance label, which is reduced in size, may be used, if and only if the following requirements are met:

(1) The alternate label is placed or incorporated within the new vehicle Monroney sticker required by the Automobile Information Disclosure Act (15 U.S.C. 1232), as provided by the vehicle manufacturer.

(2) The alternate label must display the global warming score for the vehicle, as specified in paragraph **3. Global Warming Score** of these specifications.

(3) The alternate label must display the smog score for the vehicle, as specified in paragraph **4. Smog Score** of these specifications.

(4) The following color ranges of green, as selected from the Pantone Formula Guide, product #GP1201 (2007), which is incorporated by reference herein, must not be used on the Monroney sticker within a 2-inch perimeter outside the label's border:

(A) PMS 320 (C or U) through PMS 378 (C or U)
(B) PMS 3242 (C or U) through PMS 3435 (C or U)
(C) PMS 560 (C or U) through PMS 562 (C or U)
(D) PMS 567 (C or U) through PMS 569 (C or U)

(5) The alternate label must take the form as set forth in paragraph **7**. **Alternate Environmental Performance Label Format Requirements** and Attachment B of these specifications.

3. Global Warming Score

(a) The global warming emissions value used to determine a vehicle's global warming score must be measured and calculated as follows:

(1) If California has received a waiver of federal preemption under the Clean Air Act, Section 209(b), to enforce Title 13, California Code of Regulations, Section 1961.1 as noticed in the Federal Register, then the global warming emissions value is the CO_2-equivalent combined value as calculated in accordance with Title 13, California Code of Regulations, Section 1961.1(a)(1)(B) and certified pursuant thereto.

(2) If California has not received a waiver of federal preemption under the Clean Air Act, Section 209(b), to enforce Title 13, California Code of Regulations, Section 1961.1 as noticed in the Federal Register, then the global warming emissions value is the CO_2-equivalent combined value as calculated using the following method:

(A) If the vehicle is not equipped with an air conditioning system, then the CO_2-equivalent combined value is calculated using this equation:

CO_2-equivalent combined value = [(0.55 x CO_2-city + 0.45 x CO_2-highway) + 2] x Fuel Adjustment Factor

(B) If the vehicle is equipped with an air conditioning system, then the CO_2-equivalent combined value is calculated using this equation:

CO_2-equivalent combined value = [(0.55 x CO_2-city + 0.45 x CO_2-highway) + 25 – (A/C-direct + A/C-indirect)] x Fuel Adjustment Factor

Where:

i. "CO_2-city" and "CO_2-highway" values are the vehicle's grams per mile city and highway CO_2 measured emissions reported to ARB in accordance with the August 29, 2007, ARB Mailout, MSO #2007-03, and incorporated by reference herein.

ii. "A/C-direct" is a credit for an A/C system that qualifies as a "low-leak" system. The A/C-direct default value is zero for A/C systems that do not qualify as a "low-leak" system. To qualify as a "low-leak" A/C system that uses HFC-134a as the refrigerant, the following requirements apply and the Executive Officer will review submitted demonstrations for approval:

1. The manufacturer must demonstrate via engineering evaluation that the A/C system minimizes overall refrigerant leakage by:

    a. Minimizing the number of fitting and joints.
    b. Limiting the use of single O-rings for pipe and hose connections.
    c. Using lowest permeability hose for containment of the refrigerant.
    d. Minimizing leakage from compressor shaft seal and housing seals.

2. Annual leakage refrigerant emissions are measured and determined in accordance with SAE International standard J2727 (Rev. Jul. 2007), incorporated by reference herein. If the A/C system is determined to be a “low-leak” system in accordance with paragraphs 3.(a)(2)(B)ii.1. and 2. Above and if approved by the Executive Officer, the A/C-direct credit is then calculated using the following equation:

    A/C-direct = 6 – SAE J2727 measured annual refrigerant leakage in grams x 1300 / 12,000

iii. For an A/C system that uses a refrigerant with a Global Warming Potential $\leq$ 150 times that of CO_2, the A/C-direct credit is equal to 6 grams/mile.

iv. “A/C-indirect” is a credit for an A/C system that qualifies as an “improved” system. The A/C-indirect default value is zero for A/C systems that do not qualify as an “improved” system. To qualify as an “improved” system that uses CO_2, HFC-134a, HFC-152a, or other halocarbon refrigerant, the following requirements apply and the Executive Officer will review submitted demonstrations for approval:

1. The manufacturer demonstrates using test data in an engineering evaluation that the A/C system achieves lower A/C-indirect emissions than the default value of 17 grams/mile.
2. The system manages outside and re-circulated air balance to achieve comfort, demisting, and safety requirements, based on factors such as temperature, humidity, pressure, and level of fresh air in the passenger compartment in order to minimize compressor usage.

3. The system is optimized for energy efficiency by utilizing state-of-the-art high efficiency evaporators, expansion devices, condensers, and other components.
4. The system has external controls that adjust the evaporative temperature to minimize the necessity of reheating cold air to satisfy occupant comfort. If the A/C system is determined to be an “improved” system in accordance with paragraphs 3.(a)(2)(B)iv.1. through 4. Above and if approved by the Executive Officer, the A/C-indirect credit is calculated using the following equation:

A/C-indirect = 17 – Compressor Displacement in cubic centimeters x 5 / 100

v. “Fuel Adjustment Factor” is the upstream greenhouse gas emission adjustment factor for various fuels and is assigned the following values:

Fuel Type	Fuel Adjustment Factor
Gasoline	1.00
Diesel	1.00
Natural Gas	1.03
LPG	0.89
E85	0.74

(C) Vehicles that use electricity or hydrogen as their only fuel source are exempt from testing and submission of greenhouse gas data for calculating CO_2-equivalent combined values. Such vehicles will be assigned a default CO_2-equivalent combined value as follows:

Vehicle Type	CO_2-equivalent combined value (g/mile)
Battery Electric	130
Hydrogen Internal Combustion	290
Hydrogen Fuel Cell Electric	210

(b) The average new vehicle CO_2-equivalent combined value is projected to be 360 grams per mile and will be assigned a global warming score of 5.

(c) The global warming scores in the following table apply to all:

(1) passenger cars,

(2) light-duty trucks 0-8500 lbs. GVW, except trucks 3751 lbs. LVW to 500 lbs. GVW that are certified to Option 1 LEV II NOx standard, pursuant to Title 13, California Code of Regulations, Section 1961(a)(1), and

(3) medium-duty passenger vehicles 8501-9999 lbs. GVW:

Grams per mile CO_2-equivalent combined	Global Warming Score
Less than 200	10
200-239	9
240-279	8
280-319	7
320-359	6
360-399	5
400-439	4
440-479	3
480-519	2
520 and up	1

4. Smog Score

(a) The average new vehicle NMOG + NOx certification value is projected to be closest to an Ultra-Low-Emission Vehicle (ULEV) certification and is assigned a smog score of 5, regardless of actual average certified values.

(b) The smog scores in the following table apply to 2009 and subsequent model year passenger cars and light-duty trucks 0-8500 lbs. GVW and medium-duty passenger vehicles 8501-9999 lbs. GVW, as certified pursuant to Title 13, California Code of Regulations, Section 1961(a)(1):

California Emissions Category– Federal Bins	NMOG + NOx (g/mile)	Smog Score
ZEV – Bin 1	0.0	10
PZEV	0.030	9
SULEV – Bin 2	0.030	8
Bin 3	0.085	7
Bin 4	0.110	6
ULEV	0.125	5
LEV – Bin 5	0.160	4
[LEV (option 1) – Bin 6] and [SULEV (MDPV)]	0.190 – 0.200	3

Bin 7	0.240	2
ULEV (MDPV) – Bin 8a	0.325	1

5. **Bi-Fuel, Fuel Flexible, and Dual-Fuel Vehicles**. Notwithstanding Title 13, California Code of Regulations, Section 1961.1(a)(1)(B)2., the global warming score and smog score are based on exhaust mass emission tests when the vehicle is operating on gasoline or diesel.

6. **Environmental Performance Label Format Requirements.** Detailed printing requirements and a sample label are given in Attachment A of this specification and apply to the label requirements of paragraph 2.(a) of these specifications. Unless otherwise stated, a dimensional tolerance of plus or minus 0.039 inches (1.0 millimeter) applies to printer and label feedstock alignment.

(a) Environmental Performance label:

(1) Must be rectangular in shape 6 inches wide x 4 inches high.

(2) Must be white, outlined with a 3 point green line and have a 0.5 inch high section of green at the top and a 1 inch high section of green at the bottom.

(b) Label information. The following item numbers correspond with the table numbers and sample label reference numbers in Attachment A. The information on each label must meet the following requirements:

(1) The color for the prescribed green as specified in Attachment A is PMS 347 (C or U) selected from the Pantone Formula Guide, Product # GP1201 (2007), incorporated by reference, herein. When printing in 4 color process the color build for the prescribed green is:

Cyan 100
Magenta 0
Yellow 86
Black 3

When printing in 3 color process the color build for the prescribed green is:

Red 0
Green 161
Blue 96

(2) “Environmental Performance” is the title of the label. This title must be centered in the top section of green. See Attachment A for font, size and color requirements.

(3) The phrase “Protect the environment, choose vehicles with higher scores:” must appear under the top section of green. This phrase must be centered with a 9-point gap between the phrase and the top section of green. See Attachment A for font, size and color requirements.

(4) “Global Warming Score” is a title that must always appear over its respective scale. This title must start 2 picas from the left edge of the label and the bottom of the title must start 8 picas from the top edge of the label. See Attachment A for font, size and color requirements.

(5) The number for the Global Warming Score is variable and must be centered over the block it represents on the global warming scale. The bottom of the number must start 6 points above the block it represents. Scores are determined in paragraph **3. Global Warming Score**. Vehicles certified to Option 1 LEV II NOx standard, pursuant to Title 13, California Code of Regulations, Section 1961(a)(1), are exempt from this requirement. See Attachment A for font, size and color requirements.

(6) The number 1 must appear flush left with and underneath each scale line. The top of the number must start 4 points below the bottom of the scale line. The number 1 represents the lowest score a vehicle can get on each scale. See Attachment A for font, size and color requirements.

(7) “Average new vehicle” must appear as shown in the sample label, under both scales at the center point of the fifth block (or where the fifth block would normally be), and must be marked by a triangle (item 15 in Attachment A). The top of this phrase must start 14 points below the bottom of the scale line. See Attachment A for font, size and color requirements.

(8) The following statement must appear as shown in the sample label, in the lower section of green on the label: “Vehicle emissions are a primary contributor to global warming and smog. Scores are determined by the California Air Resources Board based on this vehicle’s measured emissions. Please visit **www.DriveClean.ca.gov** for more information.” This statement must be left justified and start 2 picas from the left edge and the bottom of the phrase must be 9 points above the bottom edge of the label. The third row of text must end after the word “visit” and drop

down to a fourth line of text to allow room for item 17, the ARB logotype. See Attachment A for font, size and color requirements.

(9) The words “higher scores:” must be bolded. See Attachment A for font, size and color requirements.

(10) “Smog Score” is a title that must always appear over its respective scale. This title must be flush left with its scale line, starting 21.75 picas from the left edge of the label and the bottom of the title must start 8 picas from the top edge of the label. See Attachment A for font, size and color requirements.

(11) The number for the Smog Score is variable and must appear centered over the block it represents on the smog scale. The bottom of the number must start 6 points above the block it represents. Scores are determined in paragraph **4. Smog Score**. See Attachment A for font, size and color requirements.

(12) Squares on the scales. Each square represents a single score on the scale and must rest on top of the scale line. For example: If a vehicle scores a 5, on a given scale, there will be five squares to represent that score. The first square must be flush left with the scale line (Attachment A item 13) and the tenth square must be flush right with the scale line, therefore maintaining a distance of exactly 3 points between squares, even when not all ten squares are present. See Attachment A for size and color requirements.

(13) The scale line must appear on both scales and must be a consistent length. The left scale line must start 2 picas from the left edge of the label and the bottom of the scale line must be 2 inches below the top edge of the label. The right scale line must end 2 picas from the right edge of the label and the bottom of the scale line must be 2 inches below the top edge of the label. See Attachment A for length, stroke and color requirements.

(14) The number 10 must appear flush right with and underneath each scale line. The top of the number must start 4 points below the bottom of the scale line. The number 10 represents the highest score a vehicle can get on each scale. See Attachment A for font, size and color requirements.

(15) An upright equilateral triangle must appear under both scale lines at the center point of the fifth block (or where the fifth block would normally be) on both scale lines representing where the average new vehicle falls on

each scale. The top of the triangle must start at, and touch, the bottom of the scale line. See Attachment A for size and color requirements.

(16) The title "Cleanest" must appear flush right with and underneath each scale line. The top of the title must start 15 points below the bottom of the scale line. This title must always be bold. See Attachment A for font, size and color requirements.

(17) The California Environmental Protection Agency / Air Resources Board logotype must appear in the lower right hand corner as shown in the sample label. The dividing line must end 18 points from the right edge of the label and the bottom of the line must be 21 points above the bottom edge of the label. The top phrase must be flush left with the dividing line and the bottom phrase must start 4 points beyond the left edge of the dividing line and end 5 points beyond the right end of the dividing line. There must be a 3-point gap above and a 3-point gap below the dividing line and each corresponding phrase. See Attachment A for font, size and color requirements.

(18) The Drive Clean website (**www.DriveClean.ca.gov**) must always appear bold within Item 8. See Attachment A for font, size and color requirements.

(19) Vehicles capable of operating on more than one fuel must display the following statement: "Using alternative fuels may improve scores. See www.DriveClean.ca.gov". This statement must be centered with a 9-point gap between the statement and the bottom section of green. See Attachment A for font, size and color requirements.

7. Alternate Environmental Performance Label Format Requirements. Detailed printing requirements and a sample alternate label are given in Attachment B of this specification and apply to the label requirements of paragraph 2.(b) of these specifications. Unless otherwise stated, a dimensional tolerance of plus or minus 0.039 inches (1.0 millimeter) applies to printer and label feedstock alignment.

(a) Alternate Environmental Performance labels:

(1) Must be rectangular in shape with a minimum size of 4.5 inches wide by 2.5 inches high.

(2) Must be white, outlined with a 3 point green line and have a 0.3125 inch high section of green at the top and a 0.667 inch high section of green at the bottom.

(b) Label information. The following item numbers correspond with the table numbers and sample alternate label reference numbers in Attachment B. The information on each label must meet the following requirements:

(1) The color for the prescribed green as specified in Attachment B is PMS 347 (C or U) selected from the Pantone Formula Guide, Product # GP1201 (2007), incorporated by reference, herein. When printing in 4 color process the color build for the prescribed green is:

Cyan 100
Magenta 0
Yellow 86
Black 3

When printing in 3 color process the color build for the prescribed green is:

Red 0
Green 161
Blue 96

(2) "Environmental Performance" is the title of the label. This title must be centered in the top section of green. See Attachment B for font, size and color requirements.

(3) The phrase "Protect the environment, choose vehicles with higher scores:" must appear under the top section of green. This phrase must be centered with a 5-point gap between the phrase and the top section of green. See Attachment B for font, size and color requirements.

(4) "Global Warming Score" is a title that must always appear over its respective scale. This title must start 1.5 picas from the left edge and the bottom of the title must start 5 picas from the top edge of the label. See Attachment B for font, size and color requirements.

(5) The number for the Global Warming Score is variable and must be centered over the block it represents on the global warming scale. The bottom of the number must start 4 points above the block it represents. Scores are determined in paragraph **3. Global Warming Score**. Vehicles certified to Option 1 LEV II NOx standard, pursuant to Title 13, California Code of Regulations, Section 1961(a)(1), are exempt from this requirement. See Attachment B for font, size and color requirements.

(6) The number 1 must appear flush left with and underneath each scale line. The top of the number must start 3 points below the bottom of the scale line. The number 1 represents the lowest score a vehicle can get on each scale. See Attachment B for font, size and color requirements.

(7) “Average new vehicle” must appear as shown in the sample alternate label, under both scales at the center point of the fifth block (or where the fifth block would normally be), and must be marked by a triangle (item 15 in Attachment B). The top of this phrase must start 10 points below the bottom of the scale line. See Attachment B for font, size and color requirements.

(8) The following statement must appear as shown in the sample alternate label, in the lower section of green on the label: “Vehicle emissions are a primary contributor to global warming and smog. Scores are determined by the California Air Resources Board based on this vehicle’s measured emissions. Please visit **www.DriveClean.ca.gov** for more information.” This statement must be left justified and start 1 pica from the left edge and the bottom of the phrase must be 6 points above the bottom edge of the label. The third row of text must end after the word “visit” and drop down to a fourth line of text to allow room for item 17, the ARB logotype. See Attachment B for font, size and color requirements.

(9) The words “higher scores:” must be bolded. See Attachment B for font, size and color requirements.

(10) “Smog Score” is a title that must always appear over its respective scale. This title must be flush left with its scale line, starting 15.67 picas from the left edge of the label and the bottom of the title must start 5 picas from the top edge of the label. See Attachment B for font, size and color requirements.

(11) The number for the Smog Score is variable and must appear centered over the block it represents on the smog scale. The bottom of the number must start 4 points above the block it represents. Scores are determined in paragraph **4. Smog Score**. See Attachment B for font, size and color requirements.

(12) Squares on the scales. Each square represents a single score on the scale and must rest on top of the scale line. For example: If a vehicle scores a 5, on a given scale, there will be five squares to represent that score. The first square must be flush left with the scale line (Attachment B, item 13) and the tenth square must be flush right with the scale line, therefore maintaining a distance of exactly 2 points between squares, even when not all ten squares are present. See Attachment B for size and color requirements.

(13) The scale line must appear on both scales and must be a consistent length. The left scale line must start 1.5 picas from the left edge of the label and the bottom of the scale line must be 7.5 picas below the top edge of the label. The right scale line must end 1.5 picas from the right edge of the label and the bottom of the scale line must be 7.5 picas below the top edge of the label. See Attachment B for length, stroke and color requirements.

(14) The number 10 must appear flush right with and underneath each scale line. The top of the number must start 3 points below the bottom of the scale line. The number 10 represents the highest score a vehicle can get on each scale. See Attachment B for font, size and color requirements.

(15) An upright equilateral triangle must appear under both scale lines at the center point of the fifth block (or where the fifth block would normally be) on both scale lines, representing where the average new vehicle falls on each scale. The top of the triangle must start at, and touch, the bottom of the scale line. See Attachment B for size and color requirements.

(16) The title “Cleanest” must appear flush right with and underneath each scale line. The top of the title must start 12 points below the bottom of the scale line. This title must always be bold. See Attachment B for font, size and color requirements.

(17) The California Environmental Protection Agency / Air Resources Board logotype must appear in the lower right hand corner as shown in the sample alternate label. The dividing line must end 7 points from the right edge of the label and the bottom of the dividing line must be 14 points above the bottom edge of the label. The top phrase must be flush left with the dividing line and the bottom phrase must be flush left with the dividing line. There must be a 2-point gap above and a 2-point gap below the dividing line and each corresponding phrase. See Attachment B for font, size and color requirements.

(18) The Drive Clean website (**www.DriveClean.ca.gov**) must always appear bold within Item 8. See Attachment B for font, size and color requirements.

(19) Vehicles capable of operating on more than one fuel must display the following statement: “Using alternative fuels may improve scores. See www.DriveClean.ca.gov”. This statement must be centered with a 5-point gap between the statement and the bottom section of green. See Attachment B for font, size and color requirements.

8. **Severability**. Each provision of these specifications is severable, and in the event that any provision or part(s) thereof are held to be invalid, the remainder of these specifications remain in full force and effect.

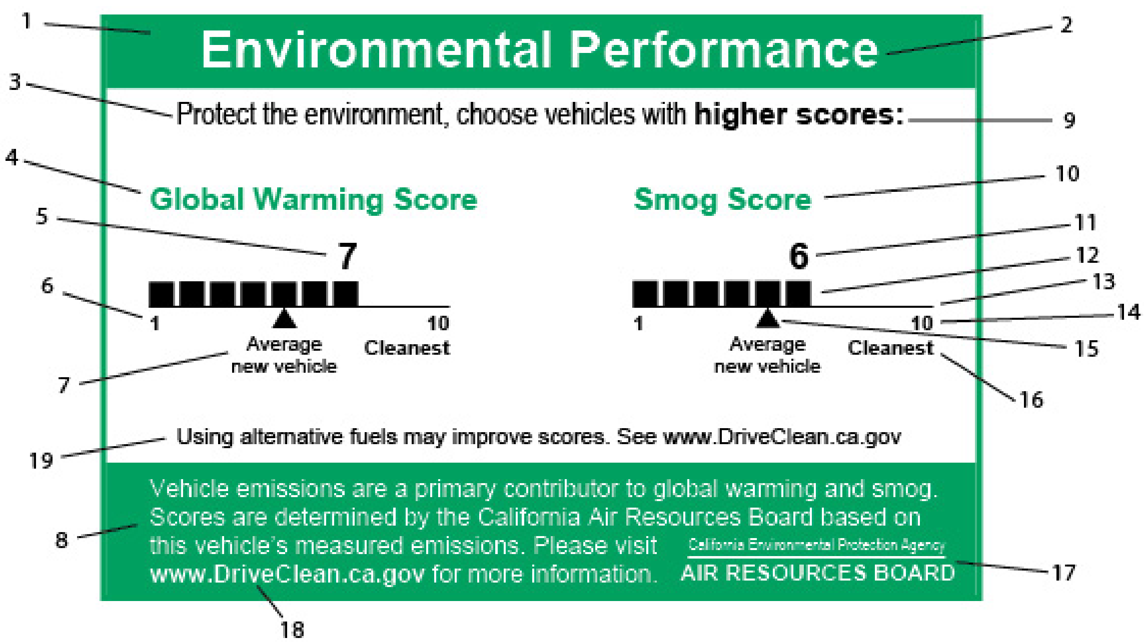
ATTACHMENT A

ENVIRONMENTAL PERFORMANCE LABEL STYLE REQUIREMENTS

1	Label Background 6 x 4 inches whole; top green: 6 x 0.5 inches; Bottom green: 6 x1 inches; green stroke: 3 points; Color: PMS 347 (C or U)
2	font: Arial Bold; size: 25 points; color: knocked out of green (appears white)
3	font: Arial Narrow; size: 15 points; color: Black
4,10	font: Arial Bold; size: 15 points; color: PMS 347 (C or U)
5, 11	font: Arial Bold; size: 18 points; color: Black
6, 14	font: Arial Bold; size: 10 points; color: Black
7	font: Arial Regular; size/leading: 10/12 points; color: Black
8	font: Arial Regular; size/leading: 12/14 points; color: knocked out of green (appears white)
9	font: Semi-bold Arial Bold; size: 15 points; color: Black
12	size: 12 x 12 points; color: Black; distance: 3 points apart
13	Scale Line: length: 147 points; stroke: 1 point; color: Black
15	size: 12 points each side; color: Black
16	font: Arial Bold; size: 10 points; color: Black
17	California Environmental Protection Agency / Air Resources Board logotype: Top Row: font: Arial Narrow; size: 8 points (Title Case) Bottom Row: font: Arial Bold; size: 11 points (All Caps) Line weight: 1 point; length: 126 points Color for all: knocked out of green (appears white)
18	**www.DriveClean.ca.gov**: Font: Arial Bold Size: 12 points Color: knocked out of green (appears white)
19	Alternative fuel phrase: font: Arial Regular; size: 11 points; color: Black

Sample

Environmental Performance Label



ATTACHMENT B

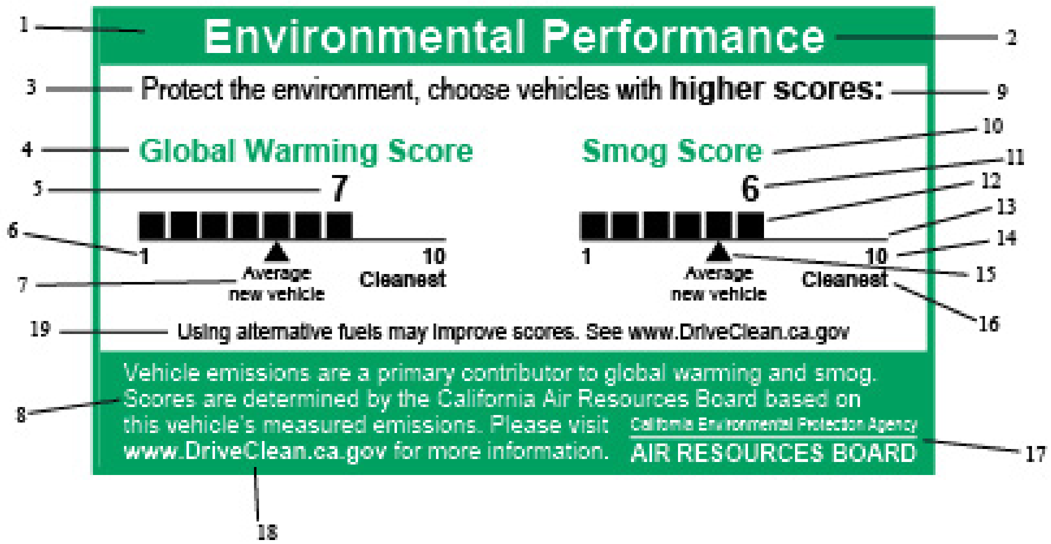
ALTERNATE
ENVIRONMENTAL PERFORMANCE LABEL STYLE REQUIREMENTS

1	Label Background 4.5 x 2.5 inches whole; top green: 4.5 x 0.3125 inches; Bottom green: 4.5 x 0.667 inches; green stroke: 3 points; Color: PMS 347 (C or U)
2	font: Arial Bold; size: 18 points; color: knocked out of green (appears white)
3	font: Arial Narrow; size: 12 points; color: Black
4, 10	font: Arial Bold; size: 12 points; color: PMS 347 (C or U)
5, 11	font: Arial Bold; size: 13 points; color: Black
6, 14	font: Arial Bold; size: 8 points; color: Black
7	font: Arial Regular; size/leading: 7/8 points; color: Black
8	font: Arial Regular; size/leading: 9/10 points; color: knocked out of green (appears white)
9	font: Arial Bold; size: 12 points; color: Black
12	size: 10 x 10 points; color: Black; distance: 2 points apart
13	scale Line: length: 118 points; stroke: 1 point; color: Black
15	size: 10 points each side; color: Black
16	font: Arial Bold; size: 8 points; color: Black
17	California Environmental Protection Agency / Air Resources Board logotype: Top Row: font: Arial Narrow; size: 7 points (Title Case) Bottom Row: font Arial Bold; size: 9 points (All Caps) Line weight: 1.0 points; line length: 110 points Color for all: knocked out of green (appears white)
18	**www.DriveClean.ca.gov**: Font: Arial Bold; Size/ leading: 9/10 points; Color: knocked out of green (appears white)
19	Alternative fuel phrase: font: Arial Regular; size: 8 points; color: Black

As Amended: March 22, 2012
Date of Hearing: January 26-27, 2012

Sample

Alternate Environmental Performance Label



ATTACHMENT A-12

State of California
California Environmental Protection Agency
AIR RESOURCES BOARD
Stationary Source Division

CALIFORNIA TEST PROCEDURES FOR EVALUATING SUBSTITUTE FUELS AND NEW CLEAN FUELS THROUGH 2014

Adopted: November 2, 1993
Amended: March 22, 2012

Note: The proposed amendments to this document are shown in underline to indicate additions and ~~strikeout~~ to indicate deletions compared to the test procedures as adopted November 2, 1993. Existing intervening text that is not amended in this rulemaking is indicated by "* * * *".

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CALIFORNIA TEST PROCEDURES FOR EVALUATING SUBSTITUTE FUELS AND NEW CLEAN FUELS THROUGH 2014

I. *Introduction*

A. Purpose and Applicability of this Protocol

1. The test procedures and analyses prescribed in this document ("test protocol") shall be used to evaluate, in terms of emissions and in terms of durability of emission control systems, (i) any fuel proposed as a substitute for a clean fuel or (ii) any fuel proposed as a new clean fuel if that fuel could be used in existing vehicles certified on another fuel. (The term "candidate fuel" is used herein to refer to either a substitute or new clean fuel.) Specifications for the properties of fuels approved for use in motor vehicles under this protocol shall be set according to this protocol.

2. The pollutant measures addressed by this protocol are carbon monoxide emissions (CO, gm/mile), oxides of nitrogen emissions (NOx, gm/mile), the ozone forming potential of exhaust NMOG emissions (gm ozone/mile), and the combined potency-weighted emissions of toxic air contaminants in the exhaust (mg/mile).

3. These test procedures shall only apply through the 2014 calendar year.

B. Synopsis of this Protocol

The candidate fuel is represented by a test fuel. The on-road fleet of vehicles capable of using the candidate fuel (but not already using it) is represented by either one test fleet in the case of a new clean fuel or two test fleets in the case of a substitute fuel. Each test fleet is composed of vehicle categories distinguished by emission control technology, emission standards, and certification fuel.

For each test vehicle, the difference in emissions between the test fuel and the vehicle's certification fuel (test fuel emissions minus certification fuel emissions, in grams/mile) is computed from test data. This difference is averaged over all vehicles within each vehicle category. These average differences by category are combined into a mileage-weighted mean that serves as an estimate of the difference in average emissions per mile between the test and certification fuels in the relevant on-road vehicle fleet. A statistical upper bound for this mileage-weighted estimate is computed at the 85 percent confidence level. A mileage-weighted estimate of average emissions per mile from the certification fuels among the on-road vehicle fleet is also computed, using the same weights.

For each pollutant, the statistical upper bound for the average difference in emissions is compared to a "tolerance" fraction of the average emissions of that pollutant from the certification fuels. If the statistical upper bound is the greater of these two numbers for any pollutant, the candidate fuel cannot be approved.

C. Definitions

1. "Applicant" means the entity that seeks approval of a candidate fuel and is responsible for the demonstration described in Section III.

2. "Board" means the Air Resources Board.

3. "Candidate fuel" means a fuel proposed as a substitute fuel or as a new clean fuel.

4. "Reference fuel" means, for a particular vehicle, a fuel meeting the same specifications in the "California Exhaust Emission Standards and Test Procedures for 1988 through 2000 ~~and Subsequent~~ Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Trucks" or the "California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2009 through 2016 Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles" (herein, "Light-Duty Test Procedures ~~1988 Standards and Procedures~~") as did the fuel that was used to certify the vehicle (certification fuel).

   ~~However, if the fuel used to certify a vehicle was gasoline meeting specifications in the 1988 Standards and Procedures as last revised July 12, 1991 (or gasoline as specified by earlier documents), "reference fuel" means a gasoline meeting the specifications, for vehicle-certifying gasoline, approved by the Board on August 14, 1992 and corresponding to the commercial gasoline standards approved by the Board on November 22, 1991.~~

   For a low emission vehicle that was certified on both gasoline and another fuel, "reference fuel" means gasoline, unless the candidate fuel is a proposed substitute fuel and the other certification fuel is the primary designated clean fuel. In that case, "reference fuel" means the primary designated clean fuel.

5. "Duplicate test" means an emission test run on a particular vehicle and a particular fuel as a repetition of the preceding test on the same vehicle and fuel, without draining and re-filling the fuel tank and without conducting pre-test dynamometer cycles, as described in VIII.D., between the tests.

6. "Executive officer" means the Executive Officer of the Air Resources Board.

7. "LDV" means light-duty vehicle, "MDV" means medium-duty vehicle, "TLEV" means transitional low-emission vehicle, "LEV" means low-

emission vehicle, and "ULEV" means ultra-low emission vehicle, all as defined in subchapter 9, Title 13, California Code of Regulations. In this protocol, "low-emission vehicle" includes LEVs, TLEVs, and ULEVs.

8. "New clean fuel" means a fuel proposed for certifying new low-emission vehicles, as described in section 12 of the "California Exhaust Emission Standards and Test Procedures for 1988 through 2000 ~~and Subsequent~~ Model Passenger Cars, Light Duty Trucks, and Medium-Duty Vehicles" or Part II of the "California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2009 through 2016 Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles," as applicable.

9. "Primary designated clean fuel" means the designated clean fuel for which the substitute fuel under consideration has been proposed pursuant to section 2317 in Subchapter 8, Title 13, California Code of Regulations.

10. "Replicate test" means an emission test or a set of duplicate tests run on a particular vehicle and a particular fuel as a repetition of another test or set of tests on the same vehicle and fuel, with draining and re-filling the fuel tank and with conducting pre-test dynamometer cycles, as described in VIII.D., between the tests or sets of tests.

11. "Substitute fuel" means a fuel used in accordance with section 2317 in Subchapter 8, Chapter 3, Title.13, California Code of Regulations.

12. "Test fuel" means the particular batch of fuel representing a candidate fuel in the emission demonstration required for approval of the candidate fuel.

13. "Toxic air contaminant" means benzene, 1,3-butadiene, formaldehyde, or acetaldehyde.

II. *Minimal Requirements for a Candidate Fuel*

A. A candidate fuel must meet all standards enforced by the Board for the kind of fuel.

III. *Demonstrations Required for a Candidate Fuel*

A. The demonstration of no increase in emissions from the use of a candidate fuel, required of a substitute fuel in the code cited in I.C.11 and required of a new clean fuel in the test procedure cited in I.C.8, shall consist of emission tests on a test fuel whose properties identified per the test plan have been accurately measured. Comparisons of the results of these tests with the results of tests on the pertinent reference fuel(s) must satisfy the criterion in Section V.

B. For a proposed substitute fuel, separate demonstrations of no increase in emissions shall be made for (i) the low-emission vehicles that have been certified on the primary designated clean fuel and (ii) all other types of vehicle that could use the candidate fuel. For a proposed new clean fuel, the demonstration of no increase in emissions shall encompass all vehicles capable of using the candidate fuel.

C. The demonstration of no increase in deterioration of vehicles' emission control system, required of a substitute fuel in the code cited in I.C.11 and required of a new clean fuel in the test procedure cited in I.C.8, shall be conducted per Section XI of this protocol.

IV. *Emission Tests and Comparisons Required for Candidate Fuels*

A. Emission tests and comparisons shall be done on vehicles in the categories that exist on-road at the time of the testing or that are expected to exist at the time the candidate fuel would first be sold. The vehicle categories appropriate for inclusion in these fleets are defined in subsection VI.A.

B. Comparisons using the criterion in Section V. shall be made between emissions measured in tests using a test fuel representing the candidate fuel and emissions measured in tests using reference fuels.

C. The criterion in Section V. shall be applied separately to CO emissions, NOx emissions, the ozone-forming potential of exhaust NMOG emissions, and the combined potency-weighted emissions of toxic air contaminants. If the test fuel fails to meet the criterion in Section V. for any of these pollutants, the candidate fuel shall have failed the required demonstration.

V. *Criterion for Acceptable Emissions*

For each comparison required in Section IV., the upper confidence limit (UCL) for the estimated mean difference in emissions between fuels (test fuel vs. reference fuel) among all on-road vehicles in the tested categories, computed at the significance level of 0.15 for the one-sided t-statistic, shall be less than or equal to a tolerance fraction (δ) of the average emissions (E_c, in grams/mile) estimated for those on-road vehicles using their reference fuels. The estimate of emission difference shall be based on the emission measurements in the test fleet. In terms of parameters calculated per Section X., the criterion is expressed as:

$$UCL = D + t_{.15,nu} \times S.E. \leq \delta \times E_c$$

where D is the estimate of the mean difference in emissions between the fuels, and S.E. is the standard error for that estimate, calculated for nu degrees of freedom.

The values of δ shall be:

Pollutant Measure	*δ*
CO	0.040
NOx	0.020
grams ozone/mile	0.040
Potency-weighted sum of toxic emissions	0.040

VI. *Test Vehicles*

A. Vehicle Categories for Testing

1. Vehicle categories eligible for testing candidate fuels are listed in 2., 3. and 4., below. Only vehicles meeting all defining descriptors for a category are included in that category.

2. For testing a proposed substitute fuel in the low-emission vehicles certified on the primary designated clean fuel, eligible categories are:

Weight Class	*Model Year*	*Emission Std.*	*Cert. Fuel*	*Catalyst Type*
light-duty	1994 +	ULEV	p.d. clean *	any
"	"	LEV	"	"
"	"	TLEV	"	"
medium-duty	"	LEV or ULEV	"	"

* primary designated clean fuel

3. For testing a proposed substitute fuel in vehicles other than those certified on the primary designated clean fuel, eligible categories are:

Weight Class	*Model Year*	*Emission Std.*	*Cert. Fuel*	*Catalyst Type*
light-duty	"	ULEV	other **	"
"	"	LEV	"	"
"	"	TLEV	"	"
"	1990 +	not LEV	gasoline	"
"	1986-1990	any	"	3-way, closed-loop
"	1981-1985	"	"	"
"	1975-1980	"	"	oxidizing
"	pre-1975	"	"	none

medium-duty	1994	LEV or ULEV	other **	any
“	pre-1994	not LEV	gasoline	any
“	“	“	“	none

** any fuel other than the primary designated clean fuel

4. For testing a proposed new clean fuel, eligible categories are:

Weight Class	*Model Year*	*Emission Std.*	*Cert. Fuel*	*Catalyst Type*
light-duty	1994+	ULEV	any	any
“	“	LEV	“	“
“	“	TLEV	“	“
“	1990 +	not LEV	“	“
“	1986-1990	any	gasoline	3-way, closed-loop
“	1981-1985	“	“	“
“	1975-1980	“	“	oxidizing
“	pre-1975	“	“	none
medium-duty	1994+	LEV or ULEV	any	any
“	pre-1994	not LEV	gasoline	“
“	“	“	“	none

5. Within each eligible category, the only vehicles eligible for testing under this protocol shall be the vehicles that are reasonably capable of operating on the candidate fuel and for which the candidate fuel is not also the reference fuel.

6. The executive officer shall maintain estimates of the total emissions from, and total annual miles travelled by, vehicles in the state in each of the categories listed in 2., 3., and 4. above, assuming that all the vehicles receive their reference fuels all the time. These estimates shall be for the same time as, consistent with, and updated on the same schedule as the estimates of miles travelled that the executive officer uses to determine the required numbers of new retail outlets for clean fuels under paragraph (d)(2)of section 2305 and paragraph (e)(2)of section 2307, Subchapter 8, Title 13, California Code of Regulations.

7. Over all vehicles in the categories in subsection VI.A.2., 3., or 4., as limited by subsection VI.A.5., the executive officer shall sum the estimates of exhaust NMOG emissions and miles travelled in the state.

8. Each test fleet required by subsection IV.A. shall consist of each vehicle category contributing at least 3 percent of the sum of NMOG emissions described in subsection VI.A.7. or at least 5 percent of the sum of miles travelled described in that sub-section.

B. Number, Descriptions, and Preparation of Vehicles

1. Within each vehicle category to be tested per subsection VI.A.8., the emission comparisons described in subsection IV.B. shall be conducted in at least five vehicles. Over all categories tested, the total number of vehicles shall be at least 20. When, per subsection III. B., the vehicle categories for a substitute fuel are divided between two separate emission demonstrations, there shall be at least 10 vehicles in each demonstration.

2. Except in the case described in subsection VI.B.6., the group of vehicles within each test category shall meet these restrictions:

   (a) no two vehicles shall be the same model and model year.

   (b) not more than 20 percent shall have the same owner or the same manufacturer.

3. Except as provided in subsection VI.B.6., within each vehicle category, the test vehicles shall have distributions of engine displacement, types of fuel/air metering, catalyst technology, emission control system, and California vs. U.S. (49-state) certification that the executive officer deems are sufficiently representative of California's on-road fleet to make significant bias of the overall test results unlikely.

4. Except as provided in subsection VI.B.6, each vehicle used under this protocol shall have accumulated at least the following miles travelled:

Age of vehicle, as determined by model year	*Minimum miles travelled*
0 to 1	4,000
2 to 5	18,000
6 to 10	41,000
11 to 15	61,000
> 15	76,000

5. Each vehicle shall be tested in its as-received condition; except, any routine maintenance scheduled to occur per the manufacturer's recommendation may be performed.

6. The executive officer may relax for any vehicle category any requirement in this subsection VI.B if the applicant demonstrates that the requirement is unreasonably difficult to meet and if either:

   a) the requirement is unnecessary to provide a group of vehicles that reasonably represents the vehicle category, or

b) the category is TLEV, LEV, or ULEV.

7. Instead of following paragraphs 2 through 5 of this subsection B., the applicant may compose each category of test vehicles required by subsection VI.A.8. through random sampling of on-road vehicles. This option may be followed only after approval by the executive officer of the proposed sampling method as part of the plan described in section VII.

VII. *Test Plan*

A. The applicant shall submit to the executive office a test plan including the following information:

1. identification of properties of the fuel that affect exhaust emissions and would require specification in commercially available fuel; these shall include (but are not limited to) all properties for which the Air Resources Board has adopted specifications for fuel of the type of the candidate fuel;

2. identification of the appropriate form of specification for each property identified in VII.A.1.; each specification shall be of one of the following forms, as necessary to ensure that all candidate fuels made to the specification would not cause greater emissions of the pollutants addressed by the protocol than would the test gasoline:

(a) allowable value of property < [specified value]

(b) allowable value of property > [specified value]

(c) [specified value] < property < [specified value]

3. the engine families, model years, California or U.S. certification, and sources of vehicles with which the applicant proposes to satisfy subsection VI.B. (if the option in subsection VI.B.7 is not exercised);

4. if the option in subsection VI.B.7 is exercised, the method by which random sampling will be accomplished;

5. the identities of any contractors who will conduct emission tests or analyses of samples;

6. quality control provisions consistent with good laboratory procedures in testing for the emission levels expected to be encountered in the tests;

7. the number of emission tests (duplicates and replicates) to be run in each vehicle within each vehicle category;

8. an approximate description of the test fuel, including all properties described in subsection VII.A.1.;

9. a test method for determining the value of each property described in VII.A.1 that does not have a test method adopted by the Air Resources Board; and

10. a description of any statistical test by which the applicant would analyze individual test data to identify and discard statistical outliers.

B. ~~Except as provided in subsection VII.D, i~~If a specification is of the kind in subsection VII.A.2.(a) or (b), the value of [specified value] shall be the value measured for that property in the test fuel.

C. ~~Except as provided in subsection VII.D, i~~If a specification is of the kind in subsection VII.A.2.(c), the values of [specified value] shall be stated in the test plan.

~~D. The specifications approved for gasoline by the Board on November 22, 1991, may be proposed for a substitute fuel. In this case, the test fuel representing the candidate fuel shall be meet the specifications for certification gasoline in "California Exhaust Emission Standards and Test Procedures for 1988 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Trucks", paragraph 86.113-90, sub-paragraph (a)(1)(ii), approved by the Board on August 14, 1992.~~

~~E~~D. Unless the option in subsection VI.B.7 is exercised, after the executive officer's approval of the plan, the applicant shall specify to the executive officer the vehicle identification numbers of the vehicles to be tested. These numbers shall become part of the approved plan.

~~F~~E. After the executive officer's approval of the plan, the applicant shall supply measurements of the properties of the test fuel, including all properties described in subsection VII A.1.

~~G~~F. No datum shall be considered valid for the purpose of a demonstration controlled by this protocol unless that datum has been produced according to a plan approved by the executive officer before the datum has been taken.

~~H~~G. Except as provided by section IX., no demonstration shall be valid unless all data corresponding to an approved plan have been taken and included in the calculations prescribed in section X.

~~I~~H. Except as provided by section IX., deviations from an approved plan shall not be permitted except by the prior permission of the executive officer.

~~J~~I. No more than 20 working days after receiving a proposed test plan, the executive officer shall either inform the applicant that the plan is complete or advise the applicant of necessary additions or changes. No more than 15 working days after receiving requested additions or changes, the executive officer shall advise the applicant that the amended plan is complete or further advise the applicant of necessary additions or changes. No more than 20 working days after advising the applicant that a plan is complete, the executive officer shall either approve or reject the plan. A rejection shall be accompanied by specifications of deficiencies.

~~K~~J. The executive officer shall not approve a test plan unless he or she finds that it would produce a valid emission demonstration, as required by section III, by the procedures described in this protocol.

~~L~~K. If requested by the executive officer, the applicant shall supply a sample of the test fuel or of the reference fuel(s).

VIII. *Emission Testing Procedures*

A. All emission tests shall be done according to the "California Exhaust Emission Standards and Test Procedures for 1988 ~~through 2000~~ ~~and Subsequent~~ Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles", incorporated by reference in Title 13, California Code of Regulations, section 1960.1 or the "California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2009 through 2016 Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles," as applicable.

B. Within any vehicle category, the same number of replicate tests and the same number of duplicate tests within each replicate test shall be run on each test vehicle on both the reference fuel and the test fuel. The number of replicate tests and the number of duplicate tests shall be determined by the applicant (subject to approval as part of the test plan) and may vary among the vehicle categories.

C. The order in which fuels are tested in any vehicle shall be determined randomly.

D. Whenever the fuel to be tested in a vehicle differs from the current fuel in the vehicle, and whenever a replicate test is to be run, the test vehicle's fuel tank and fuel delivery system shall be drained of fuel to the extent that is practicable. The fuel tank shall then receive a 40 percent fill of the fuel to be tested. The vehicle shall then be run though one Highway Fuel Economy Driving Cycle (HFEDC) (40 Code of Federal Regulations, Part 600, Subpart B). The fuel tank and fuel delivery system shall again be drained, and the tank shall receive a 40 percent fill of the test fuel. Finally, the vehicle shall undergo another HFEDC and two consecutive LA4 cycles. The test vehicle shall not be operated again before the tests required in VIII.A. are run.

E. Pre-testing procedures alternative to subsection VIII.D. may be used if they are part of the approved plan described in section VII. Such alternatives may be approved only if judged by the executive officer to be equivalent or superior in achieving a valid test of the fuel under test.

F. In each test run, the NMOG emissions shall be speciated for determining the ozone-forming potential of the vehicle's exhaust. Species in the NMOG emissions shall be identified and quantified by the procedures in the "California Non-Methane Organic Gas Test Procedures," incorporated by reference in section 1961.2, title 13, California Code of Regulations. ~~(referred to in the "California Exhaust Emission Standards and Test Procedures for 1988 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles").~~ Exhaust emissions of benzene, 1-3 butadiene, formaldehyde, and acetaldehyde shall be identified and quantified using the procedures in the same document.

IX. *Exclusion of Data or Vehicles*

A. Any datum from an individual run may be excluded as an outlier relative to its duplicate data (or to its replicate data if replicates do not contain duplicate tests) if so indicated by a statistical test approved by the executive officer as part of the test plan. If an analysis is used to exclude one or more datum for a pollutant, the same analysis shall be applied to all data for that pollutant.

B. Any vehicle may be excluded from the test program if it cannot be tested safely. In such a case, a similar vehicle shall be tested.

C. No datum shall be used in an emission demonstration under this protocol if:

1. test procedures during the generation of the datum differed from the procedures required in section VIII.A., or

2. the datum was taken without adherence to the quality control requirements in the test plan, or

3. the vehicle used to generate the datum can be shown to have operated in a way different from the way it operated during other tests, and such a difference can reasonably be expected to affect emissions, or

4. either the testing equipment or the chemical analytical equipment can be shown to have functioned differently during the generation of the datum than during other tests, and such difference in function can reasonably be expected to affect emission measurements.

D. A datum deleted according to one of the disqualifying conditions in IX.C. shall be replaced by a new test unless the vehicle used to generate the datum is no longer in the possession of the applicant or the applicant's contractor or unless the vehicle has been used in ordinary service since testing was completed. However, if the original vehicle cannot be tested and the deletion of a datum leaves no data for a particular vehicle/fuel combination, a similar vehicle shall be obtained and all tests on the original vehicle shall be repeated with the replacement vehicle.

X. *Calculations*

A. Summary and Explanation of Calculations

This procedure calculates a statistical upper bound on the difference in average emissions per mile from the test fuel and from the reference fuel(s) for the relevant on-road vehicle fleet. The emissions of all the pollutants measured during testing are expressed in units of mass per mile. The calculation procedure is the same for all pollutants.

For each vehicle, the difference in emissions per mile is calculated as the average emissions per mile from tests with the test fuel minus the average emissions per mile from tests with the reference fuel, where the averages are over all data, whether duplicate test data or replicate test data.

Within each vehicle category, the difference in emissions between the two fuels is the mean value of the difference values among vehicles. Within each vehicle category, the standard deviation of the difference among vehicles is also calculated.

The expectation value of the relevant on-road vehicle fleet's average difference in emissions per mile is the weighted average of the differences in emissions among the vehicle categories. The weights used in the averaging are the estimates of total miles travelled by vehicles in the various categories.

Estimates of the standard error and degrees of freedom corresponding to the fleet average difference in emissions are calculated from the weights, the numbers of test vehicles in the categories, and the standard deviations within categories.

The upper bound on the average difference in emissions for the on-road fleet is calculated from the expectation value, the standard error, and the one-sided student-t value for the 0.15 significance level and the calculated degrees of freedom.

The tolerance value for the upper bound is a tolerance fraction times the weighted average value of the average emissions measured within vehicle categories on the reference fuel.

The type of statistical upper bound computed by this procedure is called an "upper confidence limit" in the statistical literature. Upper confidence limits for a statistical result have a high probability of exceeding the unknown true value of the quantity being measured. The probability is approximately 85 percent that the (unknown) true value of the mileage-weighted average difference of emissions per mile is less than its corresponding upper confidence limit. Consequently, if the true value of the difference in average emissions per mile is greater than the tolerance value, approximately 85 percent, or more, of all possible upper confidence limits will exceed this true value and therefore exceed the tolerance value. It follows that a candidate fuel with a true difference of emissions of a certain pollutant greater than the tolerance value will satisfy the criterion, and be accepted (with respect to that pollutant, only) as causing no increase in emissions, only about 15 percent of the time.

The upper confidence limits computed by this procedure are 85 percent one-sided upper confidence limits for a weighted average of normally distributed random variables. They are based on an approximate t- distribution. The degrees-of-freedom parameter of this distribution is calculated by Welch's approximation.

B. Test Run Results

1. Emission rates of CO, NOx, and NMOG, expressed as "g/mile", and the emission rate of each toxic pollutant, expressed as "mg/mile", shall be determined in each test by the procedure described in the "California Exhaust Emission Standards and Test Procedures for 1988 through 2000 ~~and Subsequent~~ Model Passenger Cars, Light-Duty Trucks, and Medium- Duty Vehicles" or the “California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2009 through 2016 Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles,” as applicable.

2. Values of ozone-forming potential, in "g ozone per mile", shall be determined for exhaust emissions in each test according to Appendix VIII of the regulation stated in subsection X.B.1, above.

3. In each test, the emission rate of each toxic pollutant shall be multiplied by its relative potency, as shown in the following table, and the four products shall be summed.

	Relative Potency
1,3-butadiene	1.0
benzene	0.17
formaldehyde	0.035
acetaldehyde	0.016

C. Upper Confidence Limit for Mean Emission Difference

1. The procedures in this section shall be followed for each test fleet required by section IV.A. The procedures shall be followed separately for CO, NOx, the ozone-forming potential of exhaust NMOG, and the combined potency-weighted toxic emissions.

2. For each vehicle, the results (g/mile for CO and NOx, g ozone/mile for the ozone-forming potential of NMOG, or mg/mile for combined potency-weighted toxic emissions) from all tests (whether duplicates or replicates) on the test fuel shall be averaged, as shall the results from all tests on the reference fuel. The average result when the vehicle is tested on the reference fuel shall be subtracted from the average when the vehicle is tested on the test fuel. The result of the subtraction is a difference value for the vehicle, d_v, for the pollutant measure.

3. Within each vehicle category, the mean value and squared standard deviation of mean difference values shall be calculated over all vehicles:

$m_{d,i}$ = mean value of d_v over all (n_i) vehicles in category i.

s_d^2 = square of standard deviation corresponding to $m_{d,i}$

= sum over vehicles of $\{(d_v - m_{d,i})^2/(n_i - 1)\}$

4. The population-weighted mean value of m_d shall be calculated over all tested vehicle categories:

D = Sum over all categories (i) of $\{m_{d,i} \times p_i\}$

where p_i is total miles travelled by on-road vehicles in vehicle category i divided by the sum of total miles travelled by on-road vehicles in all categories that have been tested within the fleet. The values of "p" shall be determined with the values of NMOG emissions and miles travelled described in subsections VI.A.6.

5. The standard error of the weighted mean emission difference shall be calculated from the standard deviations within emission categories:

S.E.^{2} = Sum over all categories (i) of $\{p_i^2 \times s_{d,i}^2/n_i\}$

where n_i is the number of test vehicles in category$_i$

6. The number of degrees of freedom associated with D shall be calculated as:

$$nu = \frac{(S.E.^2)^2}{Sum\ over\ all\ categories\ of\ \{p_i^4 \times s_{d.i}^4/[n_i^2 \times (n_i - 1)]\}}$$

7. The upper confidence limit for the population mean emission difference shall be calculated as:

UCL = D + $t_{.15,\,nu} \times$ S.E.

where t is the one-tailed "student's t" value for significance level (alpha) = .15 and degrees of freedom nu.

8. "t" shall be calculated as:

$$t_{.15,nu} = U + \frac{U^3 + U}{4 \times nu} + \frac{(5 \times U^5 + 16 \times U^3 + 3 \times U)}{(96 \times nu)}$$

where $U = 1.036$

D. Emissions from the Use of Reference Fuel

1. Within each test vehicle category, the average of all emission results (mass/mile) when the reference fuel is used, as described in X.B.2, shall be averaged over all vehicles. The result, $e_{c,i}$, is the emission rate for category i.

2. The estimate of the relevant on-road fleet emissions from the use reference fuel shall be the weighted sum over categories of $e_{c,i}$, using the same weights, p_i, as in the calculation of D.

E_c = sum over all categories (i) of $\{p_i - e_{c,i}\}$

XI. *Demonstration Regarding Durability*

A. The applicant shall satisfy the requirements of paragraph (a)(3)(C), section 2317, Subchapter 8, Title 13 of the California Code of Regulations or paragraph (a)(2), section 12 of the "California Exhaust Emission Standards and Test Procedures for 1988 <u>through 2000</u> ~~and Subsequent~~ Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Trucks" <u>or Part II, section 100.3.9 of the “California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2009 through 2016 Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles,” as applicable,</u> (<u>all</u> ~~both~~ concerning deterioration of emission control), whichever applies, by the procedures in this section.

B. If the applicant demonstrates to the executive officer that the candidate fuel is substantially similar to an existing in-use or certification fuel for motor vehicles, with regard to properties that may affect the durability of emission controls, the candidate fuel shall be deemed to not increase deterioration.

C. If the demonstration of substantial similarity described in XI.B. cannot be made, the applicant shall provide to the executive officer all information available to the applicant related to the possible effects of the candidate fuel and its constituents upon the durability of the emission controls in the vehicles that could use the candidate fuel. If this information is reasonably complete and does not indicate that the candidate fuel would increase deterioration of emission controls, the candidate fuel shall be deemed to not increase deterioration.

D. If the available information for the candidate fuel does not allow a conclusion that no increase in deterioration of the emission control system is likely to occur, or if the information indicates a potential for other undesirable effects, satisfaction of the regulations cited in XI.A. shall require address of the shortcomings by further information. Such information shall be developed according to a plan, described in XI.E., that shall be approved by the executive officer before its implementation.

E. The plan referred to in XI.D. may include, but is not limited, to the following:

-- emission testing

-- 50,000-mile durability testing with emission tests every 5,000 miles

-- bench tests, including immersion tests and vapor tests for a variety of automotive materials and components

-- recommendations on statistical tests to be applied to data

F. Upon receipt of the information in the plan, the executive officer shall determine whether or not an increase in deterioration of emission control systems is likely to occur.

G. If excessive deterioration of emission control systems from the use of an approved substitute fuel or new clean fuel becomes apparent, any person may submit a petition, accompanied by supportive data, for a hearing by the executive officer to reconsider the approval of the fuel. The executive officer may hold a hearing after notification of all interested parties.

H. As a result of findings from a hearing described in XI.G., the executive officer may require the original applicant to do additional testing of the approved fuel, per a plan to be approved by the executive officer, or rescind the approval for fuel.

I. After 180 days from the date of an executive order rescinding approval for a fuel per XI.H., no person shall sell that fuel for use in California, unless a new approval has been obtained under this protocol. By the first day of the month that is 19 calendar months after the month of the executive order, all owners of retail gasoline outlets who had complied with Subchapter 8, Chapter 3, Title 13, California Code of Regulations by using the fuel as a substitute fuel shall reach and maintain compliance with that regulation. Between the date of the executive order and the first day of the calendar month that is 19 months after the month of the executive order, the number of primary designated clean fuel outlets calculated for a major gasoline supplier according to section 2305(c), Title 13 CCR, or calculated for a owner/lessor according to section 2307(d), Title 13 CCR, shall be reduced by the number of outlets in which the major gasoline supplier or owner/lessor offered the substitute fuel to comply with section 2301 or 2302, Title 13 CCR. During that period, no gasoline service station that had offered the substitute fuel shall be a selected retail clean fuel outlet of the primary designated clean fuel for the purposes of subchapter 8, Title 13 CCR.

XII. *Submission of Results*

By means agreed upon by the executive officer and the applicant, the applicant shall submit documentation of adherence to the plan described in section VII. and to the procedures specified in section VIII., the calculations required in section X., any outlier analyses conducted per paragraph IX.A., the output from all test runs, all speciations of NMOG, and the information required by section XI.

XIII. *Approval of Candidate Fuels*

A. No more than 20 working days after receiving the information described in section XII., the executive officer shall either inform the applicant that the information is complete or advise the applicant of necessary additions or changes. No more than 15 working days after receiving requested additions or changes, the executive officer shall advise the applicant that the amended information is complete or further advise the applicant of necessary additions or changes. No more than 20 working days after advising the applicant that the information is complete, the executive officer shall deem the demonstrations required by section III either to be accomplished or not accomplished. A rejection shall be accompanied by specifications of deficiencies.

B. If the executive officer determines that an applicant has accomplished the required demonstration, the executive officer shall approve the candidate fuel. The executive officer shall include in the approval order specifications on properties according to subsections VII.A.1., VII.B., and VII.C. The executive officer shall notify interested parties of the approval within 10 working days of issuing the order.

C. An approval shall be in force for five years, at which time the reapproval process in section XIV shall be followed.

XIV. *Periodic Reapproval*

A. Every five years after the initial approval of a candidate fuel, test data shall be provided for any vehicle category previously exempted from testing pursuant to section VI.A.8. if the exempting criteria (less than 3 percent of emissions and less than 5 percent of miles travelled) are no longer met. Test data shall also be provided for any previously tested vehicle category for which the executive office determines that the vehicles tested no longer provide a reasonable representation of the on-road vehicles in that category.

B. Every five years, the upper confidence limit specified in subsection X.C. and the emissions from the use of reference fuel specified in subsection X.D. shall be re-calculated for the test fleets required by subsections VI.A.8. The calculations shall use the original test data, any new test data provided pursuant to subsection XIV.A. or XV.A., and the current statistical weights (p) as described in subsection X.C.4. If the upper confidence level exceeds the criterion in section V. for any pollutant, approval for the fuel shall be rescinded.

C. After January 1 of the year that is three calendar years after the year of the executive order rescinding approval for a fuel under this section, no person shall sell that fuel for use in California, unless a new approval has been obtained under this protocol.

XV. *Augmentation of the Original Test Data*

A. An applicant who made the petition that led to the approval may augment any portion of the information in the original test plan or the submission required in section XII. All new information shall be developed according to this test protocol.

B. If new information or proposed changes are submitted, the executive officer shall evaluate and either accept or reject them by standards consistent with the requirements in this procedure for the original approval.

ATTACHMENT A-13

State of California
California Environmental Protection Agency
AIR RESOURCES BOARD
Stationary Source Division

CALIFORNIA TEST PROCEDURES FOR EVALUATING SUBSTITUTE FUELS AND NEW CLEAN FUELS IN 2015 AND SUBSEQUENT YEARS

Adopted: March 22, 2012

Note: Although this is a newly proposed document, changes to this document compared to the current "California Test Procedures for Evaluating Substitute Fuels and New Clean Fuels" are shown in underline to indicate additions and ~~strikeout~~ to indicate deletions compared to the test procedures as adopted November 2, 1993.

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CALIFORNIA TEST PROCEDURES FOR EVALUATING SUBSTITUTE FUELS AND NEW CLEAN FUELS <u>IN 2015 AND SUBSEQUENT YEARS</u>

I. *Introduction*

A. Purpose and Applicability of this Protocol

1. The test procedures and analyses prescribed in this document ("test protocol") shall be used to evaluate, in terms of emissions and in terms of durability of emission control systems, (i) any fuel proposed as a substitute for a clean fuel or (ii) any fuel proposed as a new clean fuel if that fuel could be used in existing vehicles certified on another fuel. (The term "candidate fuel" is used herein to refer to either a substitute or new clean fuel.) Specifications for the properties of fuels approved for use in motor vehicles under this protocol shall be set according to this protocol.

2. The pollutant measures addressed by this protocol are carbon monoxide emissions (CO, g~~m~~/mile), oxides of nitrogen emissions (NOx, g~~m~~/mile), the ozone forming potential of exhaust NMOG emissions (g~~m~~ ozone/mile), and the combined potency-weighted emissions of toxic air contaminants in the exhaust (mg/mile).

B. Synopsis of this Protocol

The candidate fuel is represented by a test fuel. The on-road fleet of vehicles capable of using the candidate fuel (but not already using it) is represented by either one test fleet in the case of a new clean fuel or two test fleets in the case of a substitute fuel. Each test fleet is composed of vehicle categories distinguished by emission control technology, emission standards, and certification fuel.

For each test vehicle, the difference in emissions between the test fuel and the vehicle's certification fuel (test fuel emissions minus certification fuel emissions, in grams/mile) is computed from test data. This difference is averaged over all vehicles within each vehicle category. These average differences by category are combined into a mileage-weighted mean that serves as an estimate of the difference in average emissions per mile between the test and certification fuels in the relevant on-road vehicle fleet. A statistical upper bound for this mileage-weighted estimate is computed at the 85 percent confidence level. A mileage-weighted estimate of average emissions per mile from the certification fuels among the on-road vehicle fleet is also computed, using the same weights.

For each pollutant, the statistical upper bound for the average difference in emissions is compared to a "tolerance" fraction of the average emissions of that pollutant from the certification fuels. If the statistical upper bound is the greater of these two numbers for any pollutant, the candidate fuel cannot be approved.

C. Definitions

1. “Applicant” means the entity that seeks approval of a candidate fuel and is responsible for the demonstration described in section III.

2. “Board” means the Air Resources Board.

3. “Candidate fuel” means a fuel proposed as a substitute fuel or as a new clean fuel.

4. “CCR” means California Code of Regulations.

5. "Duplicate test" means an emission test run on a particular vehicle and a particular fuel as a repetition of the preceding test on the same vehicle and fuel, without draining and re-filling the fuel tank and without conducting pre-test dynamometer cycles, as described in VIII.D, between the tests.

6. "Executive officer" means the Executive Officer of the Air Resources Board.

7. “Light-Duty Test Procedures” means the “California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2009 through 2016 Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles” or the “California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles,” incorporated by reference in section 1961 and 1961.2, title 13, CCR, respectively, as applicable.

~~7~~8. "LDV" means light-duty vehicle, "MDV" means medium-duty vehicle, ~~"TLEV" means transitional low-emission vehicle, "LEV" means low- emission vehicle, and "ULEV" means ultra-low emission vehicle, all as defined in subchapter 9, Title 13, California Code of Regulations.~~ In this protocol, "low-emission vehicle" includes all vehicles certifying to the California LEV II and LEV III standards, set forth in sections 1961 and 1961,2, title 13, CCR. ~~LEVs, TLEVs, and ULEVs.~~

~~8~~9. "New clean fuel" means a fuel proposed for certifying new low-emission vehicles, as described in Part II of the applicable Light-Duty Test Procedures ~~section 12 of the "California Exhaust Emission Standards and Test Procedures for 1988 and Subsequent Model Passenger Cars, Light Duty Trucks, and Medium-Duty Vehicles"~~.

~~9~~10. "Primary designated clean fuel" means the designated clean fuel for which the substitute fuel under consideration has been proposed pursuant to section 2317 in subchapter 8, title 13, CCR ~~California Code of Regulations~~.

~~4~~11. “Reference fuel” means, for a particular vehicle, a fuel meeting the same specifications in the Light-Duty Test Procedures ~~“California Exhaust Emission Standards and Test Procedures for 1988 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Trucks” (herein, “1988 Standards and Procedures”)~~ as did the fuel that was used to certify the vehicle (certification fuel).

~~However, if the fuel used to certify a vehicle was gasoline meeting specifications in the 1988 Standards and Procedures as last revised July 12, 1991 (or gasoline as specified by earlier documents), "reference fuel" means a gasoline meeting the specifications, for vehicle-certifying gasoline, approved by the Board on August 14, 1992 and corresponding to the commercial gasoline standards approved by the Board on November 22, 1991.~~

For a low emission vehicle that was certified on both gasoline and another fuel, "reference fuel" means gasoline, unless the candidate fuel is a proposed substitute fuel and the other certification fuel is the primary designated clean fuel. In that case, "reference fuel" means the primary designated clean fuel.

1~~0~~2. "Replicate test" means an emission test or a set of duplicate tests run on a particular vehicle and a particular fuel as a repetition of another test or set of tests on the same vehicle and fuel, with draining and re-filling the fuel tank and with conducting pre-test dynamometer cycles, as described in VIII.D., between the tests or sets of tests.

1~~1~~3. "Substitute fuel" means a fuel used in accordance with section 2317 in subchapter 8, chapter 3, title 13, CCR ~~California Code of Regulations~~.

1~~2~~3. "Test fuel" means the particular batch of fuel representing a candidate fuel in the emission demonstration required for approval of the candidate fuel.

1~~3~~4. "Toxic air contaminant" means benzene, 1,3-butadiene, formaldehyde, or acetaldehyde.

II. *Minimal Requirements for a Candidate Fuel*

A. A candidate fuel must meet all standards enforced by the Board for the kind of fuel.

III. *Demonstrations Required for a Candidate Fuel*

A. The demonstration of no increase in emissions from the use of a candidate fuel, required of a substitute fuel in the code cited in I.C.1~~1~~3 and required of a new clean fuel in the test procedure cited in I.C.~~8~~9, shall consist of emission tests on a test fuel whose properties identified per the test plan have been accurately measured. Comparisons of the results of these tests with the results of tests on the pertinent reference fuel(s) must satisfy the criterion in section V.

B. For a proposed substitute fuel, separate demonstrations of no increase in emissions shall be made for (i) the low-emission vehicles that have been certified on the primary designated clean fuel and (ii) all other types of vehicle that could use the candidate fuel. For a proposed new clean fuel, the demonstration of no increase in emissions shall encompass all vehicles capable of using the candidate fuel.

C. The demonstration of no increase in deterioration of vehicles' emission control system, required of a substitute fuel in the code cited in I.C.1~~1~~3 and required of a new clean fuel in the test procedure cited in I.C.~~8~~9, shall be conducted per section XI of this protocol.

IV. *Emission Tests and Comparisons Required for Candidate Fuels*

A. Emission tests and comparisons shall be done on vehicles in the categories that exist on-road at the time of the testing or that are expected to exist at the time the candidate fuel would first be sold. The vehicle categories appropriate for inclusion in these fleets are defined in subsection VI.A.

B. Comparisons using the criterion in section V shall be made between emissions measured in tests using a test fuel representing the candidate fuel and emissions measured in tests using reference fuels.

C. The criterion in section V shall be applied separately to CO emissions, NOx emissions, the ozone-forming potential of exhaust NMOG emissions, and the combined potency-weighted emissions of toxic air contaminants. If the test fuel fails to meet the criterion in section V for any of these pollutants, the candidate fuel shall have failed the required demonstration.

V. *Criterion for Acceptable Emissions*

For each comparison required in section IV, the upper confidence limit (UCL) for the estimated mean difference in emissions between fuels (test fuel vs. reference fuel) among all on-road vehicles in the tested categories, computed at the significance level of 0.15 for the one-sided t-statistic, shall be less than or equal to a tolerance fraction (δ) of the average emissions (E_c, in grams/mile) estimated for those on-road vehicles using their reference fuels. The estimate of emission difference shall be based on the emission measurements in the test fleet. In terms of parameters calculated per section X, the criterion is expressed as:

$$UCL = D + t_{.15,nu} \times S.E. \leq \delta \times E_c$$

where D is the estimate of the mean difference in emissions between the fuels, and $S.E.$ is the standard error for that estimate, calculated for nu degrees of freedom.

The values of δ shall be:

Pollutant Measure	*δ*
CO	0.040
NOx	0.020
grams ozone/mile	0.040
Potency-weighted sum of toxic emissions	0.040

VI. *Test Vehicles*

A. Vehicle Categories for Testing

1. Vehicle categories eligible for testing candidate fuels are only those categories subject to the LEV II and LEV III emissions standards set forth in the applicable Light-Duty Test Proceures. ~~listed in 2, 3, and 4, below. Only vehicles meeting all defining descriptors for a category are included in that category.~~

~~2. For testing a proposed substitute fuel in the low-emission vehicles certified on the primary designated clean fuel, eligible categories are:~~

~~*Weight Class*~~	~~*Model Year*~~	~~*Emission Std.*~~	~~*Cert. Fuel*~~	~~*Catalyst Type*~~
~~light-duty~~	~~1994 +~~	~~ULEV~~	~~p.d. clean *~~	~~any~~
~~“~~	~~“~~	~~LEV~~	~~“~~	~~“~~
~~“~~	~~“~~	~~TLEV~~	~~“~~	~~“~~
~~medium-duty~~	~~“~~	~~LEV or ULEV~~	~~“~~	~~“~~

~~* primary designated clean fuel~~

~~3. For testing a proposed substitute fuel in vehicles other than those certified on the primary designated clean fuel, eligible categories are:~~

~~*Weight Class*~~	~~*Model Year*~~	~~*Emission Std.*~~	~~*Cert. Fuel*~~	~~*Catalyst Type*~~
~~light-duty~~	~~“~~	~~ULEV~~	~~other **~~	~~“~~
~~“~~	~~“~~	~~LEV~~	~~“~~	~~“~~
~~“~~	~~“~~	~~TLEV~~	~~“~~	~~“~~

~~"~~	~~1990 +~~	~~not LEV~~	~~gasoline~~	~~"~~
~~"~~	~~1986-1990~~	~~any~~	~~"~~	~~3-way, closed-loop~~
~~"~~	~~1981-1985~~	~~"~~	~~"~~	~~"~~
~~"~~	~~1975-1980~~	~~"~~	~~"~~	~~oxidizing~~
~~"~~	~~pre-1975~~	~~"~~	~~"~~	~~none~~
~~medium-duty~~	~~1994~~	~~LEV or ULEV~~	~~other **~~	~~any~~
~~"~~	~~pre-1994~~	~~not LEV~~	~~gasoline~~	~~any~~
~~"~~	~~"~~	~~"~~	~~"~~	~~none~~

~~** any fuel other than the primary designated clean fuel~~

~~4. For testing a proposed new clean fuel, eligible categories are:~~

~~*Weight Class*~~	~~*Model Year*~~	~~*Emission Std.*~~	~~*Cert. Fuel*~~	~~*Catalyst Type*~~
~~light-duty~~	~~1994+~~	~~ULEV~~	~~any~~	~~any~~
~~"~~	~~"~~	~~LEV~~	~~"~~	~~"~~
~~"~~	~~"~~	~~TLEV~~	~~"~~	~~"~~
~~"~~	~~1990 +~~	~~not LEV~~	~~"~~	~~"~~
~~"~~	~~1986-1990~~	~~any~~	~~gasoline~~	~~3-way, closed-loop~~
~~"~~	~~1981-1985~~	~~"~~	~~"~~	~~"~~
~~"~~	~~1975-1980~~	~~"~~	~~"~~	~~oxidizing~~
~~"~~	~~pre-1975~~	~~"~~	~~"~~	~~none~~
~~medium-duty~~	~~1994+~~	~~LEV or ULEV~~	~~any~~	~~any~~
~~"~~	~~pre-1994~~	~~not LEV~~	~~gasoline~~	~~"~~
~~"~~	~~"~~	~~"~~	~~"~~	~~none~~

~~5~~2. Within each eligible category, the only vehicles eligible for testing under this protocol shall be the vehicles that are reasonably capable of operating on the candidate fuel and for which the candidate fuel is not also the reference fuel.

~~6~~3. The Executive Officer shall maintain estimates of the total emissions from, and total annual miles travelled by, vehicles in the state in each of the LEV II and LEV III ~~categories listed in 2, 3, and 4, above~~, assuming that all the vehicles receive their reference fuels all the time. These estimates shall be for the same time as, consistent with, and updated on the same schedule as the estimates of miles travelled that the Executive Officer uses to determine the required numbers of new retail outlets for clean fuels under paragraph (d)(2)of section 2305 and paragraph (e)(2)of section 2307, Subchapter 8, Title 13, CCR ~~California Code of Regulations~~.

~~7~~4. ~~Over all vehicles in the categories in subsection VI.A.2, 3, or 4, as limited by subsection VI.A.5, t~~The Executive Officer shall sum the estimates of exhaust NMOG emissions and miles travelled in the state over all eligible vehicle categories.

~~8~~5. Each test fleet ~~required by subsection IV.A~~ shall consist of each vehicle category contributing at least 3 percent of the sum of NMOG emissions described in subsection VI.A.~~7~~4 or at least 5 percent of the sum of miles travelled described in that sub-section.

B. Number, Descriptions, and Preparation of Vehicles

1. Within each vehicle category to be tested per subsection VI.A.~~8~~5, the emission comparisons described in subsection IV.B shall be conducted in at least five vehicles. Over all categories tested, the total number of vehicles shall be at least 20. When, per subsection III.B, the vehicle categories for a substitute fuel are divided between two separate emission demonstrations, there shall be at least 10 vehicles in each demonstration.

2. Except in the case described in subsection VI.B.6, the group of vehicles within each test category shall meet these restrictions:

   (a) no two vehicles shall be the same model and model year.

   (b) not more than 20 percent shall have the same owner or the same manufacturer.

3. Except as provided in subsection VI.B.6, within each vehicle category, the test vehicles shall have distributions of engine displacement, types of fuel/air metering, catalyst technology, emission control system, and California vs. U.S. (49-state) certification that the Executive Officer deems are sufficiently representative of California's on-road fleet to make significant bias of the overall test results unlikely.

4. Except as provided in subsection VI.B.6, each vehicle used under this protocol shall have accumulated at least the following miles travelled:

Age of vehicle, as determined by model year	*Minimum miles travelled*
0 to 1	4,000
2 to 5	18,000
6 to 10	41,000
11 to 15	61,000
> 15	76,000

5. Each vehicle shall be tested in its as-received condition; except, any routine maintenance scheduled to occur per the manufacturer's recommendation may be performed.

6. The Executive Officer may relax for any vehicle category any requirement in this subsection VI.B if the applicant demonstrates that the requirement is unreasonably difficult to meet and if ~~either:~~

   ~~a)~~ the requirement is unnecessary to provide a group of vehicles that reasonably represents the vehicle category~~, or~~

   ~~b) the category is TLEV, LEV, or ULEV~~.

7. Instead of following paragraphs 2 through 5 of this subsection B, the applicant may compose each category of test vehicles required by subsection VI.A.~~8~~5 through random sampling of on-road vehicles. This option may be followed only after approval by the Executive Officer of the proposed sampling method as part of the plan described in section VII.

VII. *Test Plan*

A. The applicant shall submit to the Executive Office a test plan including the following information:

1. identification of properties of the fuel that affect exhaust emissions and would require specification in commercially available fuel; these shall include (but are not limited to) all properties for which the Air Resources Board has adopted specifications for fuel of the type of the candidate fuel;

2. identification of the appropriate form of specification for each property identified in VII.A.1; each specification shall be of one of the following forms, as necessary to ensure that all candidate fuels made to the specification would not cause greater emissions of the pollutants addressed by the protocol than would the test gasoline:

   (a) allowable value of property < [specified value]

   (b) allowable value of property > [specified value]

   (c) [specified value] < property < [specified value]

3. the engine families, model years, California or U.S. certification, and sources of vehicles with which the applicant proposes to satisfy subsection VI.B (if the option in subsection VI.B.7 is not exercised);

4. if the option in subsection VI.B.7 is exercised, the method by which random sampling will be accomplished;

5. the identities of any contractors who will conduct emission tests or analyses of samples;

6. quality control provisions consistent with good laboratory procedures in testing for the emission levels expected to be encountered in the tests;

7. the number of emission tests (duplicates and replicates) to be run in each vehicle within each vehicle category;

8. an approximate description of the test fuel, including all properties described in subsection VII.A.1;

9. a test method for determining the value of each property described in VII.A.1 that does not have a test method adopted by the Air Resources Board; and

10. a description of any statistical test by which the applicant would analyze individual test data to identify and discard statistical outliers.

B. ~~Except as provided in subsection VII.D, i~~If a specification is of the kind in subsection VII.A.2(a) or (b), the value of [specified value] shall be the value measured for that property in the test fuel.

C. ~~Except as provided in subsection VII.D, i~~If a specification is of the kind in subsection VII.A.2(c), the values of [specified value] shall be stated in the test plan.

~~D. The specifications approved for gasoline by the Board on November 22, 1991, may be proposed for a substitute fuel. In this case, the test fuel representing the candidate fuel shall be meet the specifications for certification gasoline in "California Exhaust Emission Standards and Test Procedures for 1988 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Trucks", paragraph 86.113-90, sub-paragraph (a)(1)(ii), approved by the Board on August 14, 1992.~~

~~E~~D. Unless the option in subsection VI.B.7 is exercised, after the Executive Officer's approval of the plan, the applicant shall specify to the Executive Officer the vehicle identification numbers of the vehicles to be tested. These numbers shall become part of the approved plan.

~~F~~E. After the Executive Officer's approval of the plan, the applicant shall supply measurements of the properties of the test fuel, including all properties described in subsection VII A.1.

~~G~~F. No datum shall be considered valid for the purpose of a demonstration controlled by this protocol unless that datum has been produced according to a plan approved by the Executive Officer before the datum has been taken.

~~H~~G. Except as provided by section IX, no demonstration shall be valid unless all data corresponding to an approved plan have been taken and included in the calculations prescribed in section X.

~~I~~H. Except as provided by section IX, deviations from an approved plan shall not be permitted except by the prior permission of the Executive Officer.

~~J~~I. No more than 20 working days after receiving a proposed test plan, the Executive Officer shall either inform the applicant that the plan is complete or advise the applicant of necessary additions or changes. No more than 15 working days after receiving requested additions or changes, the Executive Officer shall advise the applicant that the amended plan is complete or further advise the applicant of necessary additions or changes. No more than 20 working days after advising the applicant that a plan is complete, the Executive Officer shall either approve or reject the plan. A rejection shall be accompanied by specifications of deficiencies.

K. The Executive Officer shall not approve a test plan unless he or she finds that it would produce a valid emission demonstration, as required by section III, by the procedures described in this protocol.

L. If requested by the Executive Officer, the applicant shall supply a sample of the test fuel or of the reference fuel(s).

VIII. *Emission Testing Procedures*

A. All emission tests shall be done according to the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for ~~1988 and Subsequent Model~~ Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles", incorporated by reference in Title 13, CCR ~~California Code of Regulations~~, section ~~1960.1~~ 1961.2.

B. Within any vehicle category, the same number of replicate tests and the same number of duplicate tests within each replicate test shall be run on each test vehicle on both the reference fuel and the test fuel. The number of replicate tests and the number of duplicate tests shall be determined by the applicant (subject to approval as part of the test plan) and may vary among the vehicle categories.

C. The order in which fuels are tested in any vehicle shall be determined randomly.

D. Whenever the fuel to be tested in a vehicle differs from the current fuel in the vehicle, and whenever a replicate test is to be run, the test vehicle's fuel tank and fuel delivery system shall be drained of fuel to the extent that is practicable. The fuel tank shall then receive a 40 percent fill of the fuel to be tested. The vehicle shall then be run though one Highway Fuel Economy Driving Cycle (HFEDC) (40 Code of Federal Regulations, Part 600, Subpart B). The fuel tank and fuel delivery system shall again be drained, and the tank shall receive a 40 percent fill of the test fuel. Finally, the vehicle shall undergo another HFEDC and two consecutive LA4 cycles. The test vehicle shall not be operated again before the tests required in VIII.A are run.

E. Pre-testing procedures alternative to subsection VIII.D may be used if they are part of the approved plan described in section VII. Such alternatives may be approved only if judged by the Executive Officer to be equivalent or superior in achieving a valid test of the fuel under test.

F. In each test run, the NMOG emissions shall be speciated for determining the ozone-forming potential of the vehicle's exhaust. Species in the NMOG emissions shall be identified and quantified by the procedures in the "California Non-Methane Organic Gas Test Procedures," incorporated by reference in section 1961.2, title 13, CCR. ~~(referred to in the "California Exhaust Emission Standards and Test Procedures for 1988 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles").~~ Exhaust emissions of benzene, 1-3 butadiene, formaldehyde, and acetaldehyde shall be identified and quantified using the procedures in the same document.

IX. *Exclusion of Data or Vehicles*

A. Any datum from an individual run may be excluded as an outlier relative to its duplicate data (or to its replicate data if replicates do not contain duplicate tests) if so indicated by a statistical test approved by the Executive Officer as part of the test plan. If an analysis is used to exclude one or more datum for a pollutant, the same analysis shall be applied to all data for that pollutant.

B. Any vehicle may be excluded from the test program if it cannot be tested safely. In such a case, a similar vehicle shall be tested.

C. No datum shall be used in an emission demonstration under this protocol if:

1. test procedures during the generation of the datum differed from the procedures required in section VIII.A, or

2. the datum was taken without adherence to the quality control requirements in the test plan, or

3. the vehicle used to generate the datum can be shown to have operated in a way different from the way it operated during other tests, and such a difference can reasonably be expected to affect emissions, or

4. either the testing equipment or the chemical analytical equipment can be shown to have functioned differently during the generation of the datum than during other tests, and such difference in function can reasonably be expected to affect emission measurements.

D. A datum deleted according to one of the disqualifying conditions in IX.C shall be replaced by a new test unless the vehicle used to generate the datum is no longer in the possession of the applicant or the applicant's contractor or unless the vehicle has been used in ordinary service since testing was completed.

However, if the original vehicle cannot be tested and the deletion of a datum leaves no data for a particular vehicle/fuel combination, a similar vehicle shall be obtained and all tests on the original vehicle shall be repeated with the replacement vehicle.

X. *Calculations*

A. Summary and Explanation of Calculations

This procedure calculates a statistical upper bound on the difference in average emissions per mile from the test fuel and from the reference fuel(s) for the relevant on-road vehicle fleet. The emissions of all the pollutants measured during testing are expressed in units of mass per mile. The calculation procedure is the same for all pollutants.

For each vehicle, the difference in emissions per mile is calculated as the average emissions per mile from tests with the test fuel minus the average emissions per mile from tests with the reference fuel, where the averages are over all data, whether duplicate test data or replicate test data.

Within each vehicle category, the difference in emissions between the two fuels is the mean value of the difference values among vehicles. Within each vehicle category, the standard deviation of the difference among vehicles is also calculated.

The expectation value of the relevant on-road vehicle fleet's average difference in emissions per mile is the weighted average of the differences in emissions among the vehicle categories. The weights used in the averaging are the estimates of total miles travelled by vehicles in the various categories.

Estimates of the standard error and degrees of freedom corresponding to the fleet average difference in emissions are calculated from the weights, the numbers of test vehicles in the categories, and the standard deviations within categories.

The upper bound on the average difference in emissions for the on-road fleet is calculated from the expectation value, the standard error, and the one-sided student-t value for the 0.15 significance level and the calculated degrees of freedom.

The tolerance value for the upper bound is a tolerance fraction times the weighted average value of the average emissions measured within vehicle categories on the reference fuel.

The type of statistical upper bound computed by this procedure is called an "upper confidence limit" in the statistical literature. Upper confidence limits for a statistical result have a high probability of exceeding the unknown true value of the quantity being measured. The probability is approximately 85 percent that the (unknown) true value of the mileage-weighted average difference of emissions per mile is less than its corresponding upper confidence limit. Consequently, if the true value of the difference in average emissions per mile is greater than the tolerance value, approximately 85 percent, or more, of all possible upper confidence limits will exceed this true value and therefore exceed the tolerance value. It follows that a candidate fuel with a true difference of emissions of a certain pollutant greater than the tolerance value will satisfy the criterion, and be accepted (with respect to that pollutant, only) as causing no increase in emissions, only about 15 percent of the time.

The upper confidence limits computed by this procedure are 85 percent one-sided upper confidence limits for a weighted average of normally distributed random variables. They are based on an approximate t- distribution. The degrees-of-freedom parameter of this distribution is calculated by Welch's approximation.

B. Test Run Results

1. Emission rates of CO, NOx, and NMOG, expressed as "g/mile", and the emission rate of each toxic pollutant, expressed as "mg/mile", shall be determined in each test by the procedure described in the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for ~~1988 and Subsequent Model~~ Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles".

2. Values of ozone-forming potential, in "g ozone per mile", shall be determined for exhaust emissions in each test according to Appendix VIII of the regulation stated in subsection X.B.1, above.

3. In each test, the emission rate of each toxic pollutant shall be multiplied by its relative potency, as shown in the following table, and the four products shall be summed.

	Relative Potency
1,3-butadiene	1.0
benzene	0.17
formaldehyde	0.035
acetaldehyde	0.016

C. Upper Confidence Limit for Mean Emission Difference

1. The procedures in this section shall be followed for each test fleet required by section IV.A. The procedures shall be followed separately for CO,

NOx, the ozone-forming potential of exhaust NMOG, and the combined potency-weighted toxic emissions.

2. For each vehicle, the results (g/mile for CO and NOx, g ozone/mile for the ozone-forming potential of NMOG, or mg/mile for combined potency-weighted toxic emissions) from all tests (whether duplicates or replicates) on the test fuel shall be averaged, as shall the results from all tests on the reference fuel. The average result when the vehicle is tested on the reference fuel shall be subtracted from the average when the vehicle is tested on the test fuel. The result of the subtraction is a difference value for the vehicle, d_v, for the pollutant measure.

3. Within each vehicle category, the mean value and squared standard deviation of mean difference values shall be calculated over all vehicles:

$m_{d,i}$ = mean value of d_v over all (n_i) vehicles in category i.

s_d^2 = square of standard deviation corresponding to $m_{d,i}$

= sum over vehicles of $\{(d_v - m_{d,i})^2/(n_i - 1)\}$

4. The population-weighted mean value of m_d shall be calculated over all tested vehicle categories:

D = Sum over all categories (i) of $\{m_{d,i} \times p_i\}$

where p_i is total miles travelled by on-road vehicles in vehicle category i divided by the sum of total miles travelled by on-road vehicles in all categories that have been tested within the fleet. The values of "p" shall be determined with the values of NMOG emissions and miles travelled described in subsections VI.A.~~6~~3.

5. The standard error of the weighted mean emission difference shall be calculated from the standard deviations within emission categories:

S.E.^{2} = Sum over all categories (i) of $\{p_i^2 \times s_{d,i}^2/n_i\}$

where n_i is the number of test vehicles in category$_i$

6. The number of degrees of freedom associated with D shall be calculated as:

$$nu = \frac{(S.E.^2)^2}{Sum\ over\ all\ categories\ of\ \{p_i^4 \times s_{d.i}^4/[n_i^2 \times (n_i - 1)]\}}$$

7. The upper confidence limit for the population mean emission difference shall be calculated as:

$$UCL = D + t_{.15,\, nu} \times S.E.$$

where t is the one-tailed "student's t" value for significance level (alpha) = .15 and degrees of freedom nu.

8. "t" shall be calculated as:

$$t_{.15,nu} = U + \frac{U^3 + U}{4 \times nu} + \frac{(5 \times U^5 + 16 \times U^3 + 3 \times U)}{(96 \times nu)}$$

where $U = 1.036$

D. Emissions from the Use of Reference Fuel

1. Within each test vehicle category, the average of all emission results (mass/mile) when the reference fuel is used, as described in X.B.2, shall be averaged over all vehicles. The result, $e_{c,i}$, is the emission rate for category i.

2. The estimate of the relevant on-road fleet emissions from the use reference fuel shall be the weighted sum over categories of $e_{c,i}$, using the same weights, p_i, as in the calculation of D.

E_c = sum over all categories (i) of $\{p_i - e_{c,i}\}$

XI. *Demonstration Regarding Durability*

A. The applicant shall satisfy the requirements of paragraph (a)(3)(C), section 2317, Subchapter 8, Title 13, CCR ~~of the California Code of Regulations~~ or paragraph (a)(2), section ~~12~~ 100.3.9, Part II of the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for ~~1988 and Subsequent Model~~ Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles" (both concerning deterioration of emission control), whichever applies, by the procedures in this section.

B. If the applicant demonstrates to the Executive Officer that the candidate fuel is substantially similar to an existing in-use or certification fuel for motor vehicles, with regard to properties that may affect the durability of emission controls, the candidate fuel shall be deemed to not increase deterioration.

C. If the demonstration of substantial similarity described in XI.B cannot be made, the applicant shall provide to the Executive Officer all information available to the applicant related to the possible effects of the candidate fuel and its constituents upon the durability of the emission controls in the vehicles that could use the candidate fuel. If this information is reasonably complete and does not indicate that the candidate fuel would increase deterioration of emission controls, the candidate fuel shall be deemed to not increase deterioration.

D. If the available information for the candidate fuel does not allow a conclusion that no increase in deterioration of the emission control system is likely to occur, or if the information indicates a potential for other undesirable effects, satisfaction of the regulations cited in XI.A shall require address of the shortcomings by further information. Such information shall be developed according to a plan, described in XI.E, that shall be approved by the Executive Officer before its implementation.

E. The plan referred to in XI.D may include, but is not limited, to the following:

-- emission testing

-- 150,000-mile durability testing with emission tests every 5,000 miles

-- bench tests, including immersion tests and vapor tests for a variety of automotive materials and components

-- recommendations on statistical tests to be applied to data

F. Upon receipt of the information in the plan, the Executive Officer shall determine whether or not an increase in deterioration of emission control systems is likely to occur.

G. If excessive deterioration of emission control systems from the use of an approved substitute fuel or new clean fuel becomes apparent, any person may submit a petition, accompanied by supportive data, for a hearing by the Executive Officer to reconsider the approval of the fuel. The Executive Officer may hold a hearing after notification of all interested parties.

H. As a result of findings from a hearing described in XI.G, the Executive Officer may require the original applicant to do additional testing of the approved fuel, per a plan to be approved by the Executive Officer, or rescind the approval for fuel.

I. After 180 days from the date of an Executive Order rescinding approval for a fuel per XI.H, no person shall sell that fuel for use in California, unless a new approval has been obtained under this protocol. By the first day of the month that is 19 calendar months after the month of the Executive Order, all owners of retail gasoline outlets who had complied with subchapter 8, chapter 3, title 13, CCR ~~California Code of Regulations~~ by using the fuel as a substitute fuel shall reach and maintain compliance with that regulation. Between the date of the Executive Order and the first day of the calendar month that is 19 months after the month of the Executive Order, the number of primary designated clean fuel outlets calculated for a major gasoline supplier according to section 2305(c), title 13, CCR, or calculated for a<u>n</u> owner/lessor according to section 2307(d), title 13, CCR, shall be reduced by the number of outlets in which the major gasoline supplier or owner/lessor offered the substitute fuel to comply with section 2301 or 2302, title 13, CCR. During that period, no gasoline service station that had offered the substitute fuel shall be a selected retail clean fuel outlet of the primary designated clean fuel for the purposes of subchapter 8, Title 13 CCR.

XII. *Submission of Results*

By means agreed upon by the Executive Officer and the applicant, the applicant shall submit documentation of adherence to the plan described in section VII and to the procedures specified in section VIII., the calculations required in section X, any outlier analyses conducted per paragraph IX.A, the output from all test runs, all speciations of NMOG, and the information required by section XI.

XIII. *Approval of Candidate Fuels*

A. No more than 20 working days after receiving the information described in section XII, the Executive Officer shall either inform the applicant that the information is complete or advise the applicant of necessary additions or changes. No more than 15 working days after receiving requested additions or changes, the Executive Officer shall advise the applicant that the amended information is complete or further advise the applicant of necessary additions or changes. No more than 20 working days after advising the applicant that the information is complete, the Executive Officer shall deem the demonstrations required by section III either to be accomplished or not accomplished. A rejection shall be accompanied by specifications of deficiencies.

B. If the Executive Officer determines that an applicant has accomplished the required demonstration, the Executive Officer shall approve the candidate fuel. The Executive Officer shall include in the approval order specifications on properties according to subsections VII.A.1, VII.B, and VII.C. The Executive Officer shall notify interested parties of the approval within 10 working days of issuing the order.

C. An approval shall be in force for five years, at which time the reapproval process in section XIV shall be followed.

XIV. *Periodic Re-approval*

A. Every five years after the initial approval of a candidate fuel, test data shall be provided for any vehicle category previously exempted from testing pursuant to section VI.A.~~8~~<u>5</u> if the exempting criteria (less than 3 percent of emissions and less than 5 percent of miles travelled) are no longer met. Test data shall also be provided for any previously tested vehicle category for which the Executive Office determines that the vehicles tested no longer provide a reasonable representation of the on-road vehicles in that category.

B. Every five years, the upper confidence limit specified in subsection X.C and the emissions from the use of reference fuel specified in subsection X.D shall be re-calculated for the test fleets required by subsections VI.A.~~8~~5. The calculations shall use the original test data, any new test data provided pursuant to subsection XIV.A or XV.A, and the current statistical weights (p) as described in subsection X.C.4. If the upper confidence level exceeds the criterion in section V for any pollutant, approval for the fuel shall be rescinded.

C. After January 1 of the year that is three calendar years after the year of the Executive Order rescinding approval for a fuel under this section, no person shall sell that fuel for use in California, unless a new approval has been obtained under this protocol.

XV. *Augmentation of the Original Test Data*

A. An applicant who made the petition that led to the approval may augment any portion of the information in the original test plan or the submission required in section XII. All new information shall be developed according to this test protocol.

B. If new information or proposed changes are submitted, the Executive Officer shall evaluate and either accept or reject them by standards consistent with the requirements in this procedure for the original approval.

ATTACHMENT A-2

California Environmental Protection Agency
AIR RESOURCES BOARD

CALIFORNIA 2001 THROUGH 2014 MODEL CRITERIA POLLUTANT EXHAUST EMISSION STANDARDS AND TEST PROCEDURES AND ~~FOR~~ 2009 THROUGH 2016 ~~AND SUBSEQUENT~~ MODEL GREENHOUSE GAS EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR PASSENGER CARS, LIGHT-DUTY TRUCKS, AND MEDIUM-DUTY VEHICLES

Adopted:	August 5, 1999
Amended:	December 27, 2000
Amended:	July 30, 2002
Amended:	September 5, 2003 (corrected February 20, 2004)
Amended:	May 28, 2004
Amended:	August 4, 2005
Amended:	June 22, 2006
Amended:	October 17, 2007
Amended:	May 2, 2008
Amended:	December 2, 2009
Amended:	February 22, 2010
Amended:	March 29, 2010
Amended:	September 27, 2010
Amended:	March 22, 2012

Note: The proposed amendments to this document are shown in underline to indicate additions and ~~strikeout~~ to indicate deletions compared to the test procedures as last amended September 27, 2010. [No change] indicates proposed federal provisions that are also proposed for incorporation herein without change. Existing intervening text that is not amended in this rulemaking is indicated by "* * * *".

As Amended: March 22, 2012
Date of Hearing: January 26-27, 2012

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NOTE: This document is incorporated by reference in sections 1960.1(k) and 1961(d), title 13, California Code of Regulations (CCR). It contains the majority of the requirements necessary for certification of a passenger car, light-duty truck or medium-duty vehicle for sale in California, in addition to containing the exhaust emission standards and test procedures for these motor vehicles. However, reference is made in these test procedures to other ARB documents that contain additional requirements necessary to complete an application for certification. These other documents are designed to be used in conjunction with this document. They include:

1. "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles" (incorporated by reference in section 1961.2, title 13, CCR);

~~1~~2. "California Exhaust Emission Standards and Test Procedures for 2005 through 2008 Model Zero-Emission Vehicles, and 2001 through 2008 Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" (incorporated by reference in section 1962, title 13, CCR);

~~2~~3. "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 ~~and Subsequent~~ Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" (incorporated by reference in section 1962.1, title 13, CCR);

~~3~~4. "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" (incorporated by reference in section 1976(c), title 13, CCR);

~~4~~5. "California Refueling Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" (incorporated by reference in section 1978(b), title 13, CCR);

~~5~~6. OBD II (section 1968, et seq. title 13, CCR, as applicable);

~~6~~7. "California Smog Index Label Specifications for 2004 through 2009 Model Year Passenger Cars and Light-Duty Trucks" (incorporated by reference in section 1965, title 13, CCR);

~~7~~8. "California Environmental Performance Label Specifications for 2009 and Subsequent Model Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles"" (incorporated by reference in section 1965, title 13, CCR);

~~8~~9. Warranty Requirements (sections 2037 and 2038, title 13, CCR);

~~9~~10. "Specifications for Fill Pipes and Openings of 1977 through 2014 Motor Vehicle Fuel Tanks" (incorporated by reference in section 2235, title 13, CCR);

11~~0~~. "Guidelines for Certification of 1983 through 2002 Model Year Federally Certified Light-Duty Motor Vehicles for Sale in California" (incorporated by reference in section 1960.5, title 13, CCR); ~~and~~

12. "Guidelines for Certification of 2003 and Subsequent Model Year Federally Certified Light-Duty Motor Vehicles for Sale in California" (incorporated by reference in section 1960.5, title 13, CCR);

13~~1~~. "California Non-Methane Organic Gas Test Procedures," (incorporated by reference in section 1961(d), title 13, CCR); and~~.~~

14. "California Test Procedures for Evaluating Substitute Fuels and New Clean Fuels through 2014," (incorporated by reference in section 2317, title 13, CCR).

The section numbering conventions for this document are set forth in Part I, section A.3 on page A-2.

Amend "CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 2001 AND SUBSEQUENT MODEL PASSENGER CARS, LIGHT-DUTY TRUCKS AND MEDIUM-DUTY VEHICLES, " as incorporated by reference in Title 13, California Code of Regulations, Section 1961(d) to read:

* * * *

CALIFORNIA 2001 THROUGH 2014 MODEL CRITERIA POLLUTANT EXHAUST EMISSION STANDARDS AND TEST PROCEDURES AND ~~FOR~~ 2009 THROUGH 2016 ~~AND SUBSEQUENT~~ MODEL GREENHOUSE GAS EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR PASSENGER CARS, LIGHT-DUTY TRUCKS AND MEDIUM-DUTY VEHICLES

The provisions of Subparts B, C, and S, Part 86, Title 40, Code of Federal Regulations, as adopted or amended on May 4, 1999 or as last amended on such other date set forth next to the 40 CFR Part 86 section title listed below, and to the extent they pertain to exhaust emission standards and test procedures, are hereby adopted as the "California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and ~~for~~ 2009 through 2016 ~~and Subsequent~~ Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles," with the following exceptions and additions.

PART I: GENERAL PROVISIONS FOR CERTIFICATION AND IN-USE VERIFICATION OF EMISSIONS

A. General Applicability

1. §86.1801 Applicability.

1.1 §86.1801-01. December 6, 2002. Amend as follows:

1.1.1 Amend subparagraph (a) as follows: Except as otherwise indicated, the provisions of this subpart apply to new 2001 through 2016 ~~and later~~ model year Otto-cycle and diesel-cycle passenger cars, light-duty trucks and medium-duty vehicles, including alternative fuel and hybrid electric vehicles. In cases where a provision applies only to a certain vehicle group based on its model year, vehicle class, motor fuel, engine type, or other distinguishing characteristics, the limited applicability is cited in the appropriate section or paragraph.

* * * *

1.2 §86.1801-12. ~~As proposed at 74 Fed. Reg. 49454, 49752 (September 28, 2009) and adopted by EPA on April 1, 2010, 75 Fed. Reg.~~ May 7, 2010 ~~[insert page] (April [insert date], 2010)~~. Amend as follows:

*   *   *   *

1.2.9 Subparagraph (i) [No change, except that this subparagraph shall only apply to vehicles certifying to the 2012 through 2016 MY National greenhouse gas program ~~for the 2012 through 2016 model years~~, in accordance with section E of these test procedures.]

1.2.10 Subparagraph (j) [No change, except that this subparagraph shall only apply to vehicles certifying to the 2012 through 2016 MY National greenhouse gas program ~~for the 2012 through 2016 model years~~, in accordance with section E of these test procedures.]

1.2.11 Subparagraph (k) [No change, except that this subparagraph shall only apply to vehicles certifying to the 2012 through 2016 MY National greenhouse gas program, in accordance with section E of these test procedures.]

*   *   *   *

B. Definitions, Acronyms and Abbreviations

1. §86.1803 Definitions.

1.1 §86.1803-01. February 26, 2007. [No change, except as otherwise noted below.]

1.2 §86.1803-01. ~~As proposed at 74 Fed. Reg. 49454, 49753 (September 28, 2009) and adopted by EPA on April 1, 2010, 75 Fed. Reg.~~ May 7, 2010 ~~[insert page] (April [insert date], 2010)~~. [No change, except as otherwise noted below.] The version of §86.1803-01 as incorporated by this section B.1.2 shall only apply to vehicles certifying to the 2012 through 2016 MY National greenhouse gas program ~~for the 2012 through 2016 model years~~, in accordance with section E of these test procedures.

2. California Definitions.

*   *   *   *

"**All-Electric Range Test**" means a test sequence used to determine the range of an electric or hybrid electric vehicle without the use of its auxiliary power unit. The All-Electric Range Test is described in the "California Exhaust Emission Standards and Test Procedures for 2005 through 2008 Model Zero-Emission Vehicles, and 2001 through 2008 Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" and the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 ~~and Subsequent~~ Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes."

*   *   *   *

"**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. ~~which is included in the definition of a "series hybrid electric vehicle," a "parallel hybrid electric vehicle," or a "battery assisted combustion engine vehicle."~~

*   *   *   *

"Intermediate Volume Manufacturer" means any 2009 through 2016 ~~and subsequent~~ model year manufacturer with California sales between 4,501 and 60,000 new light- and medium-duty vehicles based on the average number of vehicles sold for the three previous consecutive model years for which a manufacturer seeks certification. For a manufacturer certifying for the first time in California, model year sales shall be based on projected California sales. 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.

For purposes of applying the 2009 through 2016 ~~and subsequent~~ model year Greenhouse Gas requirements for intermediate volume manufacturers, the annual sales from different firms shall be aggregated in the following situations: (1) vehicles produced by two or more firms, each one of which either has a greater than 10% equity ownership in another or is more than 10% owned by another; or (2) vehicles produced by any two or more firms if a third party has equity ownership of greater than 10% in each firm.

*   *   *   *

"2012 through 2016 MY National greenhouse gas program" or "2012 through 2016 MY National greenhouse gas final rule" means the national program that applies to new 2012 through 2016 model year passenger cars, light-duty trucks, and medium-duty passenger vehicles as ~~proposed~~ adopted by the U.S. Environmental Protection Agency ~~at 74 Fed. Reg. 49454, 49748 (September 28, 2009) and adopted by EPA~~ on April 1, 2010~~,~~ (75 Fed. Reg. 25324, 25677 (May 7, 2010)) ~~[insert page] (April [insert date], 2010)~~, as incorporated in and amended by these test procedures.

*   *   *   *

~~"**Parallel hybrid electric vehicle**" means any vehicle that allows power to be delivered to the driven wheels by either a combustion engine and/or by a battery powered electric motor.~~

*   *   *   *

~~"**Series hybrid electric vehicle**" means any vehicle that allows power to be delivered to the driven wheels solely by a battery powered electric motor, but which also incorporates the use of a combustion engine to provide power to the battery and/or electric motor~~.

*   *   *   *

"**Small volume manufacturer**" means any manufacturer whose projected or combined California sales of passenger cars, light-duty trucks, medium-duty vehicles, heavy-duty vehicles and heavy-duty engines in its product line are fewer than 4,500 units based on the average number of vehicles sold for the three previous consecutive model years for which a manufacturer seeks certification. 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. ~~Beginning with~~ For the 2009 through 2016 model years, 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; 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.

*   *   *   *

"**Zero-emission vehicle**" or "**ZEV**" means any vehicle certified to the zero-emission standards set forth in the "California Exhaust Emission Standards and Test Procedures for 2005 through 2008 Model Zero-Emission Vehicles, and 2001 through 2008 Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" and the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 ~~and Subsequent~~ Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes."

*   *   *   *

C. General Requirements for Certification

1. §86.1805 Useful Life.

*   *   *   *

1.3 §86.1805-12. ~~As proposed at 74 Fed. Reg. 49454, 49755 (September 28, 2009) and adopted by EPA on April 1, 2010, 75 Fed. Reg.~~ May 7, 2010 ~~[insert page] (April [insert date], 2010)~~. [No change, except that this section §86.1805-12 shall only apply to vehicles certifying to the 2012 through 2016 MY National greenhouse gas program ~~for the 2012 through 2016 model years~~, in accordance with section E of these test procedures.]

*   *   *   *

3. **§86.1807 Vehicle Labeling**.

* * * *

3.3 **California Labeling Requirements**.

* * * *

3.3.2. For all 2004 ~~and subsequent~~ through 2014 model-year vehicles (except zero-emission vehicles (ZEVs)), the tune-up label shall also contain the following information lettered in the English language in block letters and numerals which shall be of a color that contrasts with the background of the label. For all 2015 and 2016 model-year vehicles, the tune-up label shall conform to the requirements set forth in section C.3 of the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles." ~~:~~

* * * *

(b) Identification of the Exhaust Emission Control System, including but not limited to:

ADSTWC - Hydrocarbon Adsorbing Three-Way Catalyst;
AIR - Secondary Air Injection (Pump);

* * * *

~~*~~ EHOC - Electrically Heated Oxidation Catalyst;
~~*~~ EHTWC - Electrically Heated Three-Way Catalyst;

* * * *

~~*~~ FFS - Flexible Fuel Sensor;

* * * *

~~* Pending confirmation as SAE protocol~~

Abbreviations used shall be in accordance with SAE J1930, ~~JUN 1993~~ October 2008, including the above nomenclature unless the Executive Officer approves a more current version of SAE J1930. ~~The Executive Officer shall recommend abbreviations for components not listed in SAE J1930, JUN 1993~~. For components not listed in SAE J1930, the manufacturer shall request Executive Officer approval of the abbreviations to be used for the components. Executive Officer approval shall be based on the consistency of the abbreviation with existing terminology used for the component in the applicable industry, ability to provide appropriate distinction from other similar components, and ability to be deciphered intuitively by users of the label.

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5.　§86.1809 Prohibition of Defeat Devices.

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5.2　§86-1809-10. February 26, 2007. ~~As proposed at 74 Fed. Reg. 49454, 49755 (September 28, 2009) and adopted by EPA on April 1, 2010, 75 Fed. Reg. [insert page] (April [insert date], 2010).~~ [No change except that ~~requirements applicable to the Air Conditioning Idle Test shall only apply to vehicles certifying to the National greenhouse gas program, and~~ subparagraph (e) shall apply to vehicles subject to the California TLEV, LEV, ULEV and SULEV standards.]

5.3　§86-1809-12. May 7, 2010. [No change except that requirements applicable to the Air Conditioning Idle Test shall only apply to vehicles certifying to the 2012 through 2016 MY National greenhouse gas program, and subparagraph (e) shall apply to vehicles subject to the California LEV, ULEV and SULEV standards.]

D.　§86.1810 General standards; increase in emissions; unsafe conditions; waivers

1.　§86.1810-01. December 8, 2005. Amend §86.1810-01 as follows:

This section applies to model year 2001 through 2016 ~~and later~~ light-duty vehicles, light-duty trucks, and medium-duty vehicles fueled by gasoline, diesel, methanol, ethanol, natural gas and liquefied petroleum gas fuels. Multi-fueled vehicles (including bi-fueled, dual-fueled and flexible-fueled vehicles) shall comply with all requirements established for each consumed fuel (or blend of fuels in the case of flexible-fueled vehicles). This section also applies to hybrid electric vehicles. The standards of this subpart apply to both certification and in-use vehicles unless otherwise indicated.

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1.1　**Measurement of Hydrocarbon Emissions.**

1.1.1　Except as otherwise indicated in these test procedures, for vehicles fueled by gasoline, methanol, ethanol, natural gas, or liquefied petroleum gas and certified to the Tier 1 standards, hydrocarbon emissions shall mean non-methane hydrocarbons (NMHC) and shall be measured in accordance with Part B (Determination of NMHC Emissions by Flame Ionization Detection) of the “California Non-Methane Organic Gas Test

Procedures.~~,~~” ~~as incorporated by reference in Part II, section A.100.5.4 of these test procedures.~~ For vehicles fueled by gasoline, methanol, ethanol, natural gas, or liquefied petroleum gas and certified to the TLEV, LEV, ULEV and SULEV standards, hydrocarbon emissions shall mean non-methane organic gases (NMOG) and shall be measured in accordance with the “California Non-Methane Organic Gas Test Procedures.” ~~as incorporated by reference in Part II, section A.100.5.4 of these test procedures.~~

1.1.2 For diesel vehicles, NMOG shall mean non-methane hydrocarbons and shall be measured in accordance with Part B of the “California Non-Methane Organic Gas Test Procedures.~~,~~” ~~as incorporated by reference in Part II, section A.100.5.4 of these test procedures.”~~

1.1.3 For vehicles certifying to the SFTP standards set forth in Section E.1.2.1 of these test procedures, hydrocarbon emissions shall be measured as follows: for PCs and LDTs certified to the Tier 1 exhaust standards, hydrocarbon emissions shall be measured in accordance with the “California Non-Methane Hydrocarbon Test Procedures,” as last amended May 15, 1990, which is incorporated herein by reference. For PCs and LDTs certified to the TLEV exhaust standards hydrocarbon emissions shall be measured in accordance with Part B (Determination of Non-Methane Hydrocarbon Mass Emissions by Flame Ionization Detection) of the “California Non-Methane Organic Gas Test Procedures.~~,~~” ~~as incorporated by reference in Part II, section A.100.5.4 of these test procedures.~~ For alcohol-fueled vehicles certifying to the standards in Section E.1.2.1., “Non-Methane Hydrocarbons” shall mean “Organic Material Non-Methane Hydrocarbon Equivalent.”

2. Supplemental FTP General Provisions for California.

2.1 Amend 40 CFR §86.1810-01(i) as follows:

* * * *

2.1.2 ~~Subparagraph (4) [No change.]~~ Delete subparagraph (4); replace with: The SFTP standards apply to PCs and LDTs certified on alternative fuels. The standards also apply to the gasoline and diesel fuel operation of fuel-flexible PCs and LDTs, and dual-fuel PCs and LDTs.

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2.1.6 Delete subparagraph (8); replace with: **Small Volume Provisions.** Small volume manufacturers of PCs, LDTs, and MDVs shall certify 100% of their PC and LDT fleet in 2004 through 2014 ~~and subsequent~~ model years, and 100% of their MDV fleet in 2005 through 2014 ~~and subsequent~~ model years under the supplemental FTP requirements.

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3. §86.1810-09. ~~As proposed at 74 Fed. Reg. 49454, 49755 (September 28, 2009) and adopted by EPA on April 1, 2010, 75 Fed. Reg.~~ July 6, 2011 ~~[insert page] (April [insert date], 2010)~~. [No change, except that the amendments to §86.1810-01 set forth in D.1 and D.2 shall apply.]

E. California Exhaust Emission Standards.

Delete 40 CFR §§86.1811 through 86.1819, except that for model years 2012 through 2016, a manufacturer may demonstrate compliance with the requirements of sections E.2.5 and E.3.2 by demonstrating compliance with §86.1818.12 ~~as proposed at 74 Fed. Reg. 49454, 49755 (September 28, 2009) and adopted by EPA on April 1, 2010, 75 Fed. Reg.~~ (July 6, 2011) ~~[insert page] (April [insert date], 2010)~~.

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The procedures for meeting the ZEV phase-in requirements and for earning ZEV credits are contained in the "California Exhaust Emission Standards and Test Procedures for 2005 through 2008 Model Zero-Emission Vehicles, and 2001 through 2008 Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" and the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 ~~and Subsequent~~ Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes."

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1. Exhaust Emission Standards.

1.1 FTP Exhaust Emission Standards for Light- and Medium-Duty Vehicles.
The exhaust emission standards set forth in this section refer to the exhaust emitted over the driving schedule set forth in title 40, CFR, Subparts B and C, except as amended in these test procedures.

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1.1.2 **LEV II Exhaust Standards.** The following LEV II standards represent the maximum exhaust emissions for the intermediate and full useful life from new 2004 through 2014 ~~and subsequent~~ model-year LEVs, ULEVs, and SULEVs, including fuel-flexible, bi-fuel and dual fuel vehicles when operating on the gaseous or alcohol fuel they are designed to use. Prior to the 2004 model year, a manufacturer that produces vehicles meeting these standards has the option of certifying the vehicles to the standards, in which case the vehicles will be treated as LEV II vehicles for purposes of the fleet-wide phase-in requirements.

LEV II Exhaust Mass Emission Standards for New 2004 through 2014 ~~and Subsequent~~ Model LEVs, ULEVs, and SULEVs in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes							
Vehicle Type	Durability Vehicle Basis (mi)	Vehicle Emission Category	NMOG (g/mi)	Carbon Monoxide (g/mi)	Oxides of Nitrogen (g/mi)	Formaldehyde (mg/mi)	Particulates (g/mi)
All PCs; LDTs 8,500 lbs. GVWR or less Vehicles in this category are tested at their loaded vehicle weight.	50,000	LEV	0.075	3.4	0.05	15	n/a
		LEV, Option 1	0.075	3.4	0.07	15	n/a
		ULEV	0.040	1.7	0.05	8	n/a
	120,000	LEV	0.090	4.2	0.07	18	0.01
		LEV, Option 1	0.090	4.2	0.10	18	0.01
		ULEV	0.055	2.1	0.07	11	0.01
		SULEV	0.010	1.0	0.02	4	0.01
	150,000 (optional)	LEV	0.090	4.2	0.07	18	0.01
		LEV, Option 1	0.090	4.2	0.10	18	0.01
		ULEV	0.055	2.1	0.07	11	0.01
		SULEV	0.010	1.0	0.02	4	0.01
MDVs 8,501 - 10,000 lbs. GVWR Vehicles in this category are tested at their adjusted loaded vehicle weight.	120,000	LEV	0.195	6.4	0.2	32	0.12
		ULEV	0.143	6.4	0.2	16	0.06
		SULEV	0.100	3.2	0.1	8	0.06
	150,000 (Optional)	LEV	0.195	6.4	0.2	32	0.12
		ULEV	0.143	6.4	0.2	16	0.06
		SULEV	0.100	3.2	0.1	8	0.06

Vehicle Type	Durability Vehicle Basis (mi)	Vehicle Emission Category	NMOG (g/mi)	Carbon Monoxide (g/mi)	Oxides of Nitrogen (g/mi)	Formaldehyde (mg/mi)	Particulates (g/mi)
MDVs 10,001-14,000 lbs. GVWR Vehicles in this category are tested at their adjusted loaded vehicle weight.	120,000	LEV	0.230	7.3	0.4	40	0.12
		ULEV	0.167	7.3	0.4	21	0.06
		SULEV	0.117	3.7	0.2	10	0.06
	150,000 (Optional)	LEV	0.230	7.3	0.4	40	0.12
		ULEV	0.167	7.3	0.4	21	0.06
		SULEV	0.117	3.7	0.2	10	0.06

1.2 Supplemental Federal Test Procedure ("SFTP") Exhaust Emission Standards for Light- and Medium-Duty Vehicles.

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1.2.2 The following standards represent the maximum SFTP exhaust emissions at 4,000 miles for new 2001 through 2014 ~~and subsequent~~ model LEVs, ULEVs, and SULEVs in the passenger car and light-duty truck class, and new 2003 through 2014 ~~and subsequent~~ model year LEV, ULEV and SULEV medium-duty vehicles less than 8,500 pounds gross vehicle weight rating:

SFTP EXHAUST EMISSION STANDARDS
FOR LEVS, ULEVS, AND SULEVS IN THE PASSENGER CAR, LIGHT-DUTY TRUCK, AND MEDIUM-DUTY VEHICLE CLASSES
(grams per mile)

Vehicle Type**	Gross Vehicle Weight Rating (lbs.)	~~LVW/ALVW~~ Test Weight (lbs.)	US06 Test*		A/C Test*	
			NMHC + NOx	CO	NMHC + NOx	CO
PC Vehicles in this category are tested at their loaded vehicle weight (curb weight plus 300 lbs.).	All	All	0.14	8.0	0.20	2.7
LDT ~~LDT~~ Vehicles in this category are tested at their loaded vehicle weight (curb weight plus 300 lbs.).	< 6000 lbs.	0-3750 lbs. ~~(LVW)~~	0.14	8.0	0.20	2.7
		3751-5750 lbs. ~~(LVW)~~	0.25	10.5	0.27	3.5
MDV ~~MDV~~ Vehicles in this category are tested at their adjusted loaded vehicle weight (average of curb weight and GVWR).	6,001-8,500 lbs.	3751-5750 lbs. ~~(ALVW)~~	0.40	10.5	0.31	3.5
		5751-8500 lbs. ~~(ALVW)~~	0.60	11.8	0.44	4.0

* For certification purposes, testing shall be conducted at 4000 miles ±250 miles or at the mileage determined by the manufacturer for emission-data vehicles.

** The following definitions apply for purposes of this SFTP standards table only:

"LDT" (light-duty truck) is any motor vehicle rated at 6,000 pounds gross vehicle weight or less, which is designed primarily for purposes of transportation of property or is a derivative of such a vehicle, or is available with special features enabling off-street or off-highway operation and use.

"MDV" (medium-duty ~~truck~~ vehicle) is any motor vehicle having a manufacturer's gross vehicle weight rating of greater than 6,000 pounds and less than 14,001 pounds, except passenger cars and light-duty trucks. Vehicles with a gross vehicle weight rating over 8,500 pounds are exempted from the requirements of this subsection.

1.3 NMOG Standards for Fuel-Flexible, Bi-Fuel and Dual-Fuel Vehicles Operating on Gasoline.

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1.3.2 **LEV II Standards for 2004 through 2014 ~~and Subsequent~~ Model Year Bi-fuel, Fuel-Flexible and Dual Fuel Vehicles Operating on Gasoline.** The applicable exhaust mass emission standards for NMOG when certifying the vehicle for operation on gasoline (as specified in Part II, Section A. paragraph 100.3.1) are:

LEV II NMOG Standards for Bi-Fuel, Fuel-Flexible and Dual-Fuel Vehicles Operating on Gasoline (g/mi)			
Vehicle Type	Vehicle Emission Category	Durability Vehicle Basis	
		50,000 mi	120,000 mi
All PCs; LDTs, 0-8500 lbs. GVWR	LEV	0.125	0.156
	ULEV	0.075	0.090
	SULEV	0.010	0.040
MDVs, 8501-10,000 lbs. GVWR	LEV	n/a	0.230
	ULEV	n/a	0.167
	SULEV	n/a	0.117
MDVs, 10,001-14,000 lbs. GVWR	LEV	n/a	0.280
	ULEV	n/a	0.195
	SULEV	n/a	0.143

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1.5 Cold CO Standards.

The following standards represent the 50,000 mile cold temperature exhaust carbon monoxide emission levels from new 2001 through 2014 ~~and subsequent~~ model-year passenger cars, light-duty trucks, and medium-duty vehicles:

2001 THROUGH 2014 ~~AND SUBSEQUENT~~ MODEL-YEAR COLD TEMPERATURE CARBON MONOXIDE EXHAUST EMISSIONS STANDARDS FOR PASSENGER CARS, LIGHT-DUTY TRUCKS, AND MEDIUM-DUTY VEHICLES

(grams per mile)

Vehicle Type	Carbon Monoxide
All PCs, LDTs 0-3750 lbs. LVW	10.0
LDTs 3751 lbs. LVW - 8500 lbs. GVWR LEV I and Tier 1 MDVs 8,500 lbs. GVWR and less	12.5

These standards are applicable to vehicles tested in accordance with 40 CFR Part 86 Subpart C, as modified in Part II, Section B of these test procedures at a nominal temperature of 20°F (-7°C). Natural gas vehicles, diesel-fueled vehicles, and medium-duty vehicles with a gross vehicle weight rating greater than 8,500 lbs. are exempt from these standards.

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1.7 Requirements for Vehicles Certified to the Optional 150,000 Mile Standards.

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(b) Requirement to Generate a Partial ZEV Allowance. A manufacturer that certifies to the 150,000 mile SULEV standards shall also generate a partial ZEV allocation according to the criteria set forth in section C.3 of the "California Exhaust Emission Standards and Test Procedures for 2005 through 2008 Model Zero-Emission Vehicles, and 2001 through 2008 Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" and the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 ~~and Subsequent~~ Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes."

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1.12 When a Federally-Certified Vehicle Model is Required in California.

1.12.1 **Basic Requirement.** Whenever a manufacturer federally-certifies a 2004 through 2014 ~~or subsequent~~ model-year passenger car, light-duty truck or medium-duty vehicle model to the standards for a particular emissions bin that are more stringent than the standards for an applicable California vehicle emissions category, the equivalent California model may only be certified to (i) the California standards for a vehicle emissions category that are at least as stringent as the standards for the corresponding federal emissions bin, or (ii) the exhaust emission standards to which the federal model is certified. However, where the federal exhaust emission standards for the particular emissions bin and the California standards for a vehicle emissions category are equally stringent, the California model may only be certified to either the California standards for that vehicle emissions category or more stringent California standards. The federal emission bins are those contained Tables S04-1 and S04-2 of 40 CFR section 86.1811-04(c) as adopted February 10, 2000. The criteria for applying this requirement are set forth in Part I. Section H.1 of these test procedures.

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1.13 Emission Standard for Fuel-Fired Heaters. Whenever a manufacturer elects to utilize an on-board fuel-fired heater on any passenger car, light-duty truck or medium-duty vehicle, the heater must meet the LEV II ULEV standards for passenger cars and light-duty trucks less than 8,500 pounds GVW set forth in Section E.1.1.2 of these test procedures. The exhaust emissions from the fuel-fired heater shall be determined in accordance with the "California Exhaust Emission Standards and Test Procedures for 2005 through 2008 Model Zero-Emission Vehicles, and 2001 through 2008 Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" and the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 ~~and Subsequent~~ Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes." On-board fuel-fired heaters may not be operable at ambient temperatures above 40^{o}F.

1.14 Greenhouse Gas Emission Requirements. The greenhouse gas emission levels from new 2009 through 2016 ~~and subsequent~~ model year passenger cars, light-duty trucks, and medium-duty passenger vehicles shall not exceed the requirements set forth in Section E.2.5 of these test procedures. Light-duty trucks from 3751 lbs. LVW – 8500 lbs. GVWR that are certified to the Option 1 LEV II NOx Standard in Section E.1.1.2 of these test procedures are exempt from these greenhouse gas emission requirements, however, passenger cars, light-duty trucks 0-3750 lbs. LVW, and medium-duty passenger vehicles are not eligible for this exemption.

2. Emission Standards Phase-In Requirements for Manufacturers

2.1 Fleet Average NMOG Requirements for Passenger Cars and Light-Duty Trucks.

2.1.1 The fleet average non-methane organic gas exhaust mass emission values from the passenger cars and light-duty trucks produced and delivered for sale in California each model year by a manufacturer other than a small volume manufacturer or an independent low volume manufacturer shall not exceed:

FLEET AVERAGE NON-METHANE ORGANIC GAS EXHAUST MASS EMISSION REQUIREMENTS FOR LIGHT-DUTY VEHICLE WEIGHT CLASSES (50,000 mile Durability Vehicle Basis)		
Model Year	Fleet Average NMOG (g/mi)	
	All PCs; LDTs 0-3750 lbs. LVW	LDTs 3751 lbs. LVW - 8500 lbs. GVWR
2001	0.070	0.098
2002	0.068	0.095
2003	0.062	0.093
2004	0.053	0.085
2005	0.049	0.076
2006	0.046	0.062
2007	0.043	0.055
2008	0.040	0.050
2009	0.038	0.047
2010-2014[1] ~~+~~	0.035	0.043

[1] For the 2014 model year only, a manufacturer may comply with the fleet average NMOG+NOx values in the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles," in lieu of complying with the NMOG fleet average values in this table. A manufacturer must either comply with the NMOG+NOx fleet average requirements for both its PC/LDT1 fleet and its LDT2/MDPV fleet or comply with the NMOG fleet average requirements for both its PC/LDT1 fleet and its LDT2/MDPV fleet. A manufacturer must calculate its fleet average NMOG+NOx values using the applicable full useful standards.

2.1.2 **Calculation of Fleet Average NMOG Value**.

2.1.2.1 **Basic Calculation.**

(a) Each manufacturer's PC and LDT1 fleet average NMOG value for the total number of PCs and LDT1s produced and delivered for sale in California shall be calculated as follows:

$$\frac{(\Sigma\ [\text{Number of vehicles in a test group x applicable emission standard}] + \Sigma\ [\text{Number of hybrid electric vehicles in a test group x HEV NMOG factor}])}{\text{Total Number of Vehicles Produced, Including ZEVs and HEVs}}$$

(b) Each manufacturer's LDT2 fleet average NMOG value for the total number of LDT2s produced and delivered for sale in California shall be calculated as follows:

$$(\Sigma \text{ [Number of vehicles in a test group x applicable emission standard] } +$$
$$\Sigma \text{ [Number of hybrid electric vehicles in a test group x HEV NMOG factor]}) \div$$
$$\text{Total Number of Vehicles Produced, Including ZEVs and HEVs}$$

The applicable emission standards to be used in the above equations are as follows:

Model Year	Emission Category	Emission Standard Value	
		All PCs; LDTs 0-3750 lbs. LVW	**LDTs 3751-5750 lbs. LVW**
2001 through 2014 model year ~~and subsequent~~ (AB 965 vehicles only)	All	Federal Emission Standard to which Vehicle is Certified	Federal Emission Standard to which Vehicle is Certified
2001 - 2003	Tier 1	0.25	0.32
2001 - 2006 model year vehicles certified to the "LEV I" standards in E.1.1.1 (For TLEVs, 2001 - 2003 model years only)	TLEVs	0.125	0.160
	LEVs	0.075	0.100
	ULEVs	0.040	0.050
Model Year	**Emission Category**	**All PCs; LDTs 0-3750 lbs. LVW**	**LDTs 3751 lbs. LVW - 8500 lbs. GVWR**
2001 through 2014 ~~and subsequent~~ model year vehicles certified to the "LEV II" standards in E.1.1.2	LEVs	0.075	0.075
	ULEVs	0.040	0.040
	SULEVs	0.01	0.01
2001 through 2014 ~~and subsequent~~ vehicles certified to the optional 150,000 mile "LEV II" standards for PCs and LDTs in E.1.1.2	LEVs	0.064	0.064
	ULEVs	0.034	0.034
	SULEVs	0.0085	0.0085

2.1.2.2 **HEV NMOG Factor.** The HEV NMOG factor for light-duty vehicles is calculated as follows:

LEV HEV Contribution Factor = 0.075 - [(Zero-emission VMT Factor) x 0.035]
ULEV HEV Contribution Factor = 0.040 - [(Zero-emission VMT Factor) x 0.030]

where Zero-emission VMT Factor for HEVs is determined in accordance with Section C.3 of the "California Exhaust Emission Standards and Test Procedures for 2005 through 2008 Model Zero-Emission Vehicles, and 2001 through 2008 Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" and the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 ~~and Subsequent~~ Model Zero-Emission

Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes."

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2.1.3 **Phase-in Requirements for Small Volume Manufacturers.**

(a) In 2001 through 2006 model years, a small volume manufacturer shall not exceed a fleet average NMOG value of 0.075 g/mi for PCs and LDTs from 0-3750 lbs. LVW or 0.100 g/mi for LDTs from 3751-5750 lbs. LVW calculated in accordance with subsection E.2.1.2. In 2007 <u>through 2014</u> ~~and subsequent~~ model years, a small volume manufacturer shall not exceed a fleet average NMOG value of 0.075 for PCs and LDTs from 0-3750 lbs. LVW or 0.075 for LDTs from 3751 lbs. LVW - 8,500 lbs. GVW calculated in accordance with subsection E.2.1.2.

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2.1.5 **Treatment of ZEVs.** ZEVs classified as LDTs (>3750 lbs. LVW) that have been counted toward the ZEV requirement for PCs and LDTs (0-3750 lbs. LVW) as specified in Section C of the "California Exhaust Emission Standards and Test Procedures for 2005 through 2008 Model Zero-Emission Vehicles, and 2001 through 2008 Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" and the "California Exhaust Emission Standards and Test Procedures for 2009 <u>through 2017</u> ~~and Subsequent~~ Model Zero-Emission Vehicles Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," shall be included in this equation.

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2.3 Medium-Duty Low-Emission Vehicle Phase-In Requirements.

2.3.1 (a) A manufacturer of MDVs, other than a small volume manufacturer, shall certify an equivalent percentage of its MDV fleet according to the following phase-in schedule:

Model Year	Vehicles Certified to Section E.1.1 (%)		Vehicles Certified to title 13 CCR Section 1956.8(g) or (h) (%)		
	LEV	ULEV	Tier 1	LEV	ULEV
2001	80	20	100	0	0
2002	70	30	0	100	0
2003	60	40	0	100	0
2004 through 2014 ~~+~~	40	60	0	0	100

* * * *

(c) **Phase-In Requirements for LEV II MDVs**. For the 2004 through 2006 model years, a manufacturer, other than a small volume manufacturer must phase-in at least one test group per model year to the MDV LEV II standards. All 2007 through 2014 ~~and subsequent~~ model year MDVs, including those produced by a small volume manufacturer, are subject to the LEV II MDV standards. Beginning in the 2005 model year, all medium-duty engines certified to the optional medium-duty engine standards in title 13, CCR §1956.8(c) or (h), including those produced by a small volume manufacturer, must meet the standard set forth in title 13, CCR §1956.8(c) or (h), as applicable. A manufacturer that elects to certify to the Option 1 or Option 2 federal standards as set forth in 40 CFR §86.005-10(f) is not subject to these phase-in requirements.

2.3.2 **Identifying a Manufacturer's MDV Fleet**. For the 2001 through 2014 ~~and subsequent~~ model years, each manufacturer's MDV fleet shall be defined as the total number of California-certified MDVs produced and delivered for sale in California. The percentages shall be applied to the manufacturer’s total production of California-certified medium-duty vehicles delivered for sale in California. For the 2005 through 2014 ~~and subsequent~~ model years, a manufacturer that elects to certify engines to the optional medium-duty engine standards in title 13, CCR, §1956.8(c), or (h) shall not count those engines in the manufacturer’s total production of California-certified medium-duty vehicles for purposes of this subparagraph.

2.4 Implementation Schedules for SFTP Emission Standards

2.4.1 A manufacturer of PCs and of LDTs certified to the Tier 1 and TLEV standards as set forth in Section E.1 of these test procedures, except a small volume manufacturer, shall certify a minimum percentage of its PC and LDT fleet according to the following phase-in schedule.

Model Year	Percentage of PC and LDT Fleet
2001	25
2002	50
2003	85
2004 through 2014 ~~and subsequent~~	100

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2.4.2 (a) A manufacturer of PCs, LDTs, and MDVs certified to the LEV, ULEV and SULEV standards as set forth in Section E.1 of these test procedures, except a small volume manufacturer, shall certify a minimum percentage of its PC and LDT fleet, and a minimum percentage of its MDV fleet, according to the following phase-in schedule.

Model Year	Percentage	
	PC, LDT	MDV
2001	25	NA
2002	50	NA
2003	85	25
2004	100	50
2005 through 2014 ~~and subsequent~~	100	100

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2.5 Fleet Average Greenhouse Gas Requirements for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.

2.5.1(i) The fleet average greenhouse gas exhaust mass emission values from passenger cars, light-duty trucks, and medium-duty passenger vehicles that are produced and delivered for sale in California each model year by a large volume manufacturer shall not exceed:

FLEET AVERAGE GREENHOUSE GAS EXHAUST MASS EMISSION REQUIREMENTS FOR PASSENGER CAR, LIGHT-DUTY TRUCK, AND MEDIUM-DUTY PASSENGER VEHICLE WEIGHT CLASSES[1] (4,000 mile Durability Vehicle Basis)		
Model Year	*Fleet Average Greenhouse Gas Emissions (grams per mile CO_2-equivalent)*	
	All PCs; LDTs 0-3750 lbs. LVW	*LDTs 3751 lbs. LVW - 8500 lbs. GVWR; MDPVs*
2009	323	439
2010	301	420
2011	267	390
2012	233	361
2013	227	355
2014	222	350
2015	213	341
2016~~+~~	205	332

[1] Each manufacturer shall demonstrate compliance with these values in accordance with Section E.2.5.2.

2.5.1.1 For each model year, a manufacturer must demonstrate compliance with the fleet average requirements in this section E.2.5.1 based on one of two options applicable throughout the model year, either:

Option 1: the total number of passenger cars, light-duty trucks, and medium-duty passenger vehicles that are certified to the California exhaust emission standards in section 1961.1, title 13, CCR, and are produced and delivered for sale in California; or

Option 2: the total number of passenger cars, light-duty trucks, and medium-duty passenger vehicles that are certified to the California exhaust emission standards in section 1961.1, title 13, CCR, and are produced and delivered for sale in California, the District of Columbia, and all states that have adopted California's greenhouse gas emission standards for that model year pursuant to Section 177 of the federal Clean Air Act (42 U.S.C. § 7507).

2.5.1.1.1 For the 2009 and 2010 model years, a manufacturer that selects compliance Option 2 must notify the Executive Officer of that selection in writing within 30 days of the effective date of the amendments to this section 2.5.1.1. or must comply with Option 1.

2.5.1.1.2 For the 2011 through 2016 ~~and later~~ model years, a manufacturer that selects compliance Option 2 must notify the Executive Officer of that selection in writing prior to the start of the applicable model year or must comply with Option 1.

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2.5.1(ii) For the 2012 through 2016 model years, a manufacturer may elect to demonstrate compliance with this section E.2.5 by demonstrating compliance with the 2012 through 2016 MY National greenhouse gas program as follows:

2.5.1.1 A manufacturer that selects compliance with this option E.2.5.1(ii) must notify the Executive Officer of that selection, in writing, prior to the start of the applicable model year or must comply with E.2.5.1(i).

2.5.1.2 The manufacturer must submit to ARB a copy of the Model Year CAFE report that it submitted to EPA as required under 40 CFR §86-1865-12 ~~as proposed at 74 Fed. Reg. 49454, 49760 (September 28, 2009) and adopted by EPA on April 1, 2010, (75 Fed. Reg.~~ (May 7, 2010) ~~[insert page] (April [insert date], 2010)~~, for demonstrating compliance with the 2012 through 2016 MY National greenhouse gas program and the EPA determination of compliance. These must be submitted within 30 days of receipt of the EPA determination of compliance, for each model year that a manufacturer selects compliance with this option E.2.5.1(ii).

2.5.1.3 The manufacturer must provide to the Executive Officer separate values for the number of vehicles produced and delivered for sale in California, the District of Columbia, and each individual state that has adopted California's greenhouse gas emission standards for that model year pursuant to Section 177 of the federal Clean Air Act (42 U.S.C. § 7507). and

2.5.1.~~3~~4 If a manufacturer has outstanding greenhouse gas debits at the end of the 2011 model year, as calculated in accordance with E.3.2, the manufacturer must submit to the Executive Officer a plan for offsetting all outstanding greenhouse gas debits by using greenhouse gas credits earned under the 2012 through 2016 MY National greenhouse gas program before applying those credits to offset any 2012 through 2016 MY National greenhouse gas program debits. Upon approval of the plan by the Executive Officer, the manufacturer may demonstrate compliance with this section E.2.5 by demonstrating compliance with the 2012 through 2016 MY National greenhouse gas program. Any California debits not offset by the end of the 2016 model year 2012 through 2016 MY National greenhouse gas program reporting period are subject to penalties as provided in section E.3.2.

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2.5.2.2 **Calculation of Greenhouse Gas Values for Bi-Fuel Vehicles, Fuel-Flexible Vehicles, Dual-Fuel Vehicles, and Grid-connected Hybrid Electric Vehicles.** For bi-fuel, fuel-flexible, dual-fuel, and grid-connected hybrid electric vehicles, a manufacturer shall calculate a grams per mile average CO_2-equivalent value for each GHG vehicle test group, in accordance with Section E.2.5.2.1 of these test procedures, based on exhaust mass emission tests when the vehicle is operating on gasoline or diesel, as applicable.

2.5.2.2.1 **Optional Alternative Compliance Mechanisms.** Beginning with the 2010 model year, a manufacturer that demonstrates that a bi-fuel, fuel-flexible, dual-fuel, or grid-connected hybrid electric GHG vehicle test group will be operated in use in California on the alternative fuel shall be eligible to certify those vehicles using this optional alternative compliance procedure, upon approval of the Executive Officer.

(a) To demonstrate that bi-fuel, fuel-flexible, dual-fuel, or grid-connected hybrid electric vehicles within a GHG vehicle test group will be operated in use in California on the alternative fuel, the manufacturer shall provide data that shows the previous model year sales of such vehicles to fleets that provide the alternative fuel on-site, or, for grid-connected hybrid electric vehicles, to end users with the capability to recharge the vehicle on-site. This data shall include both the total number of vehicles sales that were made to such fleets or end users with the capability to recharge the vehicle on-site and as the percentage of total GHG vehicle test group sales. The manufacturer shall also provide data demonstrating the percentage of total vehicle miles traveled by the bi-fuel, fuel-flexible, dual-fuel, or grid-connected hybrid electric vehicles sold to each fleet or to end users with the capability to recharge the vehicle on-site in the previous model year using the alternative fuel and using gasoline <u>or diesel, as applicable</u>.

(b) For each GHG vehicle test group that receives approval by the Executive Officer under Section E.2.5.2.2.1(a), a grams per mile CO_2-equivalent value shall be calculated as follows:

$$CO_2\text{-equivalent value} = [A \times E \times B \times C] + [(1 - (A \times E \times B)) \times D]$$

where: A = the percentage of previous model year vehicles within a GHG vehicle test group that were operated in use in California on the alternative fuel during the previous calendar year;

B = the percentage of miles traveled by "A" during the previous calendar year;

C = the CO_2-equivalent value for the GHG vehicle test group, as calculated in Section E.2.5.2.1, when tested using the alternative fuel;

D = the CO_2-equivalent value for the GHG vehicle test group, as calculated in Section E.2.5.2.1, when tested using gasoline <u>or diesel, as applicable</u>; and

E = 0.9 for grid-connected hybrid electric vehicles or

E = 1 for bi-fuel, fuel-flexible, and dual-fuel vehicles.

The Executive Officer may approve use of a higher value for “E” for a grid-connected hybrid electric vehicle GHG vehicle test group if a manufacturer demonstrates that the vehicles can reasonably be expected to maintain more than 90 percent of their original battery capacity over a 200,000 mile vehicle lifetime. The manufacturer may demonstrate the appropriateness of a higher value either by providing data from real world vehicle operation; or by showing that these vehicles are equipped with batteries that do not lose energy storage capacity until after 100,000 miles; or by offering 10 year/150,000 mile warranties on the batteries.

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2.5.3 **Requirements for Intermediate Volume Manufacturers.**

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2.5.3.3 In the 2016 ~~and subsequent~~ model year~~s~~, an intermediate volume manufacturer shall either:

(a) not exceed a fleet average greenhouse gas emissions value of 233 g/mi for PCs and LDT1s and 361 g/mi for LDT2s and MDPVs, or

(b) not exceed a fleet average greenhouse gas value of 0.75 times the baseline fleet average greenhouse gas value for PCs and LDT1s or 0.82 times the baseline fleet average greenhouse gas value for LDT2s and MDPVs, as calculated in Section E.2.5.3.2.

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2.5.4 **Requirements for Small Volume Manufacturers and Independent Low Volume Manufacturers.**

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2.5.4.3 In the 2016 ~~and subsequent~~ model year~~s~~, a small volume manufacturer and an independent low volume manufacturer shall either:

(a) not exceed the fleet average greenhouse gas emissions value calculated for each GHG vehicle test group for which a comparable vehicle is sold by a large volume manufacturer, in accordance with Section E.2.5.4; or

(b) not exceed a fleet average greenhouse gas emissions value of 233 g/mi for PCs and LDT1s and 361 g/mi for LDT2s and MDPVs; or

(c) upon approval of the Executive Officer, if a small volume manufacturer demonstrates a vehicle model uses an engine, transmission, and emission control system that is identical to a configuration certified for sale in California by a large volume manufacturer, those small volume manufacturer vehicle models are exempt from meeting the requirements in paragraphs E.2.5.4.3(a) and (b) of this Section.

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3. Calculation of Credits/Debits

3.1 Calculation of NMOG Credits/Debits

3.1.1 **Calculation of NMOG Credits for Passenger Cars and Light-Duty Trucks.**

3.1.1.1 In 2001 through 2014 ~~and subsequent~~ model years, a manufacturer that achieves fleet average NMOG values lower than the fleet average NMOG requirement for the corresponding model year shall receive credits in units of g/mi NMOG determined as:

[(Fleet Average NMOG Requirement) - (Manufacturer's Fleet Average NMOG Value)] x (Total No. of Vehicles Produced and Delivered for Sale in California, Including ZEVs and HEVs).

A manufacturer with 2001 through 2014 ~~and subsequent~~ model year fleet average NMOG values greater than the fleet average requirement for the corresponding model year shall receive debits in units of g/mi NMOG equal to the amount of negative credits determined by the aforementioned equation. For the 2001 through 2006 model year, the total g/mi NMOG credits or debits earned for PCs and LDTs 0-3750 lbs. LVW and for LDTs 3751-5750 lbs. and LDTs 3751 lbs. LVW - 8500 lbs. GVWR shall be summed together. For the 2007 through 2014 ~~and subsequent~~ model years, the total g/mi NMOG credits or debits earned for PCs and LDTs 0-3750 lbs. LVW and for LDTs 3751 lbs. LVW - 8500 lbs. GVWR shall be summed together. The resulting amount shall constitute the g/mi NMOG credits or debits accrued by the manufacturer for the model year.

3.1.2 **Calculation of Vehicle Equivalent NMOG Credits for Medium-Duty Vehicles.** In 2001 through 2014 ~~and subsequent~~ model years, a manufacturer that produces and delivers for sale in California MDVs in excess of the equivalent requirements for LEVs, ULEVs and/or SULEVs certified to the exhaust emission standards set forth in section E.1 of these test procedures or to the exhaust emission standards set forth in section 1956.8(h), title 13, CCR shall receive “Vehicle-Equivalent Credits” (or “VECs”) calculated in accordance with the following equation, where the term “produced” means produced and delivered for sale in California:

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3.1.2.1 The MDV HEV VEC allowance is calculated as follows:

1 + [(LEV standard - ULEV standard) x (Zero-emission VMT Allowance) ÷ LEV standard] for LEVs;
1 + [(ULEV standard - SULEV standard) x (Zero-emission VMT Allowance) ÷ ULEV standard] for ULEVs;
1 + [(SULEV standard - ZEV standard) x (Zero-emission VMT Allowance) ÷ SULEV standard] for SULEVs;

where "Zero-emission VMT Allowance" for an HEV is determined in accordance with Section C.3 of the "California Exhaust Emission Standards and Test Procedures for 2005 through 2008 Model Zero-Emission Vehicles, and 2001 through 2008 Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" and the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 ~~and Subsequent~~ Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes."

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3.1.2.4 For a manufacturer that elects to certify engines to the optional medium-duty engine standards in title 13, CCR §1956.8(c) or (h), all such 2005 through 2014 ~~and subsequent~~ model year engines used in MDVs, including those produced by a small volume manufacturer, shall be subject to the emissions averaging provisions applicable to heavy-duty diesel or Otto-cycle engines as set forth in the "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Otto-Cycle Engines," or the "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel Engines, incorporated by reference in title 13, CCR, §1956.8(b) or (d), as applicable.

3.1.3 **Procedure for Offsetting NMOG Debits.**

3.1.3.1 A manufacturer shall equalize emission debits by earning g/mi NMOG emission credits or VECs in an amount equal to the g/mi NMOG debits or VEDs, or by submitting a commensurate amount of g/mi NMOG credits or VECs to the Executive Officer that were earned previously or acquired from another manufacturer. For 2001 through 2003 and for 2007 through 2014 ~~and subsequent~~ model years, manufacturers shall equalize emission debits by the end of the following model year. For 2004 through 2006 model years, a manufacturer shall equalize NMOG debits for PCs and LDTs and LEV II MDVs within three model years and prior to the end of the 2007 model year. If emission debits are not equalized within the specified time period, the manufacturer shall be subject to the Health and Safety Code §43211 civil penalty applicable to a manufacturer which 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 emission debits are not equalized by the end of the specified time period. For the purposes of Health and Safety Code §43211, the number of passenger cars and light-duty trucks not meeting the state board's emission standards shall be determined by dividing the total amount of g/mi NMOG emission debits for the model year by the g/mi NMOG fleet average requirement for PCs and LDTs 0-3750 lbs. LVW and LDTs 3751 lbs. LVW - 8500 lbs. GVWR applicable for the model year in which the debits were first incurred and the number of medium-duty vehicles not meeting the state board's emission standards shall be equal to the amount of VEDs incurred.

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3.2 Calculation of Greenhouse Gas Credits/Debits.

3.2.1 **Calculation of Greenhouse Gas Credits for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.**

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3.2.1.2 In <u>the</u> 2009 <u>through 2016</u> ~~and subsequent~~ model years, a manufacturer that achieves fleet average Greenhouse Gas values lower than the fleet average Greenhouse Gas requirement for the corresponding model year shall receive credits in units of g/mi Greenhouse Gas determined as:

[(Fleet Average Greenhouse Gas Requirement) - (Manufacturer's Fleet Average Greenhouse Gas Value)] x (Total No. of Vehicles Produced and Delivered for Sale in California, Including ZEVs and HEVs).

3.2.2 A manufacturer with 2009 <u>through 2016</u> ~~and subsequent~~ model year fleet average Greenhouse Gas values greater than the fleet average requirement for the corresponding model year shall receive debits in units of g/mi Greenhouse Gas equal to the amount of negative credits determined by the aforementioned equation. For the 2009 <u>through 2016</u> ~~and subsequent~~ model years, the total g/mi Greenhouse Gas credits or debits earned for PCs and LDT1s and for LDT2s and MDPVs shall be summed together. The resulting amount shall constitute the g/mi Greenhouse Gas credits or debits accrued by the manufacturer for the model year.

3.2.3 **Procedure for Offsetting Greenhouse Gas Debits.**

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3.2.3.2 Greenhouse Gas emission credits earned in the 2000 through 2008 model years shall be treated as if they were earned in the 2011 model year and shall retain full value through the 2012 model year. Greenhouse Gas emission credits earned in the 2009 <u>through 2016</u> ~~and subsequent~~ model years shall retain full value through the fifth model year after they are earned. The value of any credits earned in the 2000 through 2008 model years that not used to equalize debits accrued in the 2009 through 2012 model years shall be discounted by 50% at the beginning of the 2013 model year, shall be discounted to 25% of its original value if not used by the beginning of the 2014 model year, and will have no value if not used by the beginning of the 2015 model year. Any credits earned in the 2009 <u>through 2016</u> ~~and subsequent~~ model years that are not used by the end of the fifth model year after they are accrued shall be discounted by 50% at the beginning of the sixth model year after being earned, shall be discounted to 25% of its original value if not used by the beginning of the seventh model year after being earned, and will have no value if not used by the beginning of the eighth model year after being earned.

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F.　Requirements and Procedures for Durability Demonstration

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4.　§86.1823 Durability demonstration procedures for exhaust emissions.

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4.2　§86.1823-08. ~~As proposed at 74 Fed. Reg. 49454, 49757 (September 28, 2009) and adopted by EPA on April 1, 2010, 75 Fed. Reg.~~ September 15, 2011 ~~[insert page] (April [insert date], 2010)~~. [No change, except that ~~the amendments to §86.1823-01 set forth in F.4.1 shall apply, and~~ subparagraph (m) applies only to vehicles certifying to the 2012 through 2016 MY National greenhouse gas program.]

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G.　Procedures for Demonstration of Compliance with Emission Standards

1.　§86.1827 Test Group Determination.

1.1　§86.1827-01. ~~As proposed at 74 Fed. Reg. 49454, 49758 (September 28, 2009) and adopted by EPA on April 1, 2010, 75 Fed. Reg.~~ May 7, 2010 ~~[insert page] (April [insert date], 2010)~~. [No change, except that subparagraphs (a)(5) and (f) shall only apply to vehicles certifying to the 2012 through 2016 MY National greenhouse gas program.]

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3.　§86.1829 Durability data and emission data testing requirements; waivers.

3.1　§86.1829-01. ~~As proposed at 74 Fed. Reg. 49454, 49758 (September 28, 2009) and adopted by EPA on April 1, 2010, 75 Fed. Reg.~~ May 7, 2010 ~~[insert page] (April [insert date], 2010)~~. Amend as follows:

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3.1.3　Amend (b)(1)(iii)(G) as follows: For the 2012 model year only, in lieu of testing a vehicle for N2O emissions, a manufacturer may provide a statement in its application for certification that such vehicles comply with the applicable standards. Such a statement must be based on previous emission tests, development tests, or other appropriate information and good engineering judgment. This subparagraph (b)(1)(iii)(G) only applies to vehicles certifying to the 2012 through 2016 MY National greenhouse gas program.

3.1.4 Amend (b)(4)(i) as follows: All 2001 through 2016 ~~and subsequent~~ model-year emission-data vehicles shall be required to be tail-pipe tested at 4,000 miles or at the mileage at which the vehicle is stabilized as determined in §86.1827-01 and demonstrate compliance with the California Inspection and Maintenance ("I/M") emission standards as specified in the "Mandatory Exhaust Emissions Inspection Standards and Test Procedures," title 16, California Code of Regulations, Section 3340.42. A manufacturer shall have the option of using the I/M test procedures in place at the time of certification or, if the I/M test procedures have been amended within two years of the time of certification, a manufacturer may use the preceding procedures. Test vehicles shall undergo preconditioning procedures prior to the tail-pipe test, which consist of idle conditions for a minimum period of ten minutes after the thermostat is open. Preconditioning and test procedures shall be conducted at an ambient temperature from 68^o to 86^o F. The manufacturer shall, in accordance with good engineering practices, attest that such test vehicles will meet the requirements of this section when preconditioned and tested at ambient temperatures from 35^o to 68^o F.

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3.4 Greenhouse Gas Testing Requirements.

A manufacturer shall demonstrate compliance with the greenhouse gas requirements each year by testing one vehicle per each test group that represents the vehicle configuration that is expected to be "worst-case" for greenhouse gas emissions, as calculated in Section E.2.5.2.1, subject to approval by the Executive Officer. A manufacturer may test additional vehicles within the test group that represent vehicle configuration with lower greenhouse gas emissions values than the "worst-case" configuration. All vehicles shall be tested using both the FTP and Highway Test Procedures as modified in Part II of these test procedures. A manufacturer may use emissions data from tests it conducts as part of the Corporate Average Fuel Economy Program (CAFE), in accordance with 40 CFR Part 600 – Fuel Economy and Greenhouse Gas Exhaust Emissions of Motor Vehicles, to demonstrate compliance with the greenhouse gas requirements, once those data have been judged acceptable by the U.S. Environmental Protection Agency. A manufacturer that elects to use CAFE Program emissions data to demonstrate compliance with the greenhouse gas requirements must use all of the data that is used by the U.S. Environmental Protection Agency to determine a manufacturer's corporate average fuel economy for the applicable model year, and may forego testing of the "worst-case" configuration.

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4. §86.1830~~-01~~ Acceptance of Vehicles for Testing. ~~January 17, 2006. [No change.]~~

4.1 §86.1830-01. January 17, 2006. [No change.]

5. §86.1831~~-01~~ Mileage accumulation requirements for test vehicles. ~~January 17, 2006. [No change.]~~

5.1 §86.1831-01. January 17, 2006. [No change.]

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8. §86.1834 Allowable maintenance.

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8.2 HEVs.

~~(a)~~ The manufacturer shall equip the vehicle with a maintenance indicator consisting of a light that shall activate automatically by illuminating the first time the minimum performance level is observed for all battery system components. Possible battery system components requiring monitoring are: (i) battery water level; (ii) temperature control; (iii) pressure control; and (iv) other parameters critical for determining battery condition.

~~(b) The manufacturer shall equip "off-vehicle charge capable HEVs" with a useful life indicator for the battery system consisting of a light that shall illuminate the first time the battery system is unable to achieve an all-electric operating range (starting from a full state-of-charge) which is at least 75% of the range determined for the vehicle in the Urban Driving Schedule portion of the All-Electric Range Test (see the "California Exhaust Emission Standards and Test Procedures for 2005 through 2008 Model Zero-Emission Vehicles, and 2001 through 2008 Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" and the "California Exhaust Emission Standards and Test Procedures for 2009 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes").~~

9. §86.1835~~-01~~ Confirmatory certification testing. ~~April 13, 2001. [No change.]~~
9.1 §86.1835-01. May 7, 2010. [No change.]

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12. §86.1838 Small volume manufacturers certification procedures. ~~January 17, 2006.~~

12.1 §86.1838-01. ~~December 6, 2002~~ January 17, 2006. [No change, except that the reference to 15,000 units shall mean 4,500 units in California and the reference to 14,999 units shall mean 4,499 units in California.]

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H. Certification, Information and Reporting Requirements.

1. §86.1841 Compliance with emission standards for the purpose of certification

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1.2 For 2012 through 2016 model year vehicles certifying to the 2012 through 2016 MY National greenhouse gas program, §86.1841-01~~, as proposed at 74 Fed. Reg. 49454, 49758~~

~~(September 28, 2009) and adopted by EPA on April 1, 2010, 75 Fed. Reg.~~ (July 6, 2011) ~~[insert page] (April [insert date], 2010),~~ shall apply. Changes specified under section H.1.1 shall also apply for this section H.1.2.

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1.5 **Certification of a Federal Vehicle in California.** Whenever a manufacturer federally-certifies a 2004 through 2014 ~~or subsequent~~ model-year passenger car, light-duty truck or medium-duty vehicle model to the standards for a particular emissions bin that are more stringent than the standards for an applicable California vehicle emissions category, the equivalent California model may only be certified to (i) the California standards for a vehicle emissions category that are at least as stringent as the standards for the corresponding federal emissions bin, or (ii) the exhaust emission standards to which the federal model is certified. However, where the federal exhaust emission standards for the particular emissions bin and the California standards for a vehicle emissions category are equally stringent, the California model may only be certified to either the California standards for that vehicle emissions category or more stringent California standards. The federal emission bins are those contained Tables S04-1 and S04-2 of 40 CFR section 86.1811-04(c) as adopted February 10, 2000. A California vehicle model is to be treated as equivalent to a federal vehicle model if all of the following characteristics are identical:

(a) Vehicle make and model;
(b) Cylinder block configuration (e.g., L-6, V-8);
(c) Displacement;
(d) Combustion cycle;
(e) Transmission class;
(f) Aspiration method (e.g., naturally aspirated, turbocharged); and
(g) Fuel (e.g., gasoline, natural gas, methanol).

The comparative stringency of the standards for the federal exhaust emissions bin and for the California vehicle emissions category shall be based on a comparison of the sum of the 100,000, 120,000, or 150,000 mile standards for NMOG and NOx.

1.5.1 If a federally-certified vehicle model is certified in California in accordance with subparagraph 1.~~4~~5, the model shall be subject to the federal requirements for exhaust emissions, SFTP emissions, cold CO emissions and highway NOx. The vehicle model shall be subject to all other California requirements including evaporative emissions, OBD II, greenhouse gas emissions, and emissions warranty, except that a 2004 or earlier model-year vehicle in the federal heavy light-duty truck or medium-duty passenger vehicle classes may at the manufacturer's option be subject to the federal requirements for evaporative emissions and OBD II.

1.5.2 Prior to certification of a 2004 through 2014 ~~or subsequent~~ model-year vehicle, a manufacturer must submit information sufficient to enable the Executive Officer to determine whether there is a federally-certified vehicle model for that model year that is equivalent to the California vehicle model based on the criteria listed in subparagraph 1.~~4~~5.

1.5.3 If the Executive Officer determines that there is a federally-certified vehicle model for that model year that is equivalent to the California vehicle model, the following information shall be submitted with the Part I or Part II Application for Certification as set forth below:

(a) Part I Application for Certification: (i) Evidence of federal certification including, but not limited to, federal certification exhaust emission levels and compliance with federal SFTP, cold CO and highway NOx emission levels; and (ii) evidence of compliance with California evaporative emission requirements, California OBD II requirements, and California greenhouse gas requirements or, where permitted under Section 1.~~4~~5.1 for a 2004 or earlier model-year vehicle, evidence of federal certification evaporative emission levels and compliance with federal OBD II requirements.

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1.5.7 The requirements in Section H.1.~~4~~5 do not apply in the case of a federally-certified vehicle model that is only marketed to fleet operators for applications that are subject to clean fuel fleet requirements established pursuant to section 246 of the federal Clean Air Act (42 U.S.C. sec. 7586). In addition, the Executive Officer shall exclude from the requirements a federally-certified vehicle model where the manufacturer demonstrates to the Executive Officer's reasonable satisfaction that the model will primarily be sold or leased to clean fuel fleet operators for such applications, and that other sales or leases of the model will be incidental to marketing to those clean fuel fleet operators.

1.5.8 A manufacturer may certify a passenger car, light-duty truck or medium-duty vehicle to federal exhaust emission standards pursuant to Section H.1.~~4~~5 prior to the 2004 model year.

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3. §86.1843 General information requirements

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3.2 **Alternative Fuel Information.**

For ~~TLEVs, LEVs, ULEVs, and SULEVs~~ passenger cars, light-duty trucks, and medium-duty vehicles not certified exclusively on gasoline or diesel, except for vehicles that use hydrogen fuel, the manufacturer shall submit projected California sales and fuel economy data nineteen months prior to January 1 of the model year for which the vehicles are certified. For vehicles that use hydrogen fuel, the manufacturer shall submit projected California sales and leases, fuel economy data, vehicle fuel pressure rating, name of air basin(s) where vehicles will be delivered for sale or lease, and number of vehicles projected to be delivered to each air basin, thirty-three months prior to January 1 of the model year for which the vehicles are certified. For calendar year 2012 only, the manufacturer of vehicles that use hydrogen fuel shall submit projected California sales and leases, fuel economy data, vehicle fuel pressure rating, name of air basin(s) where vehicles will be delivered for sale or lease, and number of vehicles projected to be delivered to each air basin, twenty-nine months prior to January 1 of the model year for which the vehicles are certified.

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4. §86.1844 Information Requirements: Application for Certification and Submittal of Information Upon Request.

4.1 §86.1844-01. ~~February 26, 2007~~ September 15, 2011. Amend as follows:

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4.1.2 Modify §86.1844-01(d) as follows:

(a) Delete §86.1844-01(d)(9).

(b) Delete §86.1844-01(d)(15)(ii) and replace it with the following: For vehicles with fuel fired heaters, a manufacturer must include the information specified in this section H.4.4.

(~~b~~c) Add the following requirement: A description of each greenhouse gas test vehicle including the criteria listed in Section G.2.4. and any additional information used by a manufacturer to demonstrate a "worst-case" vehicle configuration used to comply with the requirements of Section G.2.4.

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4.2 **OBD Requirements.**

For 2001 through 2016 ~~and subsequent~~ model-year passenger cars, light-duty trucks and medium-duty vehicles, information shall be submitted in the application for certification according to the requirements of section 1968, et seq., title 13, CCR, as applicable.

4.3 **HEVs.**

For HEVs, the information required in the "California Exhaust Emission Standards and Test Procedures for 2005 through 2008 Model Zero-Emission Vehicles, and 2001 through 2008 Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" and the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 ~~and Subsequent~~ Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," must be supplied with the Part I application for certification.

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4.5 **Greenhouse Gas Reporting Requirements.**

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(b) For the 2012 through 2016 model years, a manufacturer that elects to demonstrate compliance with the requirements of sections E.2.5 and E.3.2 by demonstrating compliance with the 2012 through 2016 MY National greenhouse gas program must submit all data to the Executive Officer in accordance with the reporting requirements as required under section E.2.5.1(ii) and 40 CFR §86.1865-12~~, as proposed at 74 Fed. Reg. 49454, 49760 (September 28, 2009) and adopted by EPA on April 1, 2010, 75 Fed. Reg.~~ 25324, 25691 ~~[insert page] (April [insert date], 2010)~~.

(c) All data submitted in accordance with this section H.4.5, must be submitted electronically and organized in a format specified by the Executive Officer to clearly demonstrate compliance with the fleet average greenhouse gas exhaust emission requirements in section E.2.5 or 40 CFR §86.1865-12 ~~as proposed at 74 Fed. Reg. 49454, 49760 (September 28, 2009) and adopted by EPA on April 1, 2010, 75 Fed. Reg.~~ 25324, 25691 ~~[insert page] (April [insert date], 2010)~~, as applicable.

I. In-Use Compliance Requirements and Procedures

1. §86.1845 Manufacturer in-use verification testing requirements.

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1.2 §86.1845-04. ~~As proposed at 74 Fed. Reg. 49454, 49758 (September 28, 2009) and adopted by EPA on April 1, 2010, 75 Fed. Reg.~~ May 7, 2010 ~~[insert page] (April [insert date], 2010)~~. Amend as follows:

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2. §86.1846 Manufacturer in-use confirmatory testing requirements.

2.1 §86.1846-01. ~~As proposed at 74 Fed. Reg. 49454, 49759 (September 28, 2009) and adopted by EPA on April 1, 2010, 75 Fed. Reg.~~ May 7, 2010 ~~[insert page] (April [insert date], 2010)~~. [No Change.]

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J. Procedural Requirements

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3. §86.1848-10 Certification. ~~As proposed at 74 Fed. Reg. 49454, 49759 (September 28, 2009) and adopted by EPA on April 1, 2010, 75 Fed. Reg.~~ July 6, 2011 ~~[insert page] (April [insert date], 2010)~~. [No change, except that this version of §86.1848-10 shall only apply to vehicles certifying under the 2012 through 2016 MY National greenhouse gas program ~~for the 2012 through 2016 model years.~~]

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9. §86.1854-12 Prohibited acts. ~~As proposed at 74 Fed. Reg. 49454, 49759 (September 28, 2009) and adopted by EPA on April 1, 2010, 75 Fed. Reg.~~ May 7, 2010 ~~[insert page] (April [insert date], 2010)~~. [No change.]

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14. §86.1863-07 Optional Chassis Certification for Diesel Vehicles. ~~June 17, 2003~~ September 15, 2011. [No change]
15. §86.1865-12 How to comply with the fleet average CO_2 standards. ~~As proposed at 74 Fed. Reg. 49454, 49760 (September 28, 2009) and adopted by EPA on April 1, 2010, 75 Fed. Reg.~~ September 15, 2011 ~~[insert page] (April [insert date], 2010)~~. [No change, except that this section shall only apply to vehicles certifying under the 2012 through 2016 MY National greenhouse gas program ~~for the 2012 through 2016 model years~~.]
16. §86.1866-12 CO_2 fleet average credit programs. ~~As proposed at 74 Fed. Reg. 49454, 49763 (September 28, 2009) and adopted by EPA on April 1, 2010, 75 Fed. Reg.~~ July 6, 2011 ~~[insert page] (April [insert date], 2010)~~. [No change, except that this section shall only apply to vehicles certifying under the 2012 through 2016 MY National greenhouse gas program ~~for the 2012 through 2016 model years~~.]
17. §86.1867-12 Optional early CO_2 credit programs. ~~As proposed at 74 Fed. Reg. 49454, 49766 (September 28, 2009) and adopted by EPA on April 1, 2010, 75 Fed. Reg.~~ July 6, 2011 ~~[insert page] (April [insert date], 2010)~~. [No change, except that this section shall only apply to vehicles certifying under the 2012 through 2016 MY National greenhouse gas program ~~for the 2012 through 2016 model years~~.]

PART II: CALIFORNIA EXHAUST AND PARTICULATE EMISSION TEST PROCEDURES FOR PASSENGER CARS, LIGHT-DUTY TRUCKS, AND MEDIUM-DUTY VEHICLES

This part describes the equipment required and the procedures necessary to perform gaseous and particulate exhaust emission tests (40 CFR Part 86, Subpart B); cold temperature test procedures (40 CFR Part 86, Subpart C); the California 50°F test procedure; the development of reactivity adjustment factors; and the supplemental federal test procedure (40 CFR Part 86, Subpart B) on passenger cars, light-duty trucks, and medium-duty vehicles.

A. 40 CFR Part 86, Subpart B - Emission Regulations for 1977 and Later Model Year New Light-Duty Vehicles and New Light-Duty Trucks <u>and New Otto-Cycle Complete Heavy-Duty Vehicles</u>; Test Procedures.

* * * *

100.2 Equipment and Facility Requirements.

* * * *

86.111-94 Exhaust gas analytical-system. ~~As proposed at 74 Fed.Reg. 49454, 49748 (September 28, 2009) and adopted by EPA on April 1, 2010, 75 Fed.Reg.~~ <u>May 7, 2010</u> ~~[insert page] (April [insert date], 2010)~~.

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100.3 Certification Fuel Specifications.

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100.3.2 Certification Diesel Fuel Specifications.

* * * *

100.3.2.2 Certification Diesel Fuel Specifications for the 2007 <u>through 2016</u> ~~and Subsequent~~ Model Years.

Amend subparagraphs §86.113-07(b)(2) and (b)(3) as follows:

(b)(2) Except as noted below, petroleum fuel for diesel vehicles meeting the specifications referenced in 40 CFR §86.113-07(b)(2), or substantially equivalent specifications approved by the Executive Officer, shall be used in exhaust emission testing. The grade of petroleum fuel recommended by the engine manufacturer, commercially designated as "Type 2-D" grade diesel, shall be used. The petroleum fuel used in exhaust emission testing may meet the specifications listed below, or substantially equivalent specifications approved by the Executive Officer, as an option to the specifications in 40 CFR §86.113-07(b)(2). Where a manufacturer elects pursuant to this subparagraph to conduct exhaust emission testing using the specifications of 86.113-94(b)(2) and in §86.113-07(b)(2), or the specifications listed below, the Executive Officer shall conduct exhaust emission testing with the diesel fuel meeting the specifications elected by the manufacturer.

California Certification Diesel Fuel Specifications For the 2007 <u>through 2016</u> ~~and Subsequent~~ Model Years		
Fuel Property	**Limit**	**Test Method [(a)]**
Natural Cetane Number	47-55	D 613-86
Distillation Range		§2282(g)(3), title 13, CCR
IBP	340-420 ^{o}F	
10% point	400-490 ^{o}F	
50% point	470-560 ^{o}F	
90% point	550-610 ^{o}F	
EP	580-660 ^{o}F	
API Gravity	33-39^{o}	D 287-82
Total Sulfur	7-15 ppm	§2282(g)(3), title 13, CCR
Nitrogen Content	100-500 ppmw	§2282(g)(3), title 13, CCR
Total Aromatic Hydrocarbons	8-12 vol. %	§2282(g)(3), title 13, CCR
Polycyclic Aromatic Hydrocarbons	1.4 wt. % (max)	§2282(g)(3), title 13, CCR
Flashpoint	130 ^{o}F (max)	D 93-80
Viscosity @ 40^{o}F	2.0-4.1 centistokes	D 445-83

[(a)] ASTM specifications unless otherwise noted. A reference to a subsection of §2282, title 13, CCR, means the test method identified in that subsection for the particular property. A test method other than that specified may be used following a determination by the Executive Officer that the other method produces results equivalent to the results of the specified method.

* * * *

100.3.9 Identification of New Clean Fuels to be Used in Certification Testing.

* * * *

(a) If the proposed new clean fuel may be used to fuel existing motor vehicles, the state board shall not establish certification specifications for the fuel unless the petitioner has demonstrated that:

(1) Use of the new clean fuel in such existing motor vehicles would not increase emissions of NMOG (on a reactivity-adjusted basis), NOx, CO, and the potential risk associated with toxic air contaminants, as determined pursuant to the procedures set forth in "California Test Procedures for Evaluating Substitute Fuels and New Clean Fuels through 2014.~~,~~" ~~as adopted September 17, 1993.~~ In the case of fuel-flexible vehicles or dual-fuel vehicles which were not certified on the new clean fuel but are capable of being operated on it, emissions during operation with the new clean fuel shall not increase compared to emissions during vehicle operation on gasoline.

* * * *

100.5 Test Procedures and Data Requirements.

86.127-00 Test procedures; overview. May 4, 1999. ~~As proposed at 74 Fed. Reg. 49454, 49748 (September 28, 2009) and adopted by EPA on April 1, 2010, 75 Fed. Reg. [insert page] (April [insert date], 2010).~~

86.127-12 Test procedures; overview. May 7, 2010.

* * * *

86.130-00 Test sequence; general requirements. October 22, 1996.

100.5.2 California test sequence; general requirements.

100.5.2.1 Delete subparagraph (a) of §86.130-00 and replace with:

For purposes of determining conformity with 50^{o}F test requirements, the procedures set forth in Part II, Section C. For all hybrid electric vehicles and all 2001 and subsequent model-year vehicles certifying to running loss and useful life evaporative emission standards, the test sequence specified in "California Evaporative Emission Standards and Test Procedures for ~~1978~~ 2001 and Subsequent Model Motor Vehicles" as incorporated by reference in section 1976, title 13, CCR shall apply.

* * * *

86.132-00 Vehicle preconditioning. October 22, 1996.

100.5.3 California Vehicle Preconditioning Requirements.

100.5.3.1 Add the following subparagraph: For all hybrid electric vehicles and all 2001 ~~2000~~ and subsequent model-year vehicles subject to running loss and useful life evaporative emission standards, the preconditioning sequence for the Federal Test Procedure specified in "California Evaporative Emission Standards and Test Procedures for 2001 ~~1978~~ and Subsequent Model Motor Vehicles" as incorporated by reference in section 1976, title 13, CCR shall apply.

In addition, the preconditioning sequence for the SFTP described in subparagraphs (n) and (o) of paragraph 86.132-00 shall apply.

*　　*　　*　　*

86.135-00　Dynamometer procedure. October 22, 1996. [No change, except that the amendments to §86.135-90, 70 FR 72917 (December 8, 2005), shall apply.]

86.135-12~~00~~　Dynamometer procedure. ~~As proposed at 74 Fed. Reg. 49454, 49749 (September 28, 2009) and adopted by EPA on April 1, 2010, 75 Fed. Reg.~~ May 7, 2010 ~~[insert page] (April [insert date], 2010)~~. [No change.]

*　　*　　*　　*

86.144-94　Calculations; exhaust emissions. July 13, 2005.

100.5.4 Calculations; exhaust emissions.

100.5.4.1　The exhaust emission calculations for California are set forth in the "California Non-Methane Organic Gas Test Procedures.~~,~~" ~~which is incorporated by reference in section 1961(d), title 13, CCR.~~

*　　*　　*　　*

86.165-12　Air Conditioning idle test procedure. ~~As proposed at 74 Fed. Reg. 49454, 49749 (September 28, 2009) and adopted by EPA on April 1, 2010, 75 Fed. Reg.~~ July 6, 2011 ~~[insert page] (April [insert date], 2010)~~. [No change, except that this section shall only apply to vehicles certifying under the 2012 through 2016 MY National greenhouse gas program ~~for the 2012 through 2016 model years~~.]

86.166-12　Method for calculating emissions due to air conditioning leakage. ~~As proposed at 74 Fed. Reg. 49454, 49750 (September 28, 2009) and adopted by EPA on April 1, 2010, 75 Fed. Reg.~~ May 7, 2010 ~~[insert page] (April [insert date], 2010)~~. [No change, except that this section shall only apply to vehicles certifying under the 2012 through 2016 MY National greenhouse gas program ~~for the 2012 through 2016 model years~~.]

~~86.167-12　N_2O measurement devices. As proposed at 74 Fed. Reg. 49454, 49751 (September 28, 2009) and adopted by EPA on April 1, 2010, 75 Fed. Reg. [insert page] (April [insert date], 2010). [No change, except that this section shall only apply to vehicles certifying under the National greenhouse gas program for the 2012 through 2016 model years.]~~

~~86.168-12　Interference verification for N_2O analyzers. As proposed at 74 Fed. Reg. 49454, 49752 (September 28, 2009) and adopted by EPA on April 1, 2010, 75 Fed. Reg. [insert page] (April [insert date], 2010). [No change, except that this section shall only apply to vehicles certifying under the National greenhouse gas program for the 2012 through 2016 model years.]~~

B. Subpart C - Emission Regulations for 1994 and Later Model Year Gasoline-Fueled New Light-Duty Vehicles, ~~and~~ New Light-Duty Trucks and New Medium-Duty Passenger Vehicles; Cold Temperature Test Procedures.

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ATTACHMENT A-3

California Environmental Protection Agency
AIR RESOURCES BOARD

CALIFORNIA 2015 AND SUBSEQUENT MODEL CRITERIA POLLUTANT EXHAUST EMISSION STANDARDS AND TEST PROCEDURES AND 2017 AND SUBSEQUENT MODEL GREENHOUSE GAS EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR PASSENGER CARS, LIGHT-DUTY TRUCKS, AND MEDIUM-DUTY VEHICLES

Adopted: March 22, 2012

NOTE: This document is incorporated by reference in sections 1961.2(d), title 13, California Code of Regulations (CCR). It contains the majority of the requirements necessary for certification of a passenger car, light-duty truck, or medium-duty vehicle for sale in California, in addition to containing the exhaust emission standards and test procedures for these motor vehicles. However, reference is made in these test procedures to other ARB documents that contain additional requirements necessary to complete an application for certification. These other documents are designed to be used in conjunction with this document. They include:

1. "California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2009 through 2016 Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles" (incorporated by reference in sections 1960.1(k) and 1961(d), title 13, CCR);

2. "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" (incorporated by reference in section 1962.1, title 13, CCR);

3. "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" (incorporated by reference in section 1962.2, title 13, CCR);

4. "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" (incorporated by reference in section 1976(c), title 13, CCR);

5. "California Refueling Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" (incorporated by reference in section 1978(b), title 13, CCR);

6. OBD II (section 1968, et seq. title 13, CCR, as applicable);

7. "California Environmental Performance Label Specifications for 2009 and Subsequent Model Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles" (incorporated by reference in section 1965, title 13, CCR);

8. Warranty Requirements (sections 2037 and 2038, title 13, CCR);

9. "Specifications for Fill Pipes and Openings of 2015 and Subsequent Motor Vehicle Fuel Tanks" (incorporated by reference in section 2235, title 13, CCR);

10. "Guidelines for Certification of 2003 and Subsequent Model-Year Federally Certified Light-Duty Motor Vehicles for Sale in California (incorporated by reference in section 1960.5, title 13, CCR);

11. "California Non-Methane Organic Gas Test Procedures," (incorporated by reference in section 1961.2(d), title 13, CCR);

12. “California Test Procedures for Evaluating Substitute Fuels and New Clean Fuels in 2015 and Subsequent Years,” (incorporated by reference in section 2317, title 13, CCR).

The section numbering conventions for this document are set forth in Part I, section A.3 on page A-2.

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CALIFORNIA 2015 AND SUBSEQUENT MODEL CRITERIA POLLUTANT EXHAUST EMISSION STANDARDS AND TEST PROCEDURES AND 2017 AND SUBSEQUENT MODEL GREENHOUSE GAS EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR PASSENGER CARS, LIGHT-DUTY TRUCKS, AND MEDIUM-DUTY VEHICLES

The provisions of Subparts B, C, and S, Part 86, Title 40, Code of Federal Regulations, as adopted or amended on May 4, 1999 or as last amended on such other date set forth next to the 40 CFR Part 86 section title listed below, and to the extent they pertain to exhaust emission standards and test procedures, are hereby adopted as the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles," with the following exceptions and additions.

PART I: GENERAL PROVISIONS FOR CERTIFICATION AND IN-USE VERIFICATION OF EMISSIONS

A. General Applicability

1. §86.1801 Applicability.

1.1 §86.1801-12. [Insert Federal Register for the 2017 and subsequent MY National Greenhouse Gas Final Rule as proposed at 76 Fed. Reg. 74854, 75361 (December 1, 2011)]. Amend as follows:

1.1.1 Amend subparagraph (a) as follows: Except as otherwise indicated, the provisions of this subpart apply to new passenger cars, light-duty trucks, and medium-duty vehicles, including multi-fueled, alternative fueled, hybrid electric, plug-in hybrid electric, and electric vehicles. In cases where a provision applies only to a certain vehicle group based on its model year, vehicle class, motor fuel, engine type, or other distinguishing characteristics, the limited applicability is cited in the appropriate section of this subpart.

1.1.2 Subparagraph (b) *Aftermarket conversions*. [n/a]

1.1.3 Amend subparagraph (c) *Optional Applicability* as follows:

(a) Subparagraph (c)(1) [n/a]

(b) Amend subparagraph (c)(2) as follows: A manufacturer must certify any heavy-duty complete Otto-cycle vehicle or complete diesel vehicle of 14,000 pounds Gross Vehicle Weight Rating (GVWR) or less and any medium-duty passenger vehicle in accordance with the medium-duty chassis-standards of section E.1 of these test procedures. For the 2015 through 2021 model years, a manufacturer must certify all LEV II heavy-duty engines or vehicles of 14,000 pounds GVWR or less, excluding medium-duty passenger vehicles, to the medium-duty engine standards in title 13, CCR, section 1956.8 (c) or (h), as applicable. For the 2022 and subsequent model years, a manufacturer must certify any heavy-duty vehicle of 10,000 pounds GVWR or less, including incomplete Otto-cycle vehicles and incomplete heavy-duty diesel vehicles, in accordance with the LEV III medium-duty chassis-standards of section E.1 of these test procedures. A manufacturer must certify any heavy-duty engine and vehicle of 10,001-14,000 pounds GVWR to the medium-duty engine standards in title 13, CCR, section 1956.8 (c) or (h), as applicable. A manufacturer may request to certify LEV II heavy-duty complete diesel vehicles of 14,000 pounds GVWR or less and LEV III heavy-duty complete diesel vehicles of 10,001 - 14,000 pounds GVWR to the chassis-standards in section E.1 of these test procedures; heavy-duty engine or heavy-duty vehicle provisions of 40 CFR Part 86 subpart A do not apply to such a vehicle or engine. [No change.]

(c) Subparagraph (c)(3) [No change.]

(d) Subparagraph (c)(4) [n/a; aftermarket conversions]

(e) Subparagraph (c)(5) [n/a]

1.1.4 Amend subparagraph (d) as follows: Small volume manufacturers. Special certification procedures are available for any manufacturer whose projected or actual combined California sales of passenger cars, light-duty trucks, medium-duty vehicles, heavy-duty vehicles and heavy-duty engines in its product line are fewer than 4,500 units based on the average number of vehicles sold for the three previous consecutive model years for which a manufacturer seeks certification. For manufacturers certifying for the first time in California, model-year production volume shall be based on projected California sales. The small-volume manufacturer's light- and medium-duty vehicle and truck certification procedures are described in 40 CFR §86.1838, as modified in section G.12 of these test procedures.

1.1.5 Subparagraph (e). [n/a; NLEVs.]

1.1.6 Subparagraph (f) [n/a; Tier 2 phase-in provisions]

1.1.7 Subparagraph (g) [n/a; Tier 2 phase-in provisions]

1.1.8 Subparagraph (h) [No change.]

1.1.9 Subparagraph (i) [No change.]

1.1.10 Subparagraph (j) [No change, except that this subparagraph shall only apply to vehicles certifying to the 2012 through 2016 MY National greenhouse gas program for the 2012 through 2016 model years, in accordance with the "California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2009 through 2016 Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles."]

1.1.11 Subparagraph (k) [No change, except that this subparagraph shall only apply to vehicles certifying to the 2012 through 2016 MY National greenhouse gas program for the 2012 through 2016 model years, in accordance with the "California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2009 through 2016 Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles."]

2. California Provisions.

2.1 References to "light-duty trucks" in 40 CFR 86 shall apply to both "light-duty trucks" and "medium-duty vehicles" in these procedures. References to "light-duty vehicles" shall apply to "passenger cars" in these procedures. References to dual fuel vehicles shall also mean bi-fuel vehicles.

2.2 Any reference to vehicle sales throughout the United States shall mean vehicle sales in California.

2.3 Regulations concerning U.S. EPA hearings, U.S. EPA inspections, specific language on the Certificate of Conformity, evaporative emissions, high-altitude vehicles and testing, particulate and oxides of nitrogen averaging and test group standards applicable in such averaging, alternative useful life, selective enforcement audit, Certification Short Test, and heavy-duty engines and vehicles shall not be applicable to these procedures, except where specifically noted.

2.4 Regulations both herein and in Title 40, CFR Part 86, Subparts B, C, and S, concerning Otto-cycle and diesel-cycle vehicles shall be applicable to ethanol-fueled vehicles, including dual fuel, bi-fuel and fuel-flexible vehicles, except where specifically noted otherwise.

2.5 For engines used in medium-duty vehicles that are not distinctly diesel engines nor derived from such, the Executive Officer shall determine whether the engines shall be subject to diesel or Otto-cycle engine regulations, in consideration of the relative similarity of the engines' torque-speed characteristics and vehicle applications with those of Otto-cycle and diesel engines.

2.6 Regulations concerning federal OBD system requirements shall mean the California OBD requirements, except where specifically noted otherwise.

3. §86.1802 Section Numbering; Construction.

3.1 §86.1802-01. [No change.]

3.2 The section numbering convention employed in these test procedures, in order of priority, is A.1.1.1. in order to distinguish California procedures and requirements from those of the U.S. EPA. References in these test procedures to specific sections of the Code of Federal Regulations maintain the same numbering system employed in the Code of Federal Regulations.

3.3 In cases where the entire CFR section is incorporated by reference with no modifications, the notation "[No change.]" is used. In cases where there are no changes to the CFR language but there are additional California requirements, the notation "[No change.]" is used and the additional California requirements are then noted in a separate subsection with the numbering convention set forth in subparagraph 3.2, above.

3.4 The notation "[n/a]" indicates that the subject matter of the federal regulation does not apply to California passenger cars, light-duty trucks, or medium-duty vehicles. In some cases the subject of the federal regulation is indicated in the bracket for clarity.

B. Definitions, Acronyms and Abbreviations

1. §86.1803 Definitions.

1.1 §86.1803-01. [Insert Federal Register for the 2017 and subsequent MY National Greenhouse Gas Final Rule as proposed at 76 Fed. Reg. 74854, 75361 (December 1, 2011)]. [No change, except as otherwise noted below.]

2. California Definitions.

"**AB 965 vehicle**" means a vehicle certified pursuant to section 1960.5, title 13, CCR.

"**A/C Direct Emissions"** means any refrigerant releases from a motor vehicle's air conditioning system.

"**Active Aerodynamic Improvements**" means technologies that are activated only at certain speeds to improve aerodynamic efficiency by a minimum of three percent, while preserving other vehicle attributes or functions.

"**Active Cabin Ventilation**" means devices that mechanically move heated air from the cabin interior to the exterior of the vehicle.

"**Active Transmission Warmup**" means a system that uses waste heat from the exhaust system to warm the transmission fluid to an operating temperature range quickly using a heat exchanger in the exhaust system, increasing the overall transmission efficiency by reducing parasitic losses associated with the transmission fluid, such as losses related to friction and fluid viscosity.

"**Active Engine Warmup**" means a system using waste heat from the exhaust system to warm up targeted parts of the engine so that it reduces engine friction losses and enables the closed-loop fuel control more quickly. It would allow a faster transition from cold operation to warm operation, decreasing CO_2 emissions, and increasing fuel economy.

"**Active Seat Ventilation**" means a device that draws air from the seating surface which is in contact with the occupant and exhausts it to a location away from the seat.

"**Administrator**" means the Executive Officer of the Air Resources Board (ARB).

"**Air basin**" means any California air basin that is described in sections 60100 through 60114, title 17, CCR.

"**Alcohol fuel**" means either methanol or ethanol as those terms are defined in these test procedures.

"**All-Electric Range Test**" means a test sequence used to determine the range of an electric or hybrid electric vehicle without the use of its auxiliary power unit. The All-Electric Range Test is described in the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" and the "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes."

"**Battery assisted combustion engine vehicle**" means any vehicle that allows power to be delivered to the driven wheels solely by a combustion engine, but which uses a battery pack to store energy which may be derived through remote charging, regenerative braking, and/or a flywheel energy storage system or other means which will be used by an electric motor to assist in vehicle operation.

"**Bi-fuel vehicle**" is any motor vehicle that is engineered and designed to be capable of operating on two fuels wherein the two fuels are stored on board in separate fuel tanks and metered separately, but in operation the two fuels are combusted together.

"**Blower motor controls which limit waste energy**" means a method of controlling fan and blower speeds that does not use resistive elements to decrease the voltage supplied to the motor.

"**Certificate of Conformity**" means Executive Order certifying vehicles for sale in California.

"**Certification**" means certification as defined in section 39018 of the Health and Safety Code.

"**Certification level**" means the official exhaust or evaporative emission result from an emission-data vehicle which has been adjusted by the applicable mass deterioration factor and is submitted to the Executive Officer for use in determining compliance with an emission standard for the purpose of certifying a particular test group.

"**Dedicated Ethanol-Fueled Vehicle**" means any ethanol-fueled motor vehicle that is engineered and designed to be operated solely on ethanol.

"**Dedicated Methanol Vehicle**" means any methanol-fueled motor vehicle that is engineered and designed to be operated solely on methanol.

"**Default to recirculated air mode**" means that the default position of the mechanism which controls the source of air supplied to the air conditioning system shall change from outside air to recirculated air when the operator or the automatic climate control system has engaged the air conditioning system (i.e., evaporator is removing heat), except under those conditions where dehumidification is required for visibility (i.e., defogger mode). In vehicles equipped with interior air quality sensors (e.g., humidity sensor, or carbon dioxide sensor), the controls may determine proper blend of air supply sources to maintain freshness of the cabin air and prevent fogging of windows while continuing to maximize the use of recirculated air. At any time, the vehicle operator may manually select the non-recirculated air setting during vehicle operation but the system must default to recirculated air mode on subsequent vehicle operations (i.e., next vehicle start). The climate control system may delay switching to recirculation mode until the interior air temperature is less than the outside air temperature, at which time the system must switch to recirculated air mode.

"**Diesel Engine**" means any engine powered with diesel fuel, gaseous fuel, or alcohol fuel for which diesel engine speed/torque characteristics and vehicle applications are retained.

"Dual-fuel vehicle" means any motor vehicle that is engineered and designed to be capable of operating on gasoline or diesel and on compressed natural gas or liquefied petroleum gas, with separate fuel tanks for each fuel on-board the vehicle. In operation, only one fuel is used at a time.

"**Electric Heater Circulation Pump**" means a pump system installed in a stop-start equipped vehicle or in a hybrid electric vehicle or plug-in hybrid electric vehicle that continues to circulate hot coolant through the heater core when the engine is stopped during a stop-start event. This system must be calibrated to keep the engine off for 1 minute or more when the external ambient temperature is 30^{o} F.

“**Emergency Vehicle**” means a motor vehicle manufactured primarily for use as an ambulance or combination ambulance-hearse or for use by the United States Government or a State or local government for law enforcement.

“**Engine Heat Recovery**” means a system that captures heat that would otherwise be lost through the exhaust system or through the radiator and converting that heat to electrical energy that is used to meet the electrical requirements of the vehicle. Such a system must have a capacity of at least 100W to achieve 0.7 g/mi of credit. Every additional 100W of capacity will result in an additional 0.7 g/mi of credit.

“**Engine Start-Stop**” means a technology which enables a vehicle to automatically turn off the engine when the vehicle comes to a rest and restart the engine when the driver applies pressure to the accelerator or releases the brake.

“**EPA Vehicle Simulation Tool**" means the "EPA Vehicle Simulation Tool" as incorporated by reference in 40 CFR §86.1 in the Notice of Proposed Rulemaking for EPA’s 2017 and subsequent MY National Greenhouse Gas Program, as proposed November 16, 2011 [Insert Federal Register for the 2017 and subsequent MY National Greenhouse Gas Final Rule as proposed at 76 Fed. Reg. 74854, 75357 (December 1, 2011)], which is incorporated by reference in section 1961.2, title 13, CCR.

“**Ethanol**” means any fuel for motor vehicles and motor vehicle engines that is composed of either commercially available or chemically pure ethanol (CH_3CH_2OH) and gasoline as specified in Part II, Section A.100.3 (Certification Fuel Specifications) of these test procedures. The required fuel blend is based on the type of ethanol-fueled vehicle being certified and the particular aspect of the certification procedure being conducted.

“Footprint” means the product of average track width (rounded to the nearest tenth of an inch) and wheelbase (measured in inches and rounded to the nearest tenth of an inch), divided by 144 and then rounded to the nearest tenth of a square foot, where the average track width is the average of the front and rear track widths, where each is measured in inches and rounded to the nearest tenth of an inch.

“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.

“**Fuel-Flexible Vehicle”** or “**FFV**” means any motor vehicle engineered and designed to be operated on a petroleum fuel and an alcohol fuel, or any mixture of the two. Alcohol-fueled vehicles that are only marginally functional when using gasoline (e.g., the engine has a drop in rated horsepower of more than 80 percent) are not flexible fuel vehicles.

“**Full-size pickup truck**” means a light-duty truck that has a passenger compartment and an open cargo box and which meets the following specifications:

1. A minimum cargo bed width between the wheelhouses of 48 inches, measured as the minimum lateral distance between the limiting interferences (pass-through) of the wheelhouses. The measurement shall exclude the transitional arc, local protrusions, and depressions or pockets, if present. An open cargo box means a vehicle where the cargo box does not have a permanent roof. Vehicles sold with detachable covers are considered “open” for the purposes of these criteria.
2. A minimum open cargo box length of 60 inches, where the length is defined by the lesser of the pickup bed length at the top of the body and the pickup bed length at the floor, where the length at the top of the body is defined as the longitudinal distance from the inside front of the pickup bed to the inside of the closed endgate as measured at the cargo

floor surface along vehicle centerline, and the length at the floor is defined as the longitudinal distance from the inside front of the pickup bed to the inside of the closed endgate as measured at the cargo floor surface along vehicle centerline.

3. A minimum towing capability of 5,000 pounds, where minimum towing capability is determined by subtracting the gross vehicle weight rating from the gross combined weight rating, or a minimum payload capability of 1,700 pounds, where minimum payload capability is determined by subtracting the curb weight from the gross vehicle weight rating.

"**Global Warming Potential**" or "**GWP**" means the global warming potential of the refrigerant over a 100-year horizon, as specified in Intergovernmental Panel on Climate Change (IPCC) 2007: Climate Change 2007 – The Physical Science Basis. S. Solomon et al. (editors), Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, UK and New York, NY, USA, ISBN 0-521-70596-7 or determined by ARB if such information is not available in the IPCC Fourth Assessment Report

"**Greenhouse gas**" means the following gases: carbon dioxide, methane, nitrous oxide, and hydrofluorocarbons.

"**Grid-connected hybrid electric vehicle**" means a hybrid electric vehicle that has the capacity for the battery to be recharged from an off-board source of electricity and has some all-electric range.

"**Heavy-duty engine**" means an engine which is used to propel a heavy-duty vehicle.

"**Heavy-duty vehicle**" means any motor vehicle having a manufacturer's gross vehicle weight rating greater than 8,500 pounds, except passenger cars.

"**High Efficiency Exterior Lighting**" means a lighting technology that, when installed on the vehicle, is expected to reduce the total electrical demand of the exterior lighting system by a minimum of 60 watts when compared to conventional lighting systems. To be eligible for this credit the high efficiency lighting must be installed in the following components: parking/position, front and rear turn signals, front and rear side markers, stop/brake lights (including the center-mounted location), taillights, backup/reverse lights, and license plate lighting.

"**High-priced part**" means a part determined to be high-priced in accordance with section 2037(c), title 13, CCR.

"**Highway Test Cycle**" means the driving schedule as set forth in Part II, Section F of these test procedures.

"**Highway Test Procedures**" means the Federal Test Procedure as set forth in Subpart B, 40 CFR Part 86, as modified in Part II of these test procedures, except that emissions shall be measured using the Highway Driving Schedule as set forth in Part II, Section F.

"**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.

"**Improved condensers and/or evaporators**" means that the coefficient of performance (COP) of air conditioning system using improved evaporator and condenser designs is 10 percent higher, as determined using the bench test procedures described in SAE J2765 ''Procedure for Measuring System COP of a Mobile Air Conditioning System on a Test Bench,'' when compared to a system using standard, or prior model year, component designs. SAE J2765 is incorporated by reference herein. The manufacturer must submit an engineering analysis demonstrating the increased improvement of the system relative to the baseline design, where the baseline component(s) for comparison is the version which a manufacturer most recently had in production on the same vehicle design or in a similar or related vehicle model. The dimensional characteristics (e.g., tube configuration/thickness/spacing, and fin density) of the baseline component(s) shall be compared to the new component(s) to demonstrate the improvement in coefficient of performance.

"**Incomplete vehicle**" means any vehicle that does not have the primary load carrying device or container attached. In situations where individual marketing relationships makes the status of the vehicle questionable, the Executive Officer shall determine whether a specific model complies with the definition of incomplete vehicle.

"Large volume manufacturer" means a manufacturer that is not a small volume manufacturer.

"**LEV II**" refers to the standards that were initially adopted by the Board on August 5, 1999 and are set forth in section E.1.1.1 of these test procedures.

"**LEV III**" refers to the standards that are set forth in section E.1.1.2 of these test procedures.

"**Light-duty truck**" or "**LDT**" means any motor vehicle rated at 8,500 pounds gross vehicle weight or less, that is designed primarily for purposes of transportation of property or is a derivative of such a vehicle, or is available with special features enabling off-street or off-highway operation and use.

"**LDT1**" means a light-duty truck with a loaded vehicle weight of 0-3750 pounds.

"**LDT2**" means a light-duty truck with a loaded vehicle weight of 3751 to a gross vehicle weight of 8500 pounds.

"**Low-emission vehicle**" means any vehicle certified to low-emission vehicle standards.

"**Medium-duty vehicle**" or "**MDV**" means any heavy-duty vehicle having a manufacturer's gross vehicle weight rating between 8,501 and 14,000 pounds.

"**Methanol**" means any fuel for motor vehicles and motor vehicle engines that is composed of either commercially available or chemically pure methanol (CH_3OH) and gasoline as specified in Part II, Section A.100.3.1 (Certification Fuel Specifications) of these procedures. The required fuel blend is based on the type of methanol-fueled vehicle being certified and the particular aspect of the certification procedure being conducted.

"Mild hybrid gasoline-electric vehicle" means a vehicle that has start/stop capability and regenerative braking capability, where the recaptured braking energy over the FTP is at least 15 percent but less than 75 percent of the total braking energy, where the percent of recaptured braking energy is measured and calculated according to 40 CFR §600.108(g).

"Model Type" means a unique combination of car line, basic engine, and transmission class.

"2012 through 2016 MY National greenhouse gas program" or "**2012 through 2016 MY National greenhouse gas final rule**" means the national program that applies to new 2012 through 2016 model year passenger cars, light-duty trucks, and medium-duty passenger vehicles as adopted by the U.S. Environmental Protection Agency on April 1, 2010 (75 Fed. Reg. 25324, 25677 (May 7, 2010)), as incorporated in and amended by these test procedures.

"**Natural gas vehicle**" means any motor vehicle that is engineered and designed to be operated using either compressed natural gas or liquefied natural gas.

“**Non-methane organic gas**” (or “**NMOG**”) means the sum of non-oxygenated and oxygenated hydrocarbons contained in a gas sample as measured in accordance with the “California Non-Methane Organic Gas Test Procedures.”

“**Off-vehicle charge capable hybrid electric vehicle**” means a hybrid electric vehicle that has 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. A grid-connected hybrid electric vehicle is one example of an off-vehicle charge capable hybrid electric vehicle.

“**Oil separator**” means a mechanism that removes at least 50 percent of the oil entrained in the oil/refrigerant mixture exiting the compressor and returns it to the compressor housing or compressor inlet, or a compressor design that does not rely on the circulation of an oil/refrigerant mixture for lubrication.

“**Organic material non-methane hydrocarbon equivalent**” (or “**OMNMHCE**”) for methanol-fueled vehicles means the sum of the carbon mass contribution of non-oxygenated hydrocarbons (excluding methane), methanol, and formaldehyde as contained in a gas sample, expressed as gasoline-fueled hydrocarbons. For ethanol-fueled vehicles, “organic material non-methane hydrocarbon equivalent” (or “OMNMHCE”) means the sum of carbon mass contribution of non-oxygenated hydrocarbons (excluding methane), methanol, ethanol, formaldehyde and acetaldehyde as contained in a gas sample, expressed as gasoline-fueled hydrocarbons.

“**Ozone deterioration factor**” means a factor applied to the mass of NMOG emissions from LEVs, LEV630s, LEV395s, LEV160s, ULEVs, ULEV570s, ULEV400s, ULEV340s, ULEV270s, ULEV250s, ULEV200s, ULEV125s, ULEV70s, ULEV50s, SULEV230s, SULEV200s, SULEV170s, SULEV150s, SULEV30s, or SULEV20s, which accounts for changes in the ozone-forming potential of the NMOG emissions from a vehicle as it accumulates mileage.

“**Passenger car**” or “**PC**” means any motor vehicle designed primarily for transportation of persons and having a design capacity of 12 persons or less.

“**Passive Cabin Ventilation**” means ducts or devices which utilize convective airflow to move heated air from the cabin interior to the exterior of the vehicle.

“**Reduced reheat, with externally controlled, fixed-displacement or pneumatic variable displacement compressor**” means a system in which the output of either compressor is controlled by cycling the compressor clutch off-and-on via an electronic signal, based on input from sensors (e.g., position or setpoint of interior temperature control, interior temperature, evaporator outlet air temperature, or refrigerant temperature) and air temperature at the outlet of the evaporator can be controlled to a level at 41°F, or higher.

“**Reduced reheat, with externally-controlled, variable displacement compressor**” means a system in which compressor displacement is controlled via an electronic signal, based on input from sensors (e.g., position or setpoint of interior temperature control, interior temperature, evaporator outlet air temperature, or refrigerant temperature) and air temperature at the outlet of the evaporator can be controlled to a level at 41°F, or higher.

“**Small volume manufacturer**” means any manufacturer whose projected or combined California sales of passenger cars, light-duty trucks, medium-duty vehicles, heavy-duty vehicles and heavy-duty engines in its product line are fewer than 4,500 units based on the average number of vehicles sold for the three previous consecutive model years for which a manufacturer seeks certification. 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.

Except as provided in the last paragraph of this definition, for the 2015 through 2017 model years, 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; 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 any firms where the vehicles are manufactured by the same entity and the importer or distributor is an authorized agent of the entity.

Except as provided in the last paragraph of this definition, for the 2018 and subsequent model years, 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 33.4% or greater part owned by another; or (2) vehicles produced by any two or more firms if a third party has equity ownership of 33.4% 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 any firms where the vehicles are manufactured by the same entity and the importer or distributor is an authorized agent of the entity.

For the purposes of this paragraph, all manufacturers whose annual sales are aggregated together under the provisions of this definition shall be defined as “related manufacturers.” Notwithstanding such aggregation, the Executive Officer may make a determination of operational independence if all of the following criteria are met for at least 24 months preceding the application submittal: (1) for the three years preceding the year in which the initial application is submitted, the average California sales for the applicant does not exceed 4,500 vehicles per year; (2) no financial or other support of economic value is provided by related manufacturers for purposes of design, parts procurement, R&D and production facilities and operation, and any other transactions between related manufacturers are conducted under normal commercial arrangements like those conducted with other parties, at competitive pricing rates to the manufacturer; (3) related manufacturers maintain separate and independent research and development, testing, and production facilities; (4) related manufacturers do not use any vehicle powertrains or platforms developed or produced by related manufacturers; (5) patents are not held jointly with related manufacturers; (6) related manufacturers maintain separate business administration, legal, purchasing, sales, and marketing departments, as well as autonomous decision-making on commercial matters; (7) the overlap of the Board of Directors between related manufacturers is limited to 25% with no sharing of top operational management, including president, chief executive officer, chief financial officer, and chief operating officer, and provided that no individual overlapping director or combination of overlapping directors exercises exclusive management control over either or both companies; and (8) parts or components supply between related companies must be established through open market process, and to the extent that the manufacturer sells parts/components to non-related manufacturers, it does so through the open market a competitive pricing. Any manufacturer applying for operational independence must submit to ARB an Attestation Engagement from an independent certified public accountant or firm of such accountants verifying the accuracy of the information contained in the application, as defined by and in accordance with the procedures established in

40 C.F.R. §80.125, as last amended January 19, 2007, which is incorporated by reference in section 1900, title 13, CCR. The applicant must submit information to update any of the above eight criteria as material changes to any of the criteria occur. If there are no material changes to any of the criteria, the applicant must certify that to the Executive Officer annually. With respect to any such changes, the Executive Officer may consider extraordinary conditions (e.g., changes to economic conditions, unanticipated market changes, etc.) and may continue to find the applicant to be operationally independent. In the event that a manufacturer loses eligibility as a "small volume manufacturer" after a material change occurs, the manufacturer must begin compliance with the primary emissions program in the third model year after the model year in which the manufacturer loses its eligibility. The Executive Officer may, in his or her discretion, re-establish lost "small volume manufacturer" status if the manufacturer shows that it has met the operational independence criteria for three consecutive years.

"**Solar Reflective Paint**" means a vehicle paint or surface coating which reflects at least 65 percent of the impinging infrared solar energy, as determined using ASTM standards E903, E1918-06, or C1549-09. These ASTM standards are incorporated by reference, herein.

"**Solar Roof Panels**" means the installation of solar panels on an electric vehicle or a plug-in hybrid electric vehicle such that the solar energy is used to provide energy to the electric drive system of the vehicle by charging the battery or directly providing power to the electric motor with the equivalent of at least 50 Watts of rated electricity output.

"**Strong hybrid gasoline-electric vehicle**" means a vehicle that has start/stop capability and regenerative braking capability, where the recaptured braking energy over the Federal Test Procedure is at least 75 percent of the total braking energy, where the percent of recaptured braking energy is measured and calculated according to 40 CFR §600.108(g).

"**Subconfiguration**" means

"**Super-ultra-low-emission vehicle"** means any vehicle certified to super-ultra-low-emission vehicle standards.

"**Ultra-low-emission vehicle**" means any vehicle certified to ultra-low-emission vehicle standards.

"Unified Cycle" or **"UC"** means the driving schedule as set forth in Part II, Section D of these test procedures.

"**Zero-emission vehicle**" or "**ZEV**" means any vehicle certified to the zero-emission standards set forth in the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" and the "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes."

3. §86.1804 Acronyms and Abbreviations.

3.1 §86.1804-01 January 17, 2006. [No change.]

3.2 **California Acronyms and Abbreviations.**

"ALVW" means adjusted loaded vehicle weight, which is the average of a vehicle's curb weight and gross vehicle weight.

"CCR" means California Code of Regulations.

"cc" means cubic centimeters.

"CFR" means Code of Federal Regulations.

"CH_4" means methane.

"GHG" means greenhouse gas.

"GWP" means Global Warming Potential.

"HEV" means hybrid-electric vehicle.

"LDT" means light-duty truck.

"LDT1" means a light-duty truck with a loaded vehicle weight of 0-3750 pounds.

"LDT2" means a light-duty truck with a loaded vehicle weight of 3751 to a gross vehicle weight of 8500 pounds.

"LEV" means LEV II low-emission vehicle.

"LEV II vehicle" means any vehicle certified to the LEV II exhaust standards in section E.1.1.1.

"LEV III vehicle" means any vehicle certified to the LEV III exhaust standards in section E.1.1.2.

"LEV160" means any light-duty vehicle certified to LEV III low-emission vehicle 160 standards.

"LEV395" means any medium-duty vehicle certified to LEV III low-emission vehicle 395 standards.

"LEV630" means any medium-duty vehicle certified to LEV III low-emission vehicle 630 standards.

"LVW" means loaded vehicle weight.

"MDPV" means medium-duty passenger vehicle.

"MDV" means medium-duty vehicle.

"n/a" means not applicable.

"NHTSA" means National Highway Traffic Safety Administration.

"N_2O" means nitrous oxide.

"Non-Methane Organic Gases" or "NMOG" means the total mass of oxygenated and non-oxygenated hydrocarbon emissions.

"OBD" means on-board diagnostic system.

"PC" means passenger car.

"PZEV" means any vehicle that receives partial zero-emission vehicle credit, in accordance with the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" and/or the "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes."

"SULEV" means LEV II super-ultra-low-emission vehicle.

"SULEV20" means any light-duty vehicle certified to LEV III super-ultra-low-emission 20 standards.

"SULEV30" means any light-duty vehicle certified to LEV III super-ultra-low-emission vehicle 30 standards.

"SULEV150" means any medium-duty vehicle certified to LEV III super-ultra-low-emission vehicle 150 standards.

"SULEV170" means any medium-duty vehicle certified to LEV III super-ultra-low-emission vehicle 170 standards.

"SULEV200" means any medium-duty vehicle certified to LEV III super-ultra-low-emission vehicle 200 standards.

"SULEV230" means any medium-duty vehicle certified to LEV III super-ultra-low-emission vehicle 230 standards.

"UC" means Unified Cycle.

"ULEV" means LEV II ultra-low-emission vehicle.

"ULEV50" means any light-duty vehicle certified to LEV III ultra-low-emission vehicle 50 standards.

"ULEV70" means any light-duty vehicle certified to LEV III ultra-low-emission vehicle 70 standards.

"ULEV125" means any light-duty vehicle certified to LEV III ultra-low-emission vehicle 125 standards.

"ULEV200" means any medium-duty vehicle certified to LEV III ultra-low-emission vehicle 200 standards.

"ULEV250" means any medium-duty vehicle certified to LEV III ultra-low-emission vehicle 250 standards.

"ULEV270" means any medium-duty vehicle certified to LEV III ultra-low-emission vehicle 270 standards.

"ULEV340" means any medium-duty vehicle certified to LEV III ultra-low-emission vehicle 340 standards.

"ULEV400" means any medium-duty vehicle certified to LEV III ultra-low-emission vehicle 400 standards.

"ULEV570" means any medium-duty vehicle certified to LEV III ultra-low-emission vehicle 570 standards.

C. General Requirements for Certification

1. §86.1805 Useful Life.

1.1 §86.1805-12. May 7, 2010. Amend as follows:

1.1.1 Amend subparagraph (a) as follows: The full useful life of passenger cars, light-duty trucks, and medium-duty vehicles certified to the LEV III standards in section E.1.1.2 and/or to the SFTP 150,000 mile standards in section E.1.2.2 shall be 15 years or 150,000 miles, whichever occurs first. These full useful life values apply to all exhaust, evaporative, and refueling emission requirements except for standards which are specified to only be applicable at the time of certification.

1.1.2 Amend subparagraph (b) as follows: The full useful life of passenger cars, light-duty trucks, and medium-duty vehicles certified to the optional LEV II 150,000 mile standards in section E.1.1.1 shall be 15 years or 150,000 miles, whichever occurs first.

1.1.3 Subparagraph (c) [No change.]

1.1.4 Subparagraph (d) [No change.]

2. §86.1806 On-Board Diagnostics.

2.1 §86.1806-05. Delete.

2.2 **California On-Board Diagnostic System Requirements.**

All vehicles shall be subject to the provisions of section 1968, et seq., title 13, CCR, as applicable. No vehicle shall be certified unless the Executive Officer finds that the vehicle complies with the requirements of section 1968, et seq., title 13, CCR, as applicable.

3. §86.1807 Vehicle Labeling.

3.1 §86.1807-07. July 13, 2005. Amend as follows:

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

3.1.2 Subparagraphs (a)(1) through (c)(1)(i). [No change.]

3.1.3 Subparagraph (c)(1)(ii): Amend as follows: For passenger cars, light-duty trucks, and medium-duty vehicles, the statement: "This vehicle conforms to California regulations applicable to XXX-fueled 20XX model-year new (specify LEV, LEV630, LEV395, LEV160, ULEV, ULEV570, ULEV400, ULEV340, ULEV270, ULEV250, ULEV200, ULEV125, ULEV70, ULEV50, SULEV, SULEV230, SULEV200, SULEV170, SULEV150, SULEV30, SULEV20, or ZEV, as applicable) (specify passenger cars, light-duty trucks, medium-duty vehicles)." For federally certified vehicles certified for sale in California the statement must include the phrase "conforms to U.S. EPA regulations and is certified for sale in California." Such statements shall not be used on labels placed on vehicles or engines which, in fact, do not comply with all applicable California regulations, including assembly-line test requirements, if any.

3.1.4 Subparagraphs (c)(1)(iii) through (c)(3): [No change.]

3.1.5 Subparagraph (d): Delete and replace with: Incomplete medium-duty vehicles shall have the following statement printed prominently on the label required by paragraph (a)(3)(v) of this section: "This vehicle conforms to California regulations applicable to new 20xx model-year (specify LEV, LEV630, LEV395, LEV160, ULEV, ULEV570, ULEV400, ULEV340, ULEV270, ULEV250, ULEV200, ULEV125, ULEV70, ULEV50, SULEV, SULEV230, SULEV200, SULEV170, SULEV150, SULEV30, or SULEV20, as applicable) medium-duty vehicles when it does not exceed XXX pounds in curb weight, XXX pounds in gross vehicle weight rating, and XXX square feet in frontal area."

3.1.6 Subparagraph (e): [No change.]

3.1.7 Subparagraph (f): [No change.]

3.1.8. Subparagraph (g): Add the following: The manufacturer shall obtain approval from the Executive Officer for all emission control label formats and locations prior to use. If the Executive Officer finds that the information on the label is vague or subject to misinterpretation, or that the location does not comply with these specifications, the Executive Officer may require that the label or its location be modified accordingly. Samples of all actual production emission control labels used within a test group shall be submitted to the Executive Officer within thirty days after the start of production. The Executive Officer may approve alternate label locations or may, upon request, waive or modify the label content requirements provided that the intent of these requirements is met. If the Executive Officer finds any motor vehicle or motor vehicle engine manufacturer using emission control labels which are different from those approved or which do not substantially comply with the readability or durability requirements set forth in these labeling requirements, the Executive Officer may invoke §2109, title 13, CCR.

3.2 **California Labeling Requirements**.

3.2.1. In addition to the federal requirements set forth in §86.1807, labeling shall conform with the requirements specified in section 1965, title 13, CCR and the “California Environmental Performance Label Specifications for 2009 and Subsequent Model Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles” as incorporated by reference in section 1965, title 13, CCR. In cases where there is conflict with the federal label specifications, the California requirements shall apply.

3.2.2. For all 2015 and subsequent model-year vehicles (except zero-emission vehicles (ZEVs)), the tune-up label shall also contain the following information lettered in the English language in block letters and numerals which shall be of a color that contrasts with the background of the label:

(a) “CA OBD II" or "OBD Exempt".

(b) Identification of the Exhaust Emission Control System, including but not limited to:

AIR	-	Secondary Air Injection (Pump);
CAC	-	Charge Air Cooler;
CFI	-	Continuous Fuel Injection;
CTOX	-	Continuous (Passive) Trap Oxidizer (Diesel Engine);
DFI	-	Direct Fuel Injection;

DOR	-	Direct Ozone Reduction;
DPF	-	Diesel Particulate Filter (Active);
EGR	-	Exhaust Gas Recirculation;
EGRC	-	EGR Cooler;
EHOC	-	Electrically Heated Oxidation Catalyst;
EHTWC	-	Electrically Heated Three-Way Catalyst;
EM	-	Engine Modification;
FFS	-	Flexible Fuel Sensor;
GPF	-	Particulate Filter for Spark-Ignited Engine;
HAC	-	Hydrocarbon Adsorbing Catalyst;
HO2S	-	Heated Oxygen Sensor;
IFI	-	Indirect Fuel Injection;
MFI	-	Multiport (Electronic) Fuel Injection, (Central) Multiport Fuel Injection;
NAC	-	NOx Adsorber Catalyst;
NH3OC	-	Ammonia Slip Catalyst;
NH3S	-	Ammonia Sensor;
NOXS	-	NOx Sensor;
OC	-	Oxidation Catalyst Only;
O2S	-	Oxygen Sensor;
PAIR	-	Pulsed Secondary Air Injection;
PMS	-	Particulate Matter Sensor;
RDQS	-	Reductant Quality Sensor;
SC	-	Supercharger;
SCRC	-	Selective Catalytic Reduction Catalyst (Urea-Based);
SCRC-NH3	-	Selective Catalytic Reduction Catalyst (Ammonia-Based);
SFI	-	Sequential Multipoint (Electronic) Fuel Injection;
TBI	-	Throttle Body (Electronic) Fuel Injection;
TC	-	Turbocharger;
TWC	-	Three-Way Catalyst;
TWC+OC	-	Three-Way Catalyst + Oxidation Catalyst;
WR-HO2S	-	Wide Range/Linear/Air-Fuel Ratio Heated Oxygen Sensor;
WU-TWC	-	Warm-Up Catalyst with Three-Way Catalyst;
WU-OC	-	Warm-Up Catalyst with Oxidation Catalyst.

Abbreviations used shall be in accordance with SAE J1930, October 2008, including the above nomenclature unless the Executive Officer approves a more current version of SAE J1930. For components not listed in SAE J1930, the manufacturer shall request Executive Officer approval of the abbreviations to be used for the components. Executive Officer approval shall be based on the consistency of the abbreviation with existing terminology used for the component in the applicable industry, ability to provide appropriate distinction from other similar components, and ability to be deciphered intuitively by users of the label.

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

3.2.4 Statements shall not be used on labels placed on vehicles or engines which, in fact, do not comply with all applicable California regulations, including assembly-line test requirements, if any.

4. §86.1808 Maintenance Instructions.

4.1 §86.1808-07. July 13, 2005. [No change.]

5. §86.1809 Prohibition of Defeat Devices.

5.1 §86-1809-12. May 7, 2010. [No change.]

D. §86.1810 General standards; increase in emissions; unsafe conditions; waivers

1. §86.1810-09. July 6, 2011. Amend §86.1810-09 as follows:

This section applies to model year 2015 and later light-duty vehicles, light-duty trucks, and medium-duty vehicles fueled by gasoline, diesel, methanol, ethanol, natural gas and liquefied petroleum gas fuels. Multi-fueled vehicles (including bi-fueled, dual-fueled and flexible-fueled vehicles) shall comply with all requirements established for each consumed fuel (or blend of fuels in the case of flexible-fueled vehicles). This section also applies to hybrid electric vehicles. The standards of this subpart apply to both certification and in-use vehicles unless otherwise indicated.

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

(e) On-board diagnostics. Delete and replace with:

All passenger cars, light-duty trucks and medium-duty vehicles are subject to the on-board diagnostic system requirements in section 1968 et seq., title 13, CCR, as applicable.

(f) Altitude Requirements. [No change, except that 50^{o}F standards shall only apply at low altitude conditions.]

(g) [No change.]

(h) [Delete; see D.1.1 below.]

(i) **Supplemental FTP general provisions**. [Delete; see D.2. below]

(j) **Evaporative emissions general provisions**. [Delete. (The provisions of this section are contained the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks, Medium-Duty Vehicles, Heavy-Duty Vehicles and Motorcycles.")]

(k) through (n) [Delete. (The provisions of these sections are contained the "California Refueling Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles.")]

(o) [Delete. See D.1.1 below]

(p) Amend as follows: For gasoline and diesel-fueled LEV II and LEV III vehicles, manufacturers may measure non-methane hydrocarbons (NMHC) in lieu of NMOG. For LEV II vehicles that are certified using the California Gasoline Fuel Specifications set forth in Part II, section 100.3.1.1, manufacturers must multiply NMHC measurements by an adjustment factor of 1.04 before comparing with the NMOG standard to determine compliance with the standard. For LEV III vehicles and LEV II vehicles that are certified using the California Gasoline Fuel Specifications set forth in Part II, section 100.3.1.2, manufacturers must multiply NMHC measurements by an adjustment factor of 1.1 before adding it to the measured NOx emissions and comparing with the NMOG+NOx standard to determine compliance with that standard. Manufacturers may use other factors to adjust NMHC results to more properly represent NMOG results. Such factors must be based upon comparative testing of NMOG and NMHC emissions and be approved in advance by the Administrator.

1.1 **Measurement of Hydrocarbon Emissions.**

1.1.1 Except as otherwise indicated in these test procedures, for vehicles fueled by gasoline, methanol, ethanol, natural gas, or liquefied petroleum gas and certified to the LEV II and LEV III standards, hydrocarbon emissions shall mean non-methane organic gases (NMOG) and shall be measured in accordance with the "California Non-Methane Organic Gas Test Procedures."

1.1.2 For diesel vehicles, NMOG shall mean non-methane hydrocarbons and shall be measured in accordance with Part B (Determination of NMHC Emissions by Flame Ionization Detection) of the "California Non-Methane Organic Gas Test Procedures."

1.1.3 For vehicles certifying to the SFTP standards set forth in section E.1.2 of these test procedures, hydrocarbon emissions shall be measured in accordance with Part B (Determination of NMHC Emissions by Flame Ionization Detection) of the "California Non-Methane Organic Gas Test Procedures." For alcohol-fueled vehicles certifying to the standards in section E.1.2, "Non-Methane Hydrocarbons" shall mean "Organic Material Non-Methane Hydrocarbon Equivalent."

2. Supplemental FTP General Provisions for California.

2.1 Amend 40 CFR §86.1810-09(i) as follows:

2.1.1 Delete subparagraphs (1) through (3) [The implementation schedules for SFTP are set forth in section E.2.4 of these test procedures.]

2.1.2 Delete subparagraph (4); replace with: The SFTP standards set forth in section E.1.2 of these test procedures apply to PCs, LDTs, and MDVs certified on alternative fuels. The standards also apply to the gasoline and diesel fuel operation of fuel-flexible PCs, LDTs, and MDVs, and dual-fuel PCs, LDTs, and MDVs.

2.1.3 Subparagraph (5) [No change.]

2.1.4 Delete subparagraph (6); replace with: **Air to Fuel Ratio Requirement.** With the exception of cold-start conditions, warm-up conditions and rapid-throttle motion conditions ("tip-in" or "tip-out" conditions), the air to fuel ratio shall not be richer at any time than, for a given engine operating condition (e.g., engine speed, manifold pressure, coolant temperature, air charge temperature, and any other parameters), the leanest air to fuel mixture required to obtain maximum torque (lean best torque), with a tolerance of six percent of the fuel consumption. The Executive Officer may approve a manufacturer's request for approval to use additional enrichment in subsequent testing if the manufacturer demonstrates that additional enrichment is needed to protect the vehicle, occupants, engine, or emission control hardware.

2.1.5 Delete subparagraph (7); replace with: **Single Roll Electric Dynamometer Requirement.** For all vehicles certified to the SFTP standards, a single-roll electric dynamometer or a dynamometer that produces equivalent results, as set forth in 40 CFR §86.108-00, must be used for all types of emission testing to determine compliance with the applicable emission standards.

2.1.6 Delete subparagraph (8);

2.1.7 Subparagraphs (9) through (12) [No change.]

2.1.8 Subparagraph (13) [No change, except that references to Tier 2 and non-Tier 2 vehicles shall mean California LEV II and LEV III vehicles and references to NMHC+NOx shall mean NMOG+NOx.]

2.1.9 Subparagraph (14); references to Tier 2 and non-Tier 2 vehicles shall mean California LEV II and LEV III vehicles.

Add the following sentence: The above provisions shall not apply to vehicles powered by “lean-burn” engines or Diesel-cycle engines. A “lean-burn” engine is defined as an Otto-cycle engine designed to run at an air-fuel ratio significantly greater than stoichiometry during the large majority of its operation.

2.2 For gasoline and diesel-fueled LEV II and LEV III vehicles, manufacturers may measure non-methane hydrocarbons (NMHC) in lieu of NMOG. Manufacturers shall multiply NMHC measurements by an adjustment factor of 1.03 before adding it to the measured NOx emissions and comparing with the NMOG+NOx standard to determine compliance with that standard.

E. California Exhaust Emission Standards.

Delete 40 CFR §§86.1811 through 86.1819.

Introduction. The following section E. contains the exhaust emission standards and phase-in requirements applicable to California passenger cars, light-duty trucks and medium-duty vehicles. A manufacturer must demonstrate compliance with the exhaust standards applicable to specific test groups, and with the composite phase-in requirements applicable to the manufacturer's entire fleet. For model years 2015 and 2016, a manufacturer shall demonstrate compliance with the requirements of sections E.2.5 and E.3.2 by demonstrating compliance with sections E.2.5 and E.3.2 of the "California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2009 through 2016 Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles."

For the 2015 through 2021 model years, a manufacturer has the option of certifying LEV II engines used in incomplete Otto-cycle and incomplete diesel medium-duty vehicles with a gross vehicle weight rating of greater than 8,500 lbs. GVW to the heavy-duty engine standards and test procedures set forth in title 13, CCR, sections 1956.8(c) and (h). All 2015 through 2021 model LEV II medium-duty vehicles with a gross vehicle weight rating of less than or equal to 8,500 lbs. GVW and all LEV III medium-duty vehicles with a gross vehicle weight rating of less than or equal to 10,000 lbs. GVW, including incomplete Otto-cycle medium-duty vehicles and medium-duty vehicles that use diesel cycle engines, must be certified to the chassis standards and test procedures set forth in this section E. For the 2022 and subsequent model years, a manufacturer has the option of certifying LEV III engines used in incomplete Otto-cycle and incomplete diesel medium-duty vehicles with a gross vehicle weight rating of greater than 10,000 lbs. GVW to the heavy-duty engine standards and test procedures set forth in title 13, CCR, sections 1956.8(c) and (h). All 2022 and subsequent model medium-duty vehicles with a gross vehicle weight rating of less than or equal to 10,000 lbs. GVW, including incomplete Otto-cycle medium-duty vehicles and medium-duty vehicles that use diesel cycle engines, must be certified to the LEV III chassis standards and test procedures set forth in this section E.

The procedures for meeting the ZEV phase-in requirements and for earning ZEV credits are contained in the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" and the "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes."

1. Exhaust Emission Standards.

1.1 FTP Exhaust Emission Standards for Light- and Medium-Duty Vehicles.

The exhaust emission standards set forth in this section refer to the exhaust emitted over the driving schedule set forth in title 40, CFR, Subparts B and C, except as amended in these test procedures.

1.1.1 **LEV II Exhaust Standards.** The following LEV II standards are the maximum exhaust emissions for the intermediate and full useful life from new 2015 through 2019 model year LEVs, ULEVs, and SULEVs, including fuel-flexible, bi-fuel and dual fuel vehicles when operating on the gaseous or alcohol fuel they are designed to use, except that for the 2015 through 2019 model years, SULEV exhaust standards shall only apply to vehicles that receive partial zero-emission vehicle credits according to the criteria set forth in section C.3 of the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" or the "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," incorporated by reference in section 1962.2, title 13, CCR. Vehicles that are certified to the particulate standards in section E.1.1.2.1 may not certify to LEV II standards.

2015 – 2019 model-year LEV II LEV vehicles may be certified to the NMOG+NOx numerical values for LEV160, LEV395, or LEV630, as applicable, in section E.1.1.2 and the corresponding NMOG+NOx numerical values in section E.1.4.2, in lieu of the separate NMOG and NOx exhaust emission standards in this section E.1.1.1 and the corresponding NMOG+NOx numerical values in section E.1.4.1; LEV II ULEV vehicles may be certified to the NMOG+NOx numerical values for ULEV125, ULEV340, or ULEV570, as applicable, in section E.1.1.2 and the corresponding NMOG+NOx numerical values in section E.1.4.2, in lieu of the separate NMOG and NOx exhaust emission standards in this section E.1.1.1 and the corresponding NMOG+NOx numerical values in section E.1.4.1; and LEV II SULEV vehicles may be certified to the NMOG+NOx numerical values for SULEV30, SULEV170, or SULEV230, as applicable, in section E.1.1.2 and the corresponding NMOG+NOx numerical values in section E.1.4.2, in lieu of the separate NMOG and NOx exhaust emission standards in this section E.1.1.1 and the corresponding NMOG+NOx numerical values in section E.1.4.1.

LEV II Exhaust Mass Emission Standards for New 2015 Through 2019 Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicle							
Vehicle Type	Durability Vehicle Basis (mi)	Vehicle Emission Category	NMOG (g/mi)	Carbon Monoxide (g/mi)	Oxides of Nitrogen (g/mi)	Formaldehyde (mg/mi)	Particulates (g/mi)
All PCs; LDTs 8,500 lbs. GVWR or less Vehicles in this category are tested at their loaded vehicle weight.	50,000	LEV	0.075	3.4	0.05	15	n/a
		LEV, Option 1	0.075	3.4	0.07	15	n/a
		ULEV	0.040	1.7	0.05	8	n/a
	120,000	LEV	0.090	4.2	0.07	18	0.01
		LEV, Option 1	0.090	4.2	0.10	18	0.01
		ULEV	0.055	2.1	0.07	11	0.01
		SULEV	0.010	1.0	0.02	4	0.01
	150,000 (optional)	LEV	0.090	4.2	0.07	18	0.01
		LEV, Option 1	0.090	4.2	0.10	18	0.01
		ULEV	0.055	2.1	0.07	11	0.01
		SULEV	0.010	1.0	0.02	4	0.01
MDVs 8,501 - 10,000 lbs. GVWR Vehicles in this category are tested at their adjusted loaded vehicle weight.	120,000	LEV	0.195	6.4	0.2	32	0.12
		ULEV	0.143	6.4	0.2	16	0.06
		SULEV	0.100	3.2	0.1	8	0.06
	150,000 (Optional)	LEV	0.195	6.4	0.2	32	0.12
		ULEV	0.143	6.4	0.2	16	0.06
		SULEV	0.100	3.2	0.1	8	0.06

Vehicle Type	Durability Vehicle Basis (mi)	Vehicle Emission Category	NMOG (g/mi)	Carbon Monoxide (g/mi)	Oxides of Nitrogen (g/mi)	Formaldehyde (mg/mi)	Particulates (g/mi)
MDVs 10,001-14,000 lbs. GVWR Vehicles in this category are tested at their adjusted loaded vehicle weight.	120,000	LEV	0.230	7.3	0.4	40	0.12
		ULEV	0.167	7.3	0.4	21	0.06
		SULEV	0.117	3.7	0.2	10	0.06
	150,000 (Optional)	LEV	0.230	7.3	0.4	40	0.12
		ULEV	0.167	7.3	0.4	21	0.06
		SULEV	0.117	3.7	0.2	10	0.06

1.1.2 **LEV III Exhaust Standards.** The following standards are the maximum exhaust emissions for the full useful life from new 2015 and subsequent model year "LEV III" passenger cars, light-duty trucks, and medium-duty vehicles, including fuel-flexible, bi-fuel and dual fuel vehicles when operating on both of the fuels they are designed to use. Before the 2015 model year, a manufacturer that produces vehicles meeting these standards has the option of certifying the vehicles to the standards, in which case the vehicles will be treated as LEV III vehicles for purposes of the fleet-wide phase-in requirements.

LEV III Exhaust Mass Emission Standards for New 2015 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles

Vehicle Type	Durability Vehicle Basis (mi)	Vehicle Emission Category[2]	NMOG + Oxides of Nitrogen (g/mi)	Carbon Monoxide (g/mi)	Formaldehyde (mg/mi)	Particulates[1] (g/mi)
All PCs; LDTs 8500 lbs. GVWR or less; and MDPVs Vehicles in this category are tested at their loaded vehicle weight	150,000	LEV160	0.160	4.2	4	0.01
		ULEV125	0.125	2.1	4	0.01
		ULEV70	0.070	1.7	4	0.01
		ULEV50	0.050	1.7	4	0.01
		SULEV30	0.030	1.0	4	0.01
		SULEV20	0.020	1.0	4	0.01
MDVs 8501 - 10,000 lbs. GVWR, excluding MDPVs Vehicles in this category are tested at their adjusted loaded vehicle weight	150,000	LEV395	0.395	6.4	6	0.12
		ULEV340	0.340	3.2	6	0.06
		ULEV250	0.250	2.6	6	0.06
		ULEV200	0.200	2.6	6	0.06
		SULEV170	0.170	1.5	6	0.06
		SULEV150	0.150	1.5	6	0.06
MDVs 10,001-14,000 lbs. GVWR Vehicles in this category are tested at their adjusted loaded vehicle weight	150,000	LEV630	0.630	7.3	6	0.12
		ULEV570	0.570	3.7	6	0.06
		ULEV400	0.400	3.0	6	0.06
		ULEV270	0.270	3.0	6	0.06
		SULEV230	0.230	1.7	6	0.06
		SULEV200	0.200	1.7	6	0.06

[1] These standards shall apply only to vehicles not included in the phase-in of the particulate standards set forth in Section E.1.1.2.1.

[2] The numeric portion of the category name is the NMOG+NOx value in thousandths of grams per mile.

1.1.2.1 **LEV III Particulate Standards.**

1.1.2.1.1 **Particulate Standards for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.** Beginning in the 2017 model year, a manufacturer, except a small volume manufacturer, shall certify a percentage of its passenger car, light-duty truck, and medium-duty vehicle fleet to the following particulate standards according to the following phase-in schedule. These standards represent the maximum particulate emissions allowed at full useful life. All vehicles certifying to these particulate standards must certify to the LEV III exhaust emission standards set forth in section E.1.1.2.

LEV III Particulate Emission Standard Values and Phase-in for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles		
Model Year	**% of vehicles certified to a 3 mg/mi standard**	**% of vehicles certified to a 1 mg/mi standard**
2017	10	0
2018	20	0
2019	40	0
2020	70	0
2021	100	0
2022	100	0
2023	100	0
2024	100	0
2025	75	25
2026	50	50
2027	25	75
2028 and subsequent	0	100

1.1.2.1.2 **Particulate Standards for Medium-Duty Vehicles Other than Medium-Duty Passenger Vehicles.**

1.1.2.1.2.1 Beginning in the 2017 model year, a manufacturer, except a small volume manufacturer, shall certify a percentage of its medium-duty vehicle fleet to the following particulate standards. These standards represent the maximum particulate emissions allowed at full useful life. All vehicles certifying to these particulate standards must certify to the LEV III exhaust emission standards set forth in section E.1.1.2. This section E.1.1.2.1.2.1 shall not apply to medium-duty passenger vehicles.

LEV III Particulate Emission Standard Values for Medium-Duty Vehicles, Other than Medium-Duty Passenger Vehicles	
Vehicle Type[1]	**Particulates (mg/mi)**
MDVs 8501 - 10,000 lbs. GVWR, excluding MDPVs	8
MDVs 10,001 - 14,000 lbs. GVWR	10

[1] Vehicles in these categories are tested at their adjusted loaded vehicle weight.

1.1.2.1.2.2 A manufacturer of medium-duty vehicles, except a small volume manufacturer, shall certify at least the following percentage of its medium-duty vehicle fleet to the particulate standards in section E.1.1.2.1.2.1 according to the following phase-in schedule. This section E.1.1.2.1.2.2 shall not apply to medium-duty passenger vehicles.

LEV III Particulate Emission Standard Phase-in for Medium-Duty Vehicles, Other than Medium-Duty Passenger Vehicles	
Model Year	**Total % of MDVs certified to the 8 mg/mi PM Standard or to the 10 mg/mi PM Standard, as applicable**
2017	10
2018	20
2019	40
2020	70
2021 and subsequent	100

1.1.2.1.3 **Particulate Standards for Small Volume Manufacturers.** In the 2021 through 2027 model years, a small volume manufacturer shall certify 100 percent of its passenger car, light-duty truck, and medium-duty passenger vehicle fleet to the 3 mg/mi particulate standard. In the 2028 and subsequent model years, a small volume manufacturer shall certify 100 percent of its passenger car, light-duty truck, and medium-duty passenger vehicle fleet to the 1 mg/mi particulate standard. In the 2021 and subsequent model years, a small volume manufacturer shall certify 100 percent of its medium-duty vehicles 8501 - 10,000 lbs. GVWR, excluding MDPVs, to the 8 mg/mi particulate standard. In the 2021 and subsequent model years, a small volume manufacturer shall certify 100 percent of its medium-duty vehicles 10,001 - 14,000 lbs. GVWR to the 10 mg/mi particulate standard. These standards represent the maximum particulate emissions allowed at full useful life. All vehicles certifying to these particulate standards must certify to the LEV III exhaust emission standards set forth in section E.1.1.2.

1.1.2.1.4 **Alternative Phase-in Schedule for Particulate Standards.**

1.1.2.1.4.1 **Alternative Phase-in Schedules for the 3 mg/mi Particulate Standard for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.** A manufacturer may use an alternative phase-in schedule to comply with the 3 mg/mi particulate standard phase-in requirements as long as equivalent PM emission reductions are achieved by the 2021 model year from passenger cars, light-duty trucks, and medium-duty passenger vehicles. Model year emission reductions shall be calculated by multiplying the percent of PC+LDT+MDPV vehicles meeting the 3 mg/mi particulate standard in a given model year (based on a manufacturer's projected sales volume of vehicles in each category) by 5 for the 2017 model year, 4 for the 2018 model year, 3 for the 2019 model year, 2 for the 2020 model year, and 1 for the 2021 model year. The yearly results for PC+LDT+MDPV vehicles shall be summed together to determine a cumulative total for PC+LDT+MDPV vehicles. The cumulative total must be equal to or greater than 490 in the 2021 model year to be considered equivalent. A manufacturer may add vehicles introduced before the 2017 model year (e.g., the percent of vehicles introduced in 2016 would be multiplied by 5) to the cumulative total.

1.1.2.1.4.2 **Alternative Phase-in Schedules for the 1 mg/mi Particulate Standard for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.** A manufacturer may use an alternative phase-in schedule to comply with the 1 mg/mi particulate standard phase-in requirements as long as equivalent PM emission reductions are achieved by the 2028 model year from passenger cars, light-duty trucks, and medium-duty passenger vehicles. Model year emission reductions shall be calculated by multiplying the percent of PC+LDT+MDPV vehicles meeting the 1 mg/mi particulate standard in a given model year (based on a manufacturer's projected sales volume of vehicles in each category) by 4 for the 2025 model year, 3 for the 2026 model year, 2 for the 2027 model year, and 1 for the 2028 model year. The yearly results for PC+LDT+MDPV vehicles shall be summed together to determine a cumulative total for PC+LDT+MDPV vehicles. The cumulative total must be equal to or greater than 500 in the 2028 model year to be considered equivalent. A manufacturer may add vehicles introduced before the 2025 model year (e.g., the percent of vehicles introduced in 2024 would be multiplied by 4) to the cumulative total.

1.1.2.1.4.3 **Alternative Phase-in Schedules for the Particulate Standards for Medium-Duty Vehicles Other than Medium-Duty Passenger Vehicles.** A manufacturer may use an alternative phase-in schedule to comply with the particulate standard phase-in requirements as long as equivalent PM emission reductions are achieved by the 2021 model year from medium-duty vehicles other than medium-duty passenger vehicles. Model year emission reductions shall be calculated by multiplying the total percent of MDVs certified to the 8 mg/mi PM standard or to the 10 mg/mi PM standard, as applicable, in a given model year (based on a manufacturer's projected sales volume of vehicles in each category) by 5 for the 2017 model year, 4 for the 2018 model year, 3 for the 2019 model year, 2 for the 2020 model year, and 1 for the 2021 model year. The yearly results for MDVs shall be summed together to determine a cumulative total for MDVs. The cumulative total must be equal to or greater than 490 in the 2021 model year to be considered equivalent. A manufacturer may add vehicles introduced before the 2017 model year (e.g., the percent of vehicles introduced in 2016 would be multiplied by 5) to the cumulative total.

1.2 Supplemental Federal Test Procedure ("SFTP") Exhaust Emission Standards for Light- and Medium-Duty Vehicles.

1.2.1 **4,000-mile SFTP Exhaust Emission Standards for Light- and Medium-Duty Vehicles.** The following standards represent the maximum SFTP exhaust emissions at 4,000 miles for 2015 through 2018 model year passenger cars, and light-duty truck and medium-duty vehicles (less than 8,501 pounds gross vehicle weight rating) certifying to the LEV II exhaust emission standards in section E.1.1.1:

SFTP Exhaust Emission Standards for LEV II Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles[1,2]

Vehicle Type	*Gross Vehicle Weight Rating (lbs.)*	*Test Weight*[3] *(lbs.)*	*US06 Test (g/mi)*		*A/C Test (g/mi)*	
			NMHC + NOx	*CO*	*NMHC + NOx*	*CO*
PC	All	All	0.14	8.0	0.20	2.7
LDT	≤ 6000 lbs.	0-3750 lbs.	0.14	8.0	0.20	2.7
		3751-5750 lbs.	0.25	10.5	0.27	3.5
MDV	6,001-8,500 lbs.	3751-5750 lbs.	0.40	10.5	0.31	3.5
		5751-8500 lbs.	0.60	11.8	0.44	4.0

[1] For certification purposes, testing shall be conducted at 4000 miles ±250 miles or at the mileage determined by the manufacturer for emission-data vehicles.

[2] The following definitions apply for purposes of this SFTP standards table only:

"LDT" (light-duty truck) is any motor vehicle rated at 6,000 pounds gross vehicle weight rating or less, which is designed primarily for purposes of transportation of property or is a derivative of such a vehicle, or is available with special features enabling off-street or off-highway operation and use.

"MDV" (medium-duty vehicle) is any motor vehicle having a manufacturer's gross vehicle weight rating of greater than 6,000 pounds and less than 14,001 pounds, except passenger cars and light-duty trucks. Vehicles with a gross vehicle weight rating over 8,500 pounds are exempted from the requirements of this section E.1.2.1.

[3] PCs and LDTs are tested at their loaded vehicle weight (curb weight plus 300 lbs.). MDVs are tested at their adjusted loaded vehicle weight (average of curb weight and GVWR).

1.2.2 **150,000-mile SFTP Exhaust Emission Standards for Light- and Medium-Duty Vehicles.**

1.2.2.1 **SFTP NMOG+NOx and CO Exhaust Emission Standards for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.** Manufacturers shall certify 2015 and subsequent model year LEVs, ULEVs, and SULEVs in the PC, LDT, and MDPV classes to either the *SFTP NMOG+NOx and CO Stand-Alone Exhaust Emission Standards* set forth in section E.1.2.2.1.1, or in accordance with the *SFTP NMOG+NOx and CO Composite Exhaust Emission Standards and Fleet-Average Requirements* set forth in section E.1.2.2.1.2. A manufacturer may also certify 2014 model LEVs, ULEVs, or SULEVs in the PC, LDT, or MDPV classes to LEV III SFTP standards, in which case, the manufacturer shall be subject to the LEV III SFTP emission standards and requirements, including the sales-weighted fleet-average NMOG+NOx composite emission standard applicable to 2015 model vehicles if choosing to comply with the *SFTP NMOG+NOx and CO Composite Exhaust Emission Standards and Fleet-Average Requirements* set forth in subsection E.1.2.2.1.2. The manufacturer shall notify the Executive Officer of its selected emission standard type in the Application for Certification of the first test group certifying to SFTP NMOG+NOx and CO emission standards on a 150,000 mile durability basis. Once an emission standard type for NMOG+NOx and CO is selected for a fleet, and the Executive Officer is notified of such selection, the selection must be kept through the 2025 model year for the entire fleet, which includes LEV II vehicles if selecting to comply with section E.1.2.2.1.2. The manufacturer may not change its selection until the 2026 model year. Test groups not certifying to the 150,000-mile SFTP NMOG+NOx and CO emission standards pursuant to this section E.1.2.2 shall be subject to the 4,000-mile SFTP NMOG+NOx and CO emission standards set forth in section E.1.2.1.

1.2.2.1.1 **SFTP NMOG+NOx and CO Exhaust Stand-Alone Emission Standards.** The following standards are the maximum SFTP NMOG+NOx and CO exhaust emissions through full useful life from 2015 and subsequent model-year LEV III LEVs, ULEVs, and SULEVs when operating on the same gaseous or liquid fuel they use for FTP certification. In the case of fuel-flexible vehicles, SFTP compliance shall be demonstrated using the LEV III certification gasoline specified in Part II, Section A.100.3.1.2.

SFTP NMOG+NOx and CO Stand-Alone Exhaust Emission Standards for 2015 and Subsequent Model LEV III Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles						
Vehicle Type	*Durability Vehicle Basis (mi)*	*Vehicle Emission Category*[1]	*US06 Test (g/mi)*		*SC03 Test (g/mi)*	
			NMOG + NOx	*CO*	*NMOG + NOx*	*CO*
All PCs; LDTs 0- 8,500 lbs. GVWR; and MDPVs Vehicles in these categories are tested at their loaded vehicle weight (curb weight plus 300 pounds).	150,000	LEV	0.140	9.6	0.100	3.2
		ULEV	0.120	9.6	0.070	3.2
		SULEV (Option A)[2]	0.060	9.6	0.020	3.2
		SULEV	0.050	9.6	0.020	3.2

[1] *Vehicle Emission Category*. Manufacturers must certify all vehicles, which are certifying to a LEV III FTP emission category on a 150,000-mile durability basis, to the emission standards of the equivalent, or a more stringent, SFTP emission category set forth on this table. That is, all LEV III LEVs certified to 150,000-mile FTP emission standards shall comply with the SFTP LEV emission standards in this table, all LEV III ULEVs certified to 150,000-mile FTP emission standards shall comply with the SFTP ULEV emission standards in this table, and all LEV III SULEVs certified to 150,000-mile FTP emission standards shall comply with the SFTP SULEV emission standards in this table.

[2] *Optional SFTP SULEV Standards.* A manufacturer may certify light-duty truck test groups from 6,001 to 8,500 lbs. GVWR and MDPV test groups to the SULEV, option A, emission standards set forth in this table for the 2015 through 2020 model year, only if the vehicles in the test group are equipped with a particulate filter and the manufacturer extends the particulate filter emission warranty mileage to 200,000 miles. Passenger cars and light-duty trucks 0-6,000 lbs. GVWR are not eligible for this option.

1.2.2.1.2 **SFTP NMOG+NOx and CO Composite Exhaust Emission Standards.** For the 2015 and subsequent model years, a manufacturer must certify LEV II and LEV III LEVs, ULEVs, and SULEVs, such that the manufacturer's sales-weighted fleet-average NMOG+NOx composite emission value, does not exceed the applicable NMOG+NOx composite emission standard set forth in the following table. In addition, the CO composite emission value of any LEV III test group shall not exceed the CO composite emission standard set forth in the following table. SFTP compliance shall be demonstrated using the same gaseous or liquid fuel used for FTP certification. In the case of fuel-flexible vehicles, SFTP compliance shall be demonstrated using the LEV III certification gasoline specified in Part II, Section A.100.3.1.2.

For each test group subject to this subsection, manufacturers shall calculate a Composite Emission Value for NMOG+NOx and, for LEV III test groups, a separate Composite Emission Value for CO, using the following equation:

Composite Emission Value = 0.28 x US06 + 0.37 x SC03 + 0.35 x FTP [Eq. 1] where “US06” = the test group’s NMOG+NOx or CO emission value, as applicable, determined through the US06 test;

“SC03” = the test group’s NMOG+NOx or CO emission value, as applicable, determined through the SC03 test; and

“FTP” = the test group’s NMOG+NOx or CO emission value, as applicable, determined through the FTP test.

If no vehicles in a test group have air conditioning units, the FTP cycle emission value can be used in place of the SC03 value in Equation 1. To determine compliance with the SFTP NMOG+NOx composite emission standard applicable to the model year, manufacturers shall use a sales-weighted fleet average of the NMOG+NOx composite emission values of every applicable test group. The sales-weighted fleet average shall be calculated using a combination of carry-over and new certification SFTP composite emission values (converted to NMOG+NOx, as applicable). LEV II test groups will use their emission values in the fleet average calculation but will not be considered LEV III test groups. Compliance with the CO composite emission standard cannot be demonstrated through fleet averaging. The NMOG+NOx sales-weighted fleet-average composite emission value for the fleet and the CO composite emission value for each test group shall not exceed:

SFTP NMOG+NOx and CO Composite Emission Standards for 2015 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles (g/mi) [1]

Model Year	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025+**
All PCs; LDTs 8,500 lbs. GVWR or less; and MDPVs[3]	***Sales-Weighted Fleet Average NMOG+NOx Composite Exhaust Emission Standards***[2,4,5,6]										
	0.140	0.110	0.103	0.097	0.090	0.083	0.077	0.070	0.063	0.057	0.050
Vehicles in this category are tested at their loaded vehicle weight (curb weight plus 300 pounds).	***CO Composite Exhaust Emission Standard***[7]										
	4.2										

[1] *Mileage for Compliance.* All test groups certifying to LEV III FTP emission standards on a 150,000-mile durability basis shall also certify to the SFTP on a 150,000-mile durability basis, as tested in accordance with these test procedures.

[2] *Determining NMOG+NOx Composite Emission Values of LEV II Test Groups.* For test groups certified to LEV II FTP emission standards, SFTP emission values shall be converted to NMOG+NOx and projected out to 120,000 miles or 150,000 miles (depending on LEV II FTP certification) using deterioration factors or aged components. NMHC emission values for the US06 and SC03 test cycles shall be converted to NMOG emission values by multiplying by a factor of 1.03. In lieu of deriving a deterioration factor specific to SFTP test cycles, carry-over test groups may use the applicable deterioration factor from the FTP cycle in order to determine the carry-over composite emission values for the purpose of the NMOG+NOx sales-weighted fleet-average calculation. If an SFTP full-useful life emission value is used to comply with SFTP 4k standards, that value may be used in the sales-weighted fleet-average without applying an additional deterioration factor.

[3] MDPVs are excluded from SFTP NMOG+NOx and CO emission standards and the sales-weighted fleet average until they are certified to LEV III FTP 150,000-mile NMOG+NOx and CO requirements.

[4] Test groups shall certify to bins in increments of 0.010 g/mi. Beginning with the 2018 model year, vehicles may not certify to bin values above a maximum of 0.180 g/mi.

[5] *Calculating the sales-weighted average for NMOG+NOx.* For each model year, the manufacturer shall calculate its sales-weighted fleet-average NMOG+NOx composite emission value as follows.

$$\frac{\left[\sum_{i=1}^{n}(number\ of\ vehicles\ in\ the\ test\ group)_i \times (composite\ value\ of\ bin)_i\right]}{\sum_{i=1}^{n}(number\ of\ vehicles\ in\ the\ test\ group)_i} \quad \text{[Eq. 2]}$$

where "n" = a manufacturer's total number of PC, LDT, and, if applicable, MDPV certification bins, in a given model year including carry-over certification bins, certifying to SFTP composite emission standards in that model year;

"number of vehicles in the test group" = the number of vehicles produced and delivered for sale in California in the certification test group; and

"Composite Value of Bin" = the numerical value selected by the manufacturer for the certification bin that serves as the emission standard for the vehicles in the test group with respect to all testing for test groups certifying to SFTP on a 150,000-mile durability basis, and the SFTP carry-over composite emission value, as described in footnote 7 of this table, for carry-over LEV II test groups.

[6] *Calculation of Fleet Average Total NMOG+NOx Credits or Debits.* A manufacturer shall calculate the total NMOG+NOx credits or debits, as follows:

[(NMOG+NOx Composite Emission Standard) – (Manufacturer's Sales-Weighted Fleet-Average Composite Emission Value)]
x (Total Number of Vehicles Produced and Delivered for Sale in California in the 0-8,500 lbs GVWR plus MDPVs classes, if applicable) [Eq. 3]

A negative number constitutes total NMOG+NOx debits, and a positive number constitutes total NMOG+NOx credits accrued by the manufacturer for the given model year. Total NMOG+NOx credits earned in a given model year retain full value through the fifth model year after they are earned. At the beginning of the sixth model year, the total NMOG+NOx credits have no value. A manufacturer may trade credits with other manufacturers

A manufacturer shall equalize total NMOG+NOx debits within three model years after they have been incurred by earning NMOG+NOx credits in an amount equal to the total NMOG+NOx debits. If total NMOG+NOx debits are not equalized within the three model-year period, the manufacturer is subject to the Health and Safety Code section 43211 civil penalty applicable to a manufacturer which 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 total NMOG+NOx debits are not equalized 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 emission standards is determined by dividing the NMOG+NOx debits for the model year by the NMOG+NOx composite emission standard in effect during the model year in which the debits were incurred.

[7] *Calculating the CO composite emission value.* Composite emission values for CO shall be calculated in accordance with Equation 1 above. Unlike the NMOG+NOx composite emission standards, manufacturers would not be able to meet the proposed CO composite emission standard through fleet averaging: each individual test group must comply with the standard. Test groups certified to 4,000-mile SFTP emission standards are not subject to this CO emission standard.

1.2.2.2 **SFTP PM Exhaust Emission Standards for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.** The following standards are the maximum PM exhaust emissions through the full useful life from 2017 and subsequent model-year LEV III LEVs, ULEVs, and SULEVs in the PC, LDT, and MDPV classes when operating on the same gaseous or liquid fuel they use for FTP certification. In the case of flex-fueled vehicles, SFTP compliance shall be demonstrated using the LEV III certification gasoline specified in Part II, Section A.100.3.1.2.

SFTP PM Exhaust Emission Standards for 2017 and Subsequent Model LEV III Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles[1]				
Vehicle Type	*Test Weight*	*Mileage for Compliance*	*Test Cycle*	*PM (mg/mi)*
All PCs; LDTs 0-6,000 lbs GVWR	Loaded vehicle weight	150,000	US06	10
LDTs 6,001-8,500 lbs GVWR; MDPVs	Loaded vehicle weight	150,000	US06	20

[1] All PCs, LDTs, and MDPVs certified to LEV III FTP PM emission standards in section E.1.1.2.1 on a 150,000-mile durability basis shall comply with the SFTP PM Exhaust Emission Standards in this table.

1.2.2.3 **SFTP NMOG+NOx and CO Exhaust Emission Standards for Medium-Duty Vehicles.** The following standards are the maximum NMOG+NOx and CO composite emission values for full useful life of 2016 and subsequent model-year medium-duty LEV III ULEVs and SULEVs from 8,501 through 14,000 pounds GVWR when operating on the same gaseous or liquid fuel they use for FTP certification. In the case of fuel-flexible vehicles, SFTP compliance shall be demonstrated using the LEV III certification gasoline specified in Part II, Section A.100.3.1.2. The following composite emission standards do not apply to MDPVs subject to the emission standards set forth in sections E.1.2.2.1 and E.1.2.2.2.

SFTP NMOG+NOx and CO Composite Exhaust Emission Standards for 2016 and Subsequent Model ULEVs and SULEVs in the Medium-Duty Vehicle Class						
Vehicle Type	*Mileage for Compliance*	*HP/GVWR*[2]	*Test Cycle*[3,4,5]	*Vehicle Emission Category*[6]	*Composite Emission Standard*[1] *(g/mi)*	
					NMOG + NOx	*Carbon Monoxide*
MDVs 8,501 - 10,000 lbs GVWR	150,000	≤ 0.024	US06 Bag 2, SC03, FTP	ULEV	0.550	22.0
				SULEV	0.350	12.0
		> 0.024	Full US06, SC03, FTP	ULEV	0.800	22.0
				SULEV	0.450	12.0
MDVs 10,001-14,000 lbs GVWR	150,000	n/a	Hot 1435 UC (Hot 1435 LA92), SC03, FTP	ULEV	0.550	6.0
				SULEV	0.350	4.0

[1] Manufacturers shall use Equation 1 in subsection E.1.2.2.1.2 to calculate SFTP Composite Emission Values for each test group subject to the emission standards in this table. For MDVs 10,001-14,000 lbs. GVWR, the emission results from the UC test shall be used in place of results from the US06 test.

[2] *Power to Weight Ratio.* If all vehicles in a test group have a power to weight ratio at or below a threshold of 0.024, they may opt to run the US06 Bag 2 in lieu of the full US06 cycle. The cutoff is determined by using a ratio of the engine's maximum rated horsepower, as established by the engine manufacturer in the vehicle's Application for Certification, to the vehicle's GVWR in pounds and does not include any horsepower contributed by electric motors in the case of hybrid electric or plug-in hybrid electric vehicles. Manufacturers may opt to test to the full cycle regardless of the calculated ratio; in such case, manufacturers shall meet the emission standards applicable to vehicles with power-to-weight ratios greater than 0.024.

[3] *Test Weight*. Medium-duty vehicles are tested at their adjusted loaded vehicle weight (average of curb weight and GVWR).

[4] *Road Speed Fan.* Manufacturers have the option to use a road speed modulated fan as specified in § 86.107–96(d)(1) instead of a fixed speed fan for MDV SFTP testing.

[5] If a manufacturer provides an engineering evaluation for a test group showing that SC03 emissions will be equivalent to or lower than FTP emissions, the FTP emission value may be used in place of the SC03 emission value when determining the composite emission value for that test group.

[6] *Vehicle Emission Categories.* For MDVs 8,501-10,000 lbs. GVWR, for each model year, the percentage of MDVs certified to an SFTP emission category set forth in this section E.1.2.2.3 shall be equal to or greater than the total percentage certified to the FTP ULEV250, ULEV200, SULEV170, and SULEV150 emission categories; of these vehicles, the percentage of MDVs certified to an SFTP SULEV emission category shall be equal to or greater than the total percentage certified to both the FTP SULEV170 and SULEV150 emission categories. For MDVs 10,001-14,000 lbs. GVWR, for each model year, the percentage of MDVs certified to an SFTP emission category set forth this section E.1.2.2.3 shall be equal to or greater than the total percentage certified to the FTP ULEV400, ULEV270, SULEV230, and SULEV200 emission categories; of these vehicles, the percentage of MDVs certified to an SFTP SULEV emission category shall be equal to or greater than the total percentage certified to both the FTP SULEV230 and SULEV200 emission categories.

1.2.2.4 **SFTP PM Exhaust Emission Standards for Medium-Duty Vehicles.** The following standards represent the maximum PM composite emission values for the full useful life of 2017 and subsequent model-year LEV III LEVs, ULEVs, and SULEVs when operating on the same gaseous or liquid fuel they use for FTP certification. In the case of fuel-flexible vehicles, SFTP compliance shall be demonstrated using the LEV III certification gasoline specified in Part II, Section A.100.3.1.2. The following composite emission standards do not apply to MDPVs subject to the emission standards set forth in sections E.1.2.2.1 and E.1.2.2.2.

SFTP PM Exhaust Emission Standards for 2017 and Subsequent Model Medium-Duty Vehicles[1]

Vehicle Type	*Test Weight*	*Mileage for Compliance*	*Hp/GVWR[2]*	*Test Cycle[3,4]*	*PM (mg/mi)*
MDVs 8,501-10,000 lbs GVWR	Adjusted loaded vehicle weight	150,000	≤ 0.024	US06 Bag 2	7
			>0.024	US06	10
MDVs 10,001-14,000 lbs GVWR	Adjusted loaded vehicle weight	150,000	n/a	Hot 1435 UC (Hot 1435 LA92)	7

[1] Except for MDPVs subject to the emission standards set forth in section E.1.2.2.2, MDVs certified to 150,000-mile FTP PM emission standards in section E.1.1.2 shall comply with the SFTP PM Exhaust Emission Standards in this table.

[2] *Power to Weight Ratio.* If all vehicles in a test group have a power to weight ratio at or below a threshold of 0.024, they may opt to run the US06 Bag 2 in lieu of the full US06 cycle. The cutoff is determined by using a ratio of the engine's horsepower to the vehicle's GVWR in pounds and does not include any horsepower contributed by electric motors in the case of hybrid electric or plug-in hybrid electric vehicles. Manufacturers may opt to test to the full cycle regardless of the calculated ratio; in such case, manufacturers shall meet the emission standards applicable to vehicles with power-to-weight ratios greater than 0.024.

[3] *Road Speed Fan.* Manufacturers have the option to use a road speed modulated fan as specified in § 86.107–96(d)(1) instead of a fixed speed fan for MDV SFTP testing.

[4] Manufacturers shall use Equation 1 above to calculate SFTP Composite PM Emission Values for each test group subject to the emission standards in this table. For MDVs 8,501-10,000 lbs. GVWR certifying to the US06 Bag 2 PM emission standard, the emission results from the US06 Bag 2 test shall be used in place of results from the full US06 test. For MDVs 10,001-14,000 lbs. GVWR, the emission results from the UC test shall be used in place of results from the US06 test.

1.3 NMOG+NOx Standards for Fuel-Flexible, Bi-Fuel and Dual-Fuel Vehicles.

For fuel-flexible, bi-fuel and dual-fuel PCs, LDTs and MDVs, compliance with the NMOG+NOx exhaust mass emission standards must be based on exhaust emission tests both when the vehicle is operated on the gaseous or alcohol fuel it is designed to use, and when the vehicle is operated on gasoline. A manufacturer may measure NMHC in lieu of NMOG when fuel-flexible, bi-fuel and dual-fuel vehicles are operated on gasoline, subject to the requirements of section D.1., subparagraph (p). Testing at 50°F is not required for fuel-flexible, bi-fuel and dual-fuel vehicles when operating on gasoline. The applicable CO, NOx, and formaldehyde standards are set forth in section E.1.1 above.

1.3.1 For 2015 through 2019 model year LEV II vehicles, a manufacturer must demonstrate compliance with the applicable exhaust mass emission standards for NMOG, CO, NOx and formaldehyde set forth in the tables in section E.1.1.1 when certifying the vehicle for operation on the gaseous or alcohol fuel. If the manufacturer elects to use them, the following exhaust mass emission standards represent the maximum NMOG emissions when certifying the vehicle for operation on gasoline (as specified in Part II, Section A. paragraph 100.3.1).

LEV II NMOG Standards for Bi-Fuel, Fuel-Flexible and Dual-Fuel Vehicles Operating on Gasoline (g/mi)

Vehicle Type	Vehicle Emission Category	Durability Vehicle Basis	
		50,000 mi	120,000 mi
All PCs; LDTs, 0-8500 lbs. GVW	LEV	0.125	0.156
	ULEV	0.075	0.090
	SULEV	0.010	0.040
MDVs, 8501-10,000 lbs. GVW	LEV	n/a	0.230
	ULEV	n/a	0.167
	SULEV	n/a	0.117
MDVs, 10,001-14,000 lbs. GVW	LEV	n/a	0.280
	ULEV	n/a	0.195
	SULEV	n/a	0.143

1.3.2 For the 2015 and subsequent model year LEV III vehicles, a manufacturer must demonstrate compliance with the applicable exhaust mass emission standards for NMOG+NOx, CO, and formaldehyde set forth in the tables in section E.1.1.2 when certifying the vehicle for operation on both gasoline or diesel, as applicable, and on the gaseous or alcohol fuel, as applicable.

1.4 50°F Exhaust Emission Standards.

1.4.1 Standards for Vehicles Certified to the LEV II Standards.

All passenger cars, light-duty trucks, and medium-duty vehicles certified to the LEV II exhaust emission standards set forth in subparagraph E.1.1.1 must demonstrate compliance with the following exhaust emission standards for NMOG and formaldehyde measured on the FTP (40 CFR, Part 86, Subpart B) conducted at a nominal test temperature of 50°F, as modified by Part II, Section C of these test procedures. A manufacturer may demonstrate compliance with the NMOG and HCHO certification standards contained in this subparagraph 1.4.1 by measuring NMHC exhaust emissions in accordance with section D.1., subparagraph (p) and section G.3.1.2, respectively, of these test procedures. Emissions of CO and NOx measured at 50°F shall not exceed the standards set forth in section E.1.1.1 applicable to vehicles of the same emission category and vehicle type subject to a cold soak and emission test at 68° to 86°F. Natural gas and diesel-fueled vehicles are exempt from the 50° F test requirements.

Vehicle Weight Class	**Vehicle Emission Category (g/mi)**					
	LEV		*ULEV*		*SULEV*	
	NMOG	HCHO	NMOG	HCHO	NMOG	HCHO
PCs; LDTs 0-8500 lbs. GVW	0.150	0.030	0.080	0.016	0.020	0.008
MDVs 8501-10,000 lbs. GVW	0.390	0.064	0.286	0.032	0.200	0.016
MDVs 10,001-14,000 lbs. GVW	0.460	0.080	0.334	0.042	0.234	0.020

1.4.2 Standards for Vehicles Certified to the LEV III Standards.

All passenger cars, light-duty trucks, and medium-duty vehicles certified to the LEV III exhaust emission standards set forth in subparagraph E.1.1.2, other than natural gas and diesel fueled vehicles, must demonstrate compliance with the following exhaust emission standards for NMOG+NOx and formaldehyde measured on the FTP (40 CFR, Part 86, Subpart B) conducted at a nominal test temperature of 50°F, as modified by Part II, Section C of these test procedures. A manufacturer may demonstrate compliance with the NMOG+NOx and HCHO certification standards contained in this subparagraph 1.4.2 by measuring NMHC exhaust emissions in accordance with section D.1., subparagraph (p) and section G.3.1.2, respectively, of these test procedures. Emissions of CO measured at 50°F shall not exceed the standards set forth in section E.1.1.2 applicable to vehicles of the same emission category and vehicle type subject to a cold soak and emission test at 68° to 86°F.

1.4.2.1 **Standards for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles Certified to the LEV III Standards.**

50°F Exhaust Emission Standards for LEV III Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles			
Vehicle Emission Category	*NMOG + NOx (g/mi)*		*HCHO (g/mi)*
	Gasoline	Alcohol Fuel	Both Gasoline and Alcohol Fuel
LEV160	0.320	0.320	0.030
ULEV125	0.250	0.250	0.016
ULEV70	0.140	0.250	0.016
ULEV50	0.100	0.140	0.016
SULEV30	0.060	0.125	0.008
SULEV20	0.040	0.075	0.008

1.4.2.2 **Standards for Medium-Duty Vehicles (Excluding MDPVs) Certified to the LEV III Standards.**

50^{o}F Exhaust Emission Standards for LEV III Medium-Duty Vehicles (Excluding MDPVs)			
Vehicle Emission Category	*NMOG + NOx (g/mi)*		*HCHO (g/mi)*
	Gasoline	Alcohol Fuel	Both Gasoline and Alcohol Fuel
LEV395	0.790	0.790	0.064
ULEV340	0.680	0.680	0.032
ULEV250	0.500	0.500	0.032
ULEV200	0.400	0.500	0.016
SULEV170	0.340	0.425	0.016
SULEV150	0.300	0.375	0.016
LEV630	1.260	1.260	0.080
ULEV570	1.140	1.140	0.042
ULEV400	0.800	0.800	0.042
ULEV270	0.540	0.675	0.020
SULEV230	0.460	0.575	0.020
SULEV200	0.400	0.500	0.020

1.5 Cold CO Standards.

The following standards are the maximum 50,000 mile cold temperature exhaust carbon monoxide emission levels from new 2015 and subsequent model-year passenger cars, light-duty trucks, and medium-duty passenger vehicles:

2015 AND SUBSEQUENT MODEL-YEAR COLD TEMPERATURE CARBON MONOXIDE EXHAUST EMISSIONS STANDARDS FOR PASSENGER CARS, LIGHT-DUTY TRUCKS, AND MEDIUM-DUTY VEHICLES
(grams per mile)

Vehicle Type	**Carbon Monoxide**
All PCs, LDTs 0-3750 lbs. LVW	10.0
LDTs 3751 lbs. LVW - 8500 lbs. GVW; MDPVs 10,000 lbs. GVW and less	12.5

These standards apply to vehicles tested in accordance with 40 CFR Part 86 Subpart C, as modified in Part II, Section B of these test procedures at a nominal temperature of 20°F (-7°C). Natural gas vehicles, diesel-fueled vehicles, and medium-duty vehicles with a gross vehicle weight rating greater than 8,500 lbs. are exempt from these standards.

1.6 Highway NMOG + NOx Standard.
The maximum emissions of NMOG+NOx measured on the federal Highway Fuel Economy Test (HWFET; 40 CFR 600 Subpart B, which is incorporated herein by reference) must not be greater than the applicable LEV III NMOG+NOx standard set forth in section E.1.1.2. Both the sum of the NMOG+NOx emissions and the HWFET standard must be rounded in accordance with ASTM E29-67 to the nearest 0.001 g/mi before being compared.

1.7 Requirement to Generate Additional NMOG+NOx Fleet Average Credit.
A vehicle that is certified to the LEV III standards in section E.1.1.2, which does not generate a partial ZEV allocation according to the criteria set forth in section C.3 of the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" and the "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," a manufacturer may subtract 5 mg/mi from the NMOG+NOx emission standard value set forth in section E.3.1.1 when calculating the manufacturer's fleet average, provided that the manufacturer extends the performance and defects warranty period to 15 years or 150,000 miles, whichever occurs first.

1.8 Requirement to Generate a Partial ZEV Allowance.
For the 2015 through 2017 model years, a manufacturer that certifies to the 150,000 mile LEV II SULEV standards, the LEV III SULEV30, or the LEV III SULEV20 standards may also generate a partial ZEV allocation according to the criteria set forth in section C.3 of the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes."

1.9 Optional LEV II NOx Standard.

For the 2015 through 2019 model years, a manufacturer may certify up to 4% of its light-duty truck fleet from 3751 lbs. LVW - 8500 lbs. GVW with a maximum base payload of 2500 lbs. or more, to the LEV II, option 1, standard set forth in section E.1.1.1 based on projected sales of trucks in this category. Passenger cars and light-duty trucks 0-3750 lbs. LVW are not eligible for this option.

1.10 NMOG Credit for Direct Ozone Reduction Technology.

A manufacturer that certifies vehicles equipped with direct ozone reduction technologies shall be eligible to receive NMOG credits that can be applied to the NMOG exhaust emissions of the vehicle when determining compliance with the standard. In order to receive credit, the manufacturer must submit the following information for each vehicle model for which it seeks credit, including, but not limited to:

(a) a demonstration of the airflow rate through the direct ozone reduction device and the ozone-reducing efficiency of the device over the range of speeds encountered in the UC as set forth in Part II, Section E of these test procedures;

(b) an evaluation of the durability of the device for the full useful life of the vehicle; and

(c) a description of the on-board diagnostic strategy for monitoring the performance of the device in-use.

Using the above information, the Executive Officer shall determine the value of the NMOG credit based on the calculated change in the one-hour peak ozone level using an approved airshed model.

1.11 When a Federally-Certified Vehicle Model is Required in California.

1.11.1 **Basic Requirement.** Whenever a manufacturer federally-certifies a 2015 or subsequent model-year passenger car, light-duty truck, or medium-duty vehicle model to the standards for a particular emissions bin that are more stringent than the standards for an applicable California vehicle emissions category, the equivalent California model may only be certified to (i) the California standards for a vehicle emissions category that are at least as stringent as the standards for the corresponding federal emissions bin, or (ii) the exhaust emission standards to which the federal model is certified. However, where the federal exhaust emission standards for the particular emissions bin and the California standards for a vehicle emissions category are equally stringent, the California model may only be certified to either the California standards for that vehicle emissions category or more stringent California standards. The federal emission bins are those contained Tables S04-1 and S04-2 of 40 CFR section 86.1811-04(c) as adopted February 10, 2000. The criteria for applying this requirement are set forth in Part I, Section H.1 of these test procedures.

1.11.2 **Exception for Clean Fuel Fleet Vehicles.** This requirement does not apply in the case of a federally-certified vehicle model that is only marketed to fleet operators for applications that are subject to clean fuel fleet requirements established pursuant to section 246 of the federal Clean Air Act (42 U.S.C. sec. 7586). In addition, the Executive Officer shall exclude from the requirements a federally-certified vehicle model where the manufacturer demonstrates to the Executive Officer's reasonable satisfaction that the model will primarily be sold or leased to clean fuel fleet operators for such applications, and that other sales or leases of the model will be incidental to marketing to those clean fuel fleet operators.

1.12 Emission Requirements for Fuel-Fired Heaters. Whenever a manufacturer elects to utilize an on-board fuel-fired heater on any passenger car, light-duty truck or medium-duty vehicle, the heater must meet the ULEV125 standards for passenger cars and light-duty trucks less than 8,500 pounds GVW set forth in section E.1.1.2 of these test procedures. The exhaust emissions from the fuel-fired heater shall be determined in accordance with the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" or the "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," as applicable. If the on-board fuel-fired heater is capable of operating at ambient temperatures above 40^{o}F, the measured emission levels of the on-board fuel-fired heater shall be added to the emissions measured on the FTP (40 CFR, Part 86, Subpart B) to determine compliance with the exhaust emission standards in section E.1.1.

1.13 Greenhouse Gas Emission Requirements. The greenhouse gas emission levels from new 2017 and subsequent model year passenger cars, light-duty trucks, and medium-duty passenger vehicles shall not exceed the requirements set forth in section E.2.5 of these test procedures. Light-duty trucks from 3751 lbs. LVW – 8500 lbs. GVWR with a maximum base payload of 2500 lbs. or more that certify to the LEV II LEV Option 1 exhaust standards in section E.1.1.1 are exempt from these greenhouse gas emission requirements. Passenger cars, light-duty trucks 0-3750 lbs. LVW, and medium-duty passenger vehicles are not eligible for this exemption.

2. Emission Standards Phase-In Requirements for Manufacturers.

2.1 Fleet Average NMOG + NOx Requirements for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.

2.1.1 The fleet average non-methane organic gas plus oxides of nitrogen exhaust mass emission values from the passenger cars, light-duty trucks, and medium-duty passenger vehicles produced and delivered for sale in California each model year by a manufacturer other than a small volume manufacturer shall not exceed:

FLEET AVERAGE NON-METHANE ORGANIC GAS PLUS OXIDES OF NITROGEN EXHAUST MASS EMISSION REQUIREMENTS FOR PASSENGER CARS, LIGHT-DUTY TRUCKS, AND MEDIUM-DUTY PASSENGER VEHICLES (150,000 mile Durability Vehicle Basis)		
Model Year	Fleet Average NMOG + NOx (g/mi)	
	All PCs; LDTs 0-3750 lbs. LVW	LDTs 3751 lbs. LVW - 8500 lbs. GVWR; All MDPVs
2014[1]	0.107	0.128
2015	0.100	0.119
2016	0.093	0.110
2017	0.086	0.101
2018	0.079	0.092
2019	0.072	0.083
2020	0.065	0.074
2021	0.058	0.065
2022	0.051	0.056
2023	0.044	0.047
2024	0.037	0.038
2025+	0.030	0.030

[1] For the 2014 model year, a manufacturer may comply with the fleet average NMOG+NOx values in this table in lieu of complying with the NMOG fleet average values in the "California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2009 through 2016 Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles." A manufacturer must either comply with the NMOG+NOx fleet average requirements for both its PC/LDT1 fleet and its LDT2/MDPV fleet or comply with the NMOG fleet average requirements for both its PC/LDT1 fleet and its LDT2/MDPV fleet. A manufacturer must calculate its fleet average NMOG+NOx values using the applicable full useful standards.

2.1.1.1 *Pooling Provision.*

a. For each model year, a manufacturer must demonstrate compliance with the fleet average requirements in this section E.2.1.1 based on one of two options applicable throughout the model year, either:

Option 1: the total number of passenger cars, light-duty trucks, and medium-duty passenger vehicles that are certified to the California exhaust emission standards in section E.1.1, and are produced and delivered for sale in California; or

Option 2: the total number of passenger cars, light-duty trucks, and medium-duty passenger vehicles that are certified to the California exhaust emission standards in section E.1.1, and are produced and delivered for sale in California, the District of Columbia, and all states that have adopted California's exhaust emission standards in section E.1.1 for that model year pursuant to section 177 of the federal Clean Air Act (42 U.S.C. § 7507).

b. If a manufacturer selects Option 2, that manufacturer must demonstrate compliance with sections E.1.1.2.1, E.2.1, E.2.2, E.2.3, and E.2.4 based on Option 2.

c. A manufacturer that selects compliance Option 2 must notify the Executive Officer of that selection in writing prior to the start of the applicable model year or must comply with Option 1. Once a manufacturer has selected compliance Option 2, that selection applies unless the manufacturer selects Option 1 and notifies the Executive Officer of that selection in writing before the start of the applicable model year.

d. When a manufacturer is demonstrating compliance using Option 2 for a given model year, the term "in California" as used in sections E.2.1.2 and E.3.1 means California, the District of Columbia, and all states that have adopted California's exhaust emission standards in section E.1.1 for that model year pursuant to Section 177 of the federal Clean Air Act (42 U.S.C. § 7507).

e. A manufacturer that selects compliance Option 2 must provide to the Executive Officer separate values for the number of vehicles in each test group produced and delivered for sale in the District of Columbia and for each individual state within the average.

2.1.1.2 **PZEVs Anti-Backsliding Requirement**. In the 2018 and subsequent model years, a manufacturer must produce and deliver for sale in California a minimum percentage of its passenger car and light-duty truck fleet that certifies to SULEV30 and SULEV20 standards. This minimum percentage must be equal to the average percentage of PZEVs produced and deliver for sale in California for that manufacturer for the 2015 through 2017 model year. A manufacturer may calculate this average percentage using the projected sales for these model years in lieu of actual sales.

2.1.2 **Calculation of Fleet Average NMOG + NOx Value**.

2.1.2.1 **Basic Calculation.**

(a) Each manufacturer's PC and LDT1 fleet average NMOG+NOx value for the total number of PCs and LDT1s produced and delivered for sale in California shall be calculated as follows:

(Σ [Number of vehicles in a test group excluding off-vehicle charge capable hybrid electric vehicles x applicable emission standard] +

Σ [Number of off-vehicle charge capable hybrid electric vehicles in a test group x HEV NMOG+NOx contribution factor]) ÷

Total Number of PCs plus LDT1s Produced and Delivered for sale in California, Including ZEVs and HEVs

(b) Each manufacturer's LDT2 and MDPV fleet average NMOG+NOx value for the total number of LDT2s and MDPVs produced and delivered for sale in California shall be calculated as follows:

(Σ [Number of vehicles in a test group excluding off-vehicle charge capable hybrid electric vehicles x applicable emission standard] +
Σ [Number of off-vehicle charge capable hybrid electric vehicles in a test group x HEV NMOG+NOx contribution factor]) ÷
Total Number of LDT2s plus MDPVs Produced and Delivered for sale in California, Including ZEVs and HEVs

(c) The applicable emission standards to be used in the above equations are as follows:

Model Year	Emission Category	Emission Standard Value[1] (g/mi)	
		All PCs; LDTs 0-3750 lbs. LVW	**LDTs 3751-5750 lbs. LVW; All MDPVs**
2015 and subsequent model year federally-certified vehicles	All	Sum of the full useful life NMOG and NOx Federal Emission Standards to which Vehicle is Certified	Sum of the full useful life NMOG and NOx Federal Emission Standards to which Vehicle is Certified
Model Year	**Emission Category**	**All PCs; LDTs 0-3750 lbs. LVW**	**LDTs 3751 lbs. LVW - 8500 lbs. GVWR; All MDPVs**
2015 through 2019 model year vehicles certified to the "LEV II" standards in E.1.1.1; 2015 and subsequent model year vehicles certified to the "LEV III" standards in E.1.1.2	LEV II LEVs; LEV160s	0.160	0.160
	LEV II ULEVs; LEV125s	0.125	0.125
	ULEV70s	0.070	0.070
	ULEV50s	0.050	0.050
	LEV II SULEVs; SULEV30s	0.030	0.030
	SULEV20s	0.020	0.020
	LEV II LEVs; LEV395s	n/a	0.395
	LEV II ULEVs	n/a	0.343
	ULEV340s	n/a	0.340
	ULEV250s	n/a	0.250
	ULEV200s	n/a	0.200
	SULEV170s	n/a	0.170
	SULEV150s	n/a	0.150

[1] For LEV III vehicle test groups that meet the extended emission warranty requirements in section E.1.7, the applicable emission standard value shall be the emission standard value set forth in this table minus 5 mg/mi.

2.1.2.2 **NMOG+NOx Contribution Factor for Off-vehicle Charge Capable HEVs.** The HEV NMOG+NOx contribution factor for light-duty off-vehicle charge capable hybrid electric vehicles is calculated as follows:

LEV160 HEV Contribution Factor = 0.160 - [(Zero-emission VMT Allowance) x 0.035]
ULEV125 HEV Contribution Factor = 0.125 - [(Zero-emission VMT Allowance) x 0.055]
ULEV70 HEV Contribution Factor = 0.070 - [(Zero-emission VMT Allowance) x 0.020]
ULEV50 HEV Contribution Factor = 0.050 - [(Zero-emission VMT Allowance) x 0.020]
SULEV30 HEV Contribution Factor = 0.030 - [(Zero-emission VMT Allowance) x 0.010]
SULEV20 HEV Contribution Factor = 0.020 - [(Zero-emission VMT Allowance) x 0.020]

where the Zero-emission VMT Allowance for off-vehicle charge capable HEVs is determined in accordance with section C.3 of the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" and the "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," as applicable, except that for the purposes of this section E.2.1.2.2, the maximum allowable Zero-emission VMT Allowance that may be used in these equations is 1.0. This section E.2.1.2.2 shall only apply to off-vehicle charge capable HEVs certified to the LEV III standards set forth in section E.1.1.2.

2.1.3 **Phase-in Requirements for Small Volume Manufacturers.**

(a) In the 2015 through 2021 model years, a small volume manufacturer shall not exceed a fleet average NMOG+NOx value of 0.160 g/mi for PCs and LDTs from 0-3750 lbs. LVW or 0.160 g/mi for LDTs from 3751-5750 lbs. LVW calculated in accordance with section E.2.1.2. In 2022 through 2024 model years, a small volume manufacturer shall not exceed a fleet average NMOG+NOx value of 0.125 g/mi for PCs and LDTs from 0-3750 lbs. LVW or 0.125 g/mi for LDTs from 3751 lbs. LVW - 8,500 lbs. GVW and MDPVs calculated in accordance with section E.2.1.2. In 2025 and subsequent model years, a small volume manufacturer shall not exceed a fleet average NMOG+NOx value of 0.070 g/mi for PCs and LDTs from 0-3750 lbs. LVW or 0.070 g/mi for LDTs from 3751 lbs. LVW - 8,500 lbs. GVW and MDPVs calculated in accordance with section E.2.1.2. For the 2015 through 2021 model years, a small volume manufacturer may certify its vehicles to the LEV II exhaust standards in section E.1.1.1. All vehicles certified by a small volume manufacturer for the 2022 and subsequent model years must meet the LEV III exhaust standards in section E.1.1.2.

(b) If a manufacturer's average California sales exceeds 4500 units of new PCs, LDTs, MDVs, heavy-duty vehicles, and heavy-duty engines based on the average number of vehicles sold for the three previous consecutive model years, the manufacturer shall no longer be treated as a small volume manufacturer. If this is the first time the manufacturer exceeds the 4500 unit sales limit, the manufacturer must comply with the fleet average requirements applicable to a large volume manufacturer, as specified in section E.2.1.1 beginning with the fourth model year after the last of the three consecutive model years. If during this four year lead time period the manufacturer's sales drop below the 4500 unit sales limit and then increase again above the 4500 unit sales limit, the four year lead time period shall be calculated based on the first model year in which the manufacturer again exceeds the 4500 unit sales limit. Except as noted above – i.e., if this is not the first time the manufacturer has exceeded the 4500 unit sales limit – the manufacturer shall comply with the fleet average requirements applicable to larger manufacturers as specified in section E.2.1.1 beginning with the following model year after the last of the three consecutive model years.

(c) If a manufacturer's average California sales falls below 4500 units of new PCs, LDTs, MDVs, heavy-duty vehicles, and heavy duty engines based on the average number of vehicles sold for the three previous consecutive model years, the manufacturer shall be treated as a small volume manufacturer and shall be subject to the requirements for small volume manufacturers beginning with the next model year.

2.1.4 **Treatment of ZEVs.** ZEVs classified as LDTs (>3750 lbs. LVW) that have been counted toward the ZEV requirement for PCs and LDTs (0-3750 lbs. LVW) as specified in section C of the “California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes” and the “California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes,” shall be included in this equation.

2.2 LEV III Phase-In Requirement for Light-Duty Vehicles and Medium-Duty Passenger Vehicles.

For the 2015 and 2016 model years, the LEV II SULEV emission standards set forth in section E.1.1.1 that are applicable to PCs, LDTs, and MDPVs shall only apply to those PCs, LDT1s, LDT2s, and MDPVs that certify to SULEV emission standards using “carryover” of emission test data from a previous model year in accordance with U.S. EPA OMS Advisory Circular A/C No. 17F, issued November 16, 1982, and last amended January 21, 1988, incorporated by reference in section 1961.2, title 13, CCR. Beginning in the 2017 model year, the LEV II SULEV emission standards set forth in section E.1.1.1 that are applicable to PCs, LDTs, and MDPVs shall only apply to those PCs, LDT1s, LDT2s, and MDPVs that receive partial ZEV allowances in accordance with the “California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes.” A manufacturer, other than a small volume manufacturer, must certify 100 percent of its PC, LDT, and MDPV fleet to the LEV III standards in section E.1.1.2 in 2020 and subsequent model years. A small volume manufacturer must certify 100 percent of its PC, LDT, and MDPV fleet to the LEV III standards in section E.1.1.2 in 2022 and subsequent model years.

2.3 LEV III Phase-In Requirements for Medium-Duty Vehicles Other than Medium-Duty Passenger Vehicles.

2.3.1 (a) A manufacturer of MDVs, other than a small volume manufacturer, shall certify its MDV fleet according to the following phase-in schedule:

Model Year	Vehicles Certified to Section E.1.1 (%)				Vehicles Certified to title 13 CCR Section 1956.8(c) or (h) (%)
	LEV II LEV; LEV III LEV395 or LEV630	LEV II ULEV; LEV III ULEV340 or ULEV570	LEV III ULEV250 or ULEV400	LEV III SULEV170 or SULEV230	ULEV
2015	40	60	0	0	100
2016	20	60	20	0	100
2017	10	50	40	0	100
2018	0	40	50	10	100
2019	0	30	40	30	100
2020	0	20	30	50	100
2021	0	10	20	70	100
2022 +	0	0	10	90	100

(b) **Requirements for Small Volume Manufacturers.** In the 2015 through 2017 model years, a small volume manufacturer shall certify, produce, and deliver for sale in California vehicles or engines certified to the MDV LEV II LEV standards or to the LEV III LEV395 or LEV III LEV630 standards, as applicable, in a quantity equivalent to 100% of its MDV fleet. In the 2018 through 2021 model years, a small volume manufacturer shall certify, produce, and deliver for sale in California vehicles or engines certified to the MDV LEV II ULEV standards or to the LEV III ULEV340 or LEV III ULEV570 standards, as applicable, in a quantity equivalent to 100% of its MDV fleet. In the 2022 and subsequent model years, a small volume manufacturer shall certify, produce, and deliver for sale in California vehicles or engines certified to the MDV LEV III ULEV250 or LEV III ULEV400 standards, as applicable, in a quantity equivalent to 100% of its MDV fleet. Engines certified to these MDV standards are not eligible for emissions averaging.

(c) **Alternate Phase-In Schedules for LEV III MDVs.** For the 2016 and subsequent model years, a manufacturer, that produces and delivers for sale in California four or fewer medium-duty test groups may comply with the following alternate phase-in schedule for LEV III medium-duty vehicles.

1. A manufacturer that produces and delivers for sale in California four medium-duty test groups may comply with the following alternate phase-in schedule for LEV III medium-duty vehicles.

Model Year	Number of Test Groups Certified to Section E.1.1				Vehicles Certified to §1956.8(c) or (h) (%)
	LEV II LEV; LEV III LEV395 or LEV630	LEV II ULEV; LEV III ULEV340 or ULEV570	LEV III ULEV250 or ULEV400	LEV III SULEV170 or SULEV230	ULEV
2016-2017	1	2	1	0	100
2018	0	2	2	0	100
2019	0	1	2	1	100
2020	0	1	1	2	100
2021	0	0	1	3	100
2022 +	0	0	0	4	100

2. A manufacturer that produces and delivers for sale in California three medium-duty test groups may comply with the following alternate phase-in schedule for LEV III medium-duty vehicles.

Model Year	Number of Test Groups Certified to Section E.1.1				Vehicles Certified to §1956.8(c) or (h) (%)
	LEV II LEV; LEV III LEV395 or LEV630	LEV II ULEV; LEV III ULEV340 or ULEV570	LEV III ULEV250 or ULEV400	LEV III SULEV170 or SULEV230	ULEV
2016	1	2	0	0	100
2017	0	2	1	0	100
2018	0	1	2	0	100
2019-2020	0	1	1	1	100
2021	0	0	1	2	100
2022 +	0	0	0	3	100

3. A manufacturer that produces and delivers for sale in California two medium-duty test groups may comply with the following alternate phase-in schedule for LEV III medium-duty vehicles.

Model Year	Number of Test Groups Certified to Section E.1.1				Vehicles Certified to §1956.8(c) or (h) (%)
	LEV II LEV; LEV III LEV395 or LEV630	LEV II ULEV; LEV III ULEV340 or ULEV570	LEV III ULEV250 or ULEV400	LEV III SULEV170 or SULEV230	ULEV
2016	1	1	0	0	100
2017-2019	0	1	1	0	100
2020-2021	0	0	1	1	100
2022 +	0	0	0	2	100

4. A manufacturer that produces and delivers for sale in California one medium-duty test groups may comply with the following alternate phase-in schedule for LEV III medium-duty vehicles.

Model Year	Number of Test Groups Certified to Section E.1.1				Vehicles Certified to §1956.8(c) or (h) (%)
	LEV II LEV; LEV III LEV395 or LEV630	LEV II ULEV; LEV III ULEV340 or ULEV570	LEV III ULEV250 or ULEV400	LEV III SULEV170 or SULEV230	ULEV
2016-2018	0	1	0	0	100
2019-2021	0	0	1	0	100
2022 +	0	0	0	1	100

2.3.2 **Identifying a Manufacturer's MDV Fleet**. Each manufacturer's MDV fleet shall be defined as the total number of California-certified MDVs produced and delivered for sale in California. The percentages shall be applied to the manufacturer's total production of California-certified medium-duty vehicles delivered for sale in California. A manufacturer that elects to certify engines to the optional medium-duty engine standards in title 13, CCR, §1956.8(c), or (h) shall not count those engines in the manufacturer's total production of California-certified medium-duty vehicles for purposes of this subparagraph.

2.4 Implementation Schedules for SFTP Emission Standards.

2.4.1 **Phase-In Requirement for PC, LDT, and MDPV Manufacturers**. A test group certifying to LEV III FTP emission categories on a 150,000-mile durability basis shall also certify to SFTP requirements on a 150,000-mile durability basis.

Manufacturers shall have two options for phase in to the SFTP NMOG+NOx and CO emission standards.

(a) Under Option 1, beginning with the 2015 model year, a manufacturer shall certify its PCs, LDTs, and MDPVs to the SFTP NMOG+NOx and CO emission standards in section E.1.2.2.1.1 when the vehicles are also certifying to a LEV III FTP emission category at 150,000-mile durability.

(b) Under Option 2, for 2015 and subsequent model years, a manufacturer shall certify its fleet of PCs, LDTs, and MDPVs such that the manufacturer's sales-weighted fleet-average NMOG+NOx composite emission value does not exceed the composite emission standard in effect for that model year. During the 150,000-mile durability phase-in, the sales-weighted fleet-average NMOG+NOx composite emission value shall be calculated using a combination of carry-over values and new-certification values. Carry-over test groups shall convert values to NMOG+NOx and may use the applicable deterioration factor from the FTP cycle in lieu of deriving a deterioration factor specific to SFTP test cycles. Any vehicle certified to SFTP requirements on a 150,000-mile durability basis shall be subject to the applicable emission standards for the full useful life of that vehicle. Compliance with the CO composite emission standard cannot be demonstrated through fleet averaging.

Beginning with the 2017 model year, a manufacturer shall certify its PCs, LDTs, and MDPVs certifying to LEV III FTP PM emission standards on a 150,000-mile durability basis to the SFTP PM emission standards in section E.1.2.2.2.

2.4.2 **Phase-In Requirements for MDV Manufacturers**. Phase-in for NMOG+NOx and CO emission standards begins with the 2016 model year. For MDVs 8,501-10,000 lbs. GVWR, for each model year, the percentage of MDVs certified to 150,000-mile SFTP exhaust emission standards shall be equal to or greater than the total percentage certified the FTP ULEV250, ULEV200, SULEV170, and SULEV150 emission categories; of these vehicles, the percentage of MDVs certified to 150,000-mile SFTP SULEV emission standards shall be equal to or greater than the total percentage certified to both the FTP SULEV170 and SULEV150 emission categories. For MDVs 10,001-14,000 lbs. GVWR, for each model year, the percentage of MDVs certified to 150,000-mile SFTP exhaust emission standards shall be equal to or greater than the percentage certified to the FTP ULEV400, ULEV270, SULEV230, and SULEV200 emission categories, and the percentage of MDVs certified to 150,000-mile SFTP SULEV exhaust emission standards shall be equal to or greater than the total percentage certified to both the FTP SULEV230 and SULEV200 emission categories.

In addition, 2017 and subsequent model MDVs certifying to LEV III FTP PM emission standards on a 150,000-mile durability basis must also certify to the SFTP emission standards set forth in section E.1.2.2.4.

2.4.3 **Identifying a Manufacturer's MDV Fleet**. For the 2016 and subsequent model years, each manufacturer's MDV fleet shall be defined as the total number of California-certified MDVs, other than MDPVs, produced and delivered for sale in California. For 2016 and subsequent model years, a manufacturer that elects to certify engines to the optional medium-duty engine emission standards in title 13, CCR, §1956.8(c) or (h) shall not count those engines in the manufacturer's total production of California-certified medium-duty vehicles for purposes of this subparagraph.

2.5 Greenhouse Gas Requirements for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.

2.5.1 *Fleet Average Carbon Dioxide Requirements for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.* For the purpose of determining compliance with this section E.2.5, the applicable fleet average CO_2 mass emissions standards for each model year is the sales-weighted average of the calculated CO_2 exhaust mass emission target values for each manufacturer. For each model year, the sales-weighted fleet average CO_2 mass emissions value shall not exceed the sales-weighted average of the calculated CO_2 exhaust mass emission target values for that manufacturer.

2.5.1.1 *Fleet Average Carbon Dioxide Target Values for Passenger Cars.* The fleet average CO_2 exhaust mass emission target values for passenger cars that are produced and delivered for sale in California each model year shall be determined as follows:

2.5.1.1.1 For passenger cars with a footprint of less than or equal to 41 square feet, the gram per mile CO_2 target value shall be selected for the appropriate model year from the following table:

Model Year	*CO_2 Target Value (grams/mile)*
2017	195.0
2018	185.0
2019	175.0
2020	166.0
2021	157.0
2022	150.0
2023	143.0
2025	137.0
2025 and subsequent	131.0

2.5.1.1.2 For passenger cars with a footprint of greater than 56 square feet, the gram per mile CO_2 target value shall be selected for the appropriate model year from the following table:

Model Year	*CO_2 Target Value (grams/mile)*
2017	263.0
2018	250.0
2019	238.0
2020	226.0
2021	215.0
2022	205.0
2023	196.0
2025	188.0
2025 and subsequent	179.0

2.5.1.1.3 For passenger cars with a footprint that is greater than 41 square feet and less than or equal to 56 square feet, the gram per mile CO_2 target value shall be calculated using the following equation and rounded to the nearest 0.1 grams/mile:

$$\text{Target } gCO_2/\text{mile} = [a \times f] + b$$

Where: *f* is the vehicle footprint and coefficients *a* and *b* are selected from the following table for the applicable model year.

Model year	*a*	*b*
2017	4.53	8.9
2018	4.35	6.5
2019	4.17	4.2
2020	4.01	1.9
2021	3.84	-0.4
2022	3.69	-1.1
2023	3.54	-1.8
2024	3.4	-2.5
2025 and subsequent	3.26	-3.2

2.5.1.2 *Fleet Average Carbon Dioxide Target Values for Light-Duty Trucks and Medium-Duty Passenger Vehicles.* The fleet average CO_2 exhaust mass emission target values for light-duty trucks and medium-duty passenger vehicles that are produced and delivered for sale in California each model year shall be determined as follows:

2.5.1.2.1 For light-duty trucks and medium-duty passenger vehicles with a footprint of less than or equal to 41 square feet, the gram per mile CO_2 target value shall be selected from the following table:

Model Year	*CO_2 Target Value (grams/mile)*
2017	238.0
2018	227.0
2019	220.0
2020	212.0
2021	195.0
2022	186.0
2023	176.0
2025	168.0
2025 and subsequent	159.0

2.5.1.2.2 For light-duty trucks and medium-duty passenger vehicles with a footprint of greater than 41 square feet and less than or equal to the maximum footprint value specified in the table below for each model year, the gram/mile CO_2 target value shall be calculated using the following equation and rounded to the nearest 0.1 grams/mile:

$$\text{Target } gCO_2/\text{mile} = [a \times f] + b$$

Where: *f* is the vehicle footprint and
coefficients *a* and *b* are selected from the following table for the applicable model year.

As Adopted: March 22, 2012
Date of Hearing: January 26-27, 2012

Model year	*Maximum Footprint*	*a*	*b*
2017	50.7	4.87	38.3
2018	60.2	4.76	31.6
2019	66.4	4.68	27.7
2020	68.3	4.57	24.6
2021	73.5	4.28	19.8
2022	74.0	4.09	17.8
2023	74.0	3.91	16.0
2024	74.0	3.74	14.2
2025 and subsequent	74.0	3.58	12.5

2.5.1.2.3 For light-duty trucks and medium-duty passenger vehicles with a footprint that is greater than the minimum footprint value specified in the table below and less than or equal to the maximum footprint value specified in the table below for each model year, the gram/mile CO_2 target value shall be calculated using the following equation and rounded to the nearest 0.1 grams/mile:

$$\text{Target gCO}_2\text{/mile} = [a \text{ x } f] + b$$

Where: *f* is the vehicle footprint and coefficients *a* and *b* are selected from the following table for the applicable model year.

Model year	*Minimum Footprint*	*Maximum Footprint*	*a*	*b*
2017	50.7	66.0	4.04	80.5
2018	60.2	66.0	4.04	75.0

2.5.1.2.4 For light-duty trucks and medium-duty passenger vehicles with a footprint that is greater than the minimum value specified in the table below for each model year, the gram/mile CO_2 target value shall be selected for the applicable model year from the following table:

Model year	*Minimum Footprint*	*CO_2 target value (grams/mile)*
2017	66.0	347.0
2018	66.0	342.0
2019	66.4	339.0
2020	68.3	337.0
2021	73.5	335.0
2022	74.0	321.0
2023	74.0	306.0
2024	74.0	291.0
2025 and subsequent	74.0	277.0

2.5.1.3 *Calculation of Fleet Average Carbon Dioxide Standards.* For each model year, a manufacturer must comply with its fleet average CO_2 standards for passenger cars and for light-duty trucks plus medium-duty passenger vehicles, as applicable, calculated for that model year as follows. A manufacturer shall calculate separate fleet average CO_2 values for its passenger car fleet and for its combined light-duty truck plus medium-duty passenger vehicle fleet.

2.5.1.3.1 A CO_2 target value shall be calculated in accordance with subparagraph E.2.5.1.1 or E.2.5.1.2, as applicable, for each unique combination of model type and footprint value.

2.5.1.3.2 Each CO_2 target value, determined for each unique combination of model type and footprint value, shall be multiplied by the total production of that model type/footprint combination for the applicable model year.

2.5.1.3.3 The resulting products shall be summed, and that sum shall be divided by the total production of passenger cars or total combined production of light-duty trucks and medium-duty passenger vehicles, as applicable, in that model year. The result shall be rounded to the nearest whole gram per mile. This result shall be the applicable fleet average CO_2 standard for the manufacturer's passenger car fleet or its combined light-duty truck and medium-duty passenger vehicle fleet, as applicable.

2.5.2 *Nitrous Oxide (N_2O) and Methane (CH_4) Exhaust Emission Standards for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.* Each manufacturer's fleet of combined passenger automobile, light-duty trucks, and medium-duty passenger vehicles must comply with N_2O and CH_4 standards using either the provisions of section E.2.5.2.1, section E.2.5.2.2, or section E.2.5.2.3. Except with prior approval of the Executive Officer, a manufacturer may not use the provisions of both section E.2.5.2.1 and section E.2.5.2.2 in the same model year. For example, a manufacturer may not use the provisions of section E.2.5.2.1 for their passenger automobile fleet and the provisions of section E.2.5.2.2 for their light-duty truck and medium-duty passenger vehicle fleet in the same model year. The manufacturer may use the provisions of both section E.2.5.2.1 and section E.2.5.2.3 in the same model year. For example, a manufacturer may meet the N_2O standard in section E.2.5.2.1 and an alternative CH_4 standard determined under section E.2.5.2.3.

2.5.2.1 *Standards Applicable to Each Test Group.*

2.5.2.1.1 Exhaust emissions of N_2O shall not exceed 0.010 grams per mile at full useful life, as measured on the FTP (40 CFR, Part 86, Subpart B), as amended by these test procedures. Manufacturers may optionally determine an alternative N_2O standard under section E.2.5.2.3.

2.5.2.1.2 Exhaust emissions of CH_4 shall not exceed 0.030 grams per mile at full useful life, as measured on the FTP (40 CFR, Part 86, Subpart B), as amended by these test procedures. Manufacturers may optionally determine an alternative CH_4 standard under section E.2.5.2.3.

2.5.2.2 *Including N_2O and CH_4 in Fleet Averaging Program.* Manufacturers may elect to not meet the emission standards in section E.2.5.2.1. Manufacturers making this election shall measure N_2O and CH_4 emissions for each unique combination of model type and footprint value on both the FTP test cycle and the Highway Fuel Economy test cycle at full useful life, multiply the measured N_2O emissions value by 298 and the measured CH_4 emissions value by 25, and include both of these adjusted N_2O and CH_4 full useful life values in the fleet average calculations for passenger automobiles and light-duty trucks plus medium-duty passenger vehicles, as calculated in accordance with section E.2.5.2.4.

2.5.2.3 *Optional Use of Alternative N_2O and/or CH_4 Standards.* Manufacturers may select an alternative standard applicable to a test group, for either N_2O or CH_4, or both. For example, a manufacturer may choose to meet the N_2O standard in section E.2.5.2.1.1 and an alternative CH_4 standard in lieu of the standard in section E.2.5.2.1.2. The alternative standard for each pollutant must be less stringent than the applicable exhaust emission standard specified in section E.2.5.2.1. Alternative N_2O and CH_4 standards apply to emissions as measured on the FTP (40 CFR, Part 86, Subpart B), as amended by these test procedures, for the full useful life, and become the applicable certification and in-use emission standard(s) for the test group. Manufacturers using an alternative standard for N_2O and/or CH_4 must calculate emission debits according to the provisions of section E.2.5.2.4 for each test group/alternative standard combination. Debits must be included in the calculation of total credits or debits generated in a model year as required under section E.2.5.2.2. Flexible fuel vehicles (or other vehicles certified for multiple fuels) must meet these alternative standards when tested on all applicable test fuel type.

2.5.2.4 *CO_2-Equivalent Debits.* CO_2-equivalent debits for test groups using an alternative N_2O and/or CH_4 standard as determined under E.2.5.2.3 shall be calculated according to the following equation and rounded to the nearest whole gram per mile:

Debits = GWP × (Production) × (AltStd - Std)

Where:

Debits = N_2O or CH_4 CO_2-equivalent debits for a test group using an alternative N_2O or CH_4 standard;

GWP = 25 if calculating CH_4 debits and 298 if calculating N_2O debits;

Production = The number of vehicles of that test group produced and delivered for sale in California;

AltStd = The alternative standard (N_2O or CH_4) selected by the manufacturer under 1961.3(a)(2)(C); and

Std = The exhaust emission standard for N_2O or CH_4 specified in 1961.3(a)(2)(A).

2.5.3 *Alternative Fleet Average Standards for Manufacturers with Limited U.S. Sales.* Manufacturers meeting the criteria in this section E.2.5.3 may request that the Executive Officer establish alternative fleet average CO_2 standards that would apply instead of the standards in section E.2.5.1. The provisions of this section E.2.5.3 are applicable only to the 2017 and subsequent model years.

2.5.3.1 *Eligibility for Alternative Standards.* Eligibility as determined in this section E.2.5.3 shall be based on the total sales of combined passenger cars, light-duty trucks, and medium-duty passenger vehicles. The terms “sales” and “sold” as used in this section E.2.5.3 shall mean vehicles produced and delivered for sale (or sold) in the states and territories of the United States. For the purpose of determining eligibility the sales of related companies shall be aggregated according to the provisions of title 13, CCR, section 1900. To be eligible for alternative standards established under this section E.2.5.3, the manufacturer's average sales for the three most recent consecutive model years must remain below 5,000. If a manufacturer's average sales for the three most recent consecutive model years exceeds 4,999, the manufacturer will no longer be eligible for exemption and must meet applicable emission standards as follows.

2.5.3.1.1 If a manufacturer's average sales for three consecutive model years exceeds 4,999, and if the increase in sales is the result of corporate acquisitions, mergers, or purchase by another manufacturer, the manufacturer shall comply with the emission standards described in sections E.2.5.1 and E.2.5.2, as applicable, beginning with the first model year after the last year of the three consecutive model years.

2.5.3.1.2 If a manufacturer's average sales for three consecutive model years exceeds 4,999 and is less than 50,000, and if the increase in sales is solely the result of the manufacturer's expansion in vehicle production (not the result of corporate acquisitions, mergers, or purchase by another manufacturer), the manufacturer shall comply with the emission standards described in sections E.2.5.1 and E.2.5.2, as applicable, beginning with the second model year after the last year of the three consecutive model years.

2.5.3.2 *Requirements for New Entrants into the U.S. Market.* New entrants are those manufacturers without a prior record of automobile sales in the United States and without prior certification to (or exemption from, under 40 CFR §86.1801-12(k)) greenhouse gas emission standards in 40 CFR §86.1818-12 or greenhouse gas standards in section 1961.1, title 13, CCR. In addition to the eligibility requirements stated in section E.2.5.3.1, new entrants must meet the following requirements:

2.5.3.2.1 In addition to the information required under section E.2.5.3.4, new entrants must provide documentation that shows a clear intent by the company to actually enter the U.S. market in the years for which alternative standards are requested. Demonstrating such intent could include providing documentation that shows the establishment of a U.S. dealer network, documentation of work underway to meet other U.S. requirements (e.g., safety standards), or other information that reasonably establishes intent to the satisfaction of the Executive Officer.

2.5.3.2.2 Sales of vehicles in the U.S. by new entrants must remain below 5,000 vehicles for the first two model years in the U.S. market and the average sales for any three consecutive years within the first five years of entering the U.S. market must remain below 5,000 vehicles. Vehicles sold in violation of these limits will be considered not covered by the certificate of conformity and the manufacturer will be subject to penalties on an individual-vehicle basis for sale of vehicles not covered by a certificate. In addition, violation of these limits will result in loss of eligibility for alternative standards until such point as the manufacturer demonstrates two consecutive model years of sales below 5,000 automobiles.

2.5.3.2.3 A manufacturer with sales in the most recent model year of less than 5,000 automobiles, but where prior model year sales were not less than 5,000 automobiles, is eligible to request alternative standards under section E.2.5.3. However, such a manufacturer will be considered a new entrant and subject to the provisions regarding new entrants in this section E.2.5.3, except that the requirement to demonstrate an intent to enter the U.S. market in section E.2.5.3.2 shall not apply.

2.5.3.3 *How to Request Alternative Fleet Average Standards.* Eligible manufacturers may petition for alternative standards for up to five consecutive model years if sufficient information is available on which to base such standards.

2.5.3.3.1 To request alternative standards starting with the 2017 model year, eligible manufacturers must submit a completed application no later than July 30, 2013.

2.5.3.3.2 To request alternative standards starting with a model after 2017, eligible manufacturers must submit a completed request no later than 36 months prior to the start of the first model year to which the alternative standards would apply.

2.5.3.3.3 The request must contain all the information required in section E.2.5.3.4, and must be signed by a chief officer of the company. If the Executive Officer determines that the content of the request is incomplete or insufficient, the manufacturer will be notified and given an additional 30 days to amend the request.

2.5.3.4 *Data and Information Submittal Requirements.* Eligible manufacturers requesting alternative standards under section E.2.5.3.3 must submit the following information to the California Air Resources Board. The Executive Officer may request additional information as s/he deems appropriate. The completed request must be sent to the California Air Resources Board at the following address: Chief, Mobile Source Operations Division, California Air Resources Board, 9480 Telstar Avenue, Suite 4, El Monte, California 91731.

2.5.3.4.1 *Vehicle Model and Fleet Information*.

a. The model years to which the requested alternative standards would apply, limited to five consecutive model years.

b. Vehicle models and projections of production volumes for each model year.

c. Detailed description of each model, including the vehicle type, vehicle mass, power, footprint, and expected pricing.

d. The expected production cycle for each model, including new model introductions and redesign or refresh cycles.

2.5.3.4.2 *Technology Evaluation Information*.

a. The CO_2 reduction technologies employed by the manufacturer on each vehicle model, including information regarding the cost and CO_2 -reducing effectiveness. Include technologies that improve air conditioning efficiency and reduce air conditioning system leakage, and any “off-cycle” technologies that potentially provide benefits outside the operation represented by the FTP and the HWFET.

b. An evaluation of comparable models from other manufacturers, including CO_2 results and air conditioning credits generated by the models. Comparable vehicles should be similar, but not necessarily identical, in the following respects: vehicle type, horsepower, mass, power-to-weight ratio, footprint, retail price, and any other relevant factors. For manufacturers requesting alternative standards starting with the 2017 model year, the analysis of comparable vehicles should include vehicles from the 2012 and 2013 model years, otherwise the analysis should at a minimum include vehicles from the most recent two model years.

c. A discussion of the CO_2-reducing technologies employed on vehicles offered outside of the U.S. market but not available in the U.S., including a discussion as to why those vehicles and/or technologies are not being used to achieve CO_2 reductions for vehicles in the U.S. market.

d. An evaluation, at a minimum, of the technologies projected by the California Air Resources Board in the "Staff Report: Initial Statement of Reasons for Proposed Rulemaking, Public Hearing to Consider the "LEV III" Amendments to The California Greenhouse Gas and Criteria Pollutant Exhaust and Evaporative Emission Standards and Test Procedures and to the On-Board Diagnostic System Requirements for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles, and to the Evaporative Emission Requirements for Heavy-Duty Vehicles" and the appendices to this report, released on December 7, 2011, as those technologies likely to be used to meet greenhouse gas emission standards and the extent to which those technologies are employed or projected to be employed by the manufacturer. For any technology that is not projected to be fully employed, the manufacturer must explain why this is the case.

2.5.3.4.3 *Information Supporting Eligibility*.

a. U.S. sales for the three previous model years and projected sales for the model years for which the manufacturer is seeking alternative standards.

b. Information regarding ownership relationships with other manufacturers, including details regarding the application of the provisions of 40 CFR §86.1838–01(b)(3) and title 13, CCR, section 1900 regarding the aggregation of sales of related companies.

2.5.3.5 *Alternative Standards.* Upon receiving a complete application, the Executive Officer will review the application and determine whether an alternative standard is warranted. If the Executive Officer judges that an alternative standard is warranted, the following standards shall apply. For the purposes of this section E.2.5.3.5, an "ultra-small volume manufacturer" shall mean a manufacturer that meets the requirements of section E.2.5.3.

2.5.3.5.1 At the beginning of the model year that is three model years prior to the model year for which an alternative standard is requested, each ultra-small volume manufacturer shall identify all vehicle models from the model year that is four model years prior to the model year for which an alternative standard is requested, certified by a large volume manufacturer that are comparable to that small volume manufacturer's vehicle models for the model year for which an alternative standard is requested, based on model type and footprint value. The ultra-small volume manufacturer shall demonstrate to the Executive Officer the appropriateness of each comparable vehicle model selected. Upon approval of the Executive Officer, s/he shall provide to the ultra-small volume manufacturer the target grams CO_2 per mile for each vehicle model type and footprint value that is approved. The ultra-small volume manufacturer shall calculate its fleet average CO_2 standard in accordance with section E.2.5.1.3 based on these target grams CO_2 per mile values provided by the Executive Officer.

2.5.3.5.2 In the 2017 and subsequent model years, an ultra-small volume manufacturer shall either:

a. not exceed its fleet average CO_2 standard calculated in accordance with section E.2.5.1.3 based on the target grams CO_2 per mile values provided by the Executive Officer; or

b. upon approval of the Executive Officer, if an ultra-small volume manufacturer demonstrates a vehicle model uses an engine, transmission, and emission control system and has a footprint value that are identical to a configuration certified for sale in California by a large volume manufacturer, those ultra-small volume manufacturer vehicle models are exempt from meeting the requirements in section E.2.5.3.5.2.a.

2.5.3.6 *Restrictions on Credit Trading.* Manufacturers subject to alternative standards approved by the Executive Officer under this section E.2.5.3 may not trade credits to another manufacturer. Transfers of credits between a manufacturer's car and truck fleets are allowed.

2.5.4 *Greenhouse Gas Emissions Values for Electric Vehicles, "Plug-In" Hybrid Electric Vehicles, and Fuel Cell Vehicles.*

2.5.4.1 *Electric Vehicle Calculations.*

2.5.4.1.1 For each unique combination of model type and footprint value, a manufacturer shall calculate the City CO_2 Value using the following formula:

$$City\ CO_2\ Value = (270\ gCO_2e/kWh) * E_{EV} - 0.25 * GHG_{target}$$

Where E_{EV} is measured directly from each cycle for each test vehicle of battery electric vehicle technology in units of kilowatt-hours per mile (per SAE J1634, incorporated by reference in section 1961.2, title 13, CCR).

2.5.4.1.2 For each unique combination of model type and footprint value, a manufacturer shall calculate the Highway CO_2 Value using the following formula:

$$Highway\ CO_2\ Value = (270\ gCO_2e/kWh) * E_{EV} \ - \ 0.25 * GHG_{target}$$

Where E_{EV} is measured directly from each cycle for each test vehicle of battery electric vehicle technology in units of kilowatt-hours per mile (per SAE J1634, incorporated herein by reference).

2.5.4.2 *"Plug-In" Hybrid Electric Vehicle Calculations.* For each unique combination of model type and footprint value, a manufacturer shall calculate the City CO_2 Value and the Highway CO_2 Value using the following formulas:

$$City\ CO_2\ Value = GHG_{urban}$$

and

$$Highway\ CO_2\ Value = GHG_{highway}$$

Where GHG_{urban} and $GHG_{highway}$ are measured in accordance with section G.12 of the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" or the "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," as applicable.

2.5.4.3 *Fuel Cell Vehicle Calculations.* For each unique combination of model type and footprint value, a manufacturer shall calculate the City CO_2 Value and the Highway CO_2 Value using the following formulas:

$$City\ CO_2 = GHG_{FCV} = (9132\ gCO_2e/kg\ H_2) * H_{FCV} - G_{upstream}$$

and

$$Highway\ CO_2 = GHG_{FCV} = (9132\ gCO_2e/kg\ H_2) * H_{FCV} - G_{upstream}$$

Where H_{FCV} means hydrogen consumption in kilograms of hydrogen per mile, measured for the applicable test cycle, in accordance with SAE J2572 (published October 2008), incorporated by reference in section 1961.2, title 13, CCR.

2.5.5 *Calculation of Fleet Average Carbon Dioxide Value.*

2.5.5.1 For each unique combination of model type and footprint value, a manufacturer shall calculate a combined city/highway CO_2 exhaust emission value as follows:

0.55 x City CO_2 Value + 0.45 x Highway CO_2 Value

"City" CO_2 exhaust emissions shall be measured using the FTP test cycle (40 CFR, Part 86, Subpart B), as amended by the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures Passenger Cars, Light Duty Trucks, and Medium Duty Vehicles." "Highway" CO_2 exhaust emission shall be measured using the using the Highway Fuel Economy Test (HWFET; 40 CFR 600 Subpart B).

2.5.5.2 Each combined city/highway CO_2 exhaust emission, determined for each unique combination of model type and footprint value, shall be multiplied by the total production of that model type/footprint combination for the applicable model year.

2.5.5.3 The resulting products shall be summed, and that sum shall be divided by the total production of passenger cars or total combined production of light-duty trucks and medium-duty passenger vehicles, as applicable, in that model year. The result shall be rounded to the nearest whole gram per mile. This result shall be the manufacturer's actual sales-weighted fleet average CO_2 value for the manufacturer's passenger car fleet or its combined light-duty truck and medium-duty passenger vehicle fleet, as applicable.

2.5.5.4 For each model year, a manufacturer must demonstrate compliance with the fleet average requirements in section E.2.5 based on one of two options applicable throughout the model year, either:

Option 1: the total number of passenger cars, light-duty trucks, and medium-duty passenger vehicles that are certified to the California exhaust emission standards in section E.2.5, and are produced and delivered for sale in California; or

Option 2: the total number of passenger cars, light-duty trucks, and medium-duty passenger vehicles that are certified to the California exhaust emission standards in section E.2.5, and are produced and delivered for sale in California, the District of Columbia, and all states that have adopted California's greenhouse gas emission standards for that model year pursuant to Section 177 of the federal Clean Air Act (42 U.S.C. § 7507).

1. A manufacturer that selects compliance Option 2 must notify the Executive Officer of that selection, in writing, prior to the start of the applicable model year or must comply with Option 1. Once a manufacturer has selected compliance Option 2, that selection applies unless the manufacturer selects Option 1 and notifies the Executive Officer of that selection in writing before the start of the applicable model year.

2. When a manufacturer is demonstrating compliance using Option 2 for a given model year, the term "in California" as used in sections E.2.5 and E.3.2 means California, the District of Columbia, and all states that have adopted California's greenhouse gas emission standards for that model year pursuant to Section 177 of the federal Clean Air Act (42 U.S.C. § 7507).

3. A manufacturer that selects compliance Option 2 must provide to the Executive Officer separate values for the number of vehicles in each model type and footprint value produced and delivered for sale in the District of Columbia and for each individual state within the average and the City CO_2 Value and Highway CO_2 exhaust emission values that apply to each model type and footprint value.

2.5.6 *Credits for Reduction of Air Conditioning Direct Emissions.* Manufacturers may generate A/C Direct Emissions Credits by implementing specific air conditioning system technologies designed to reduce air conditioning direct emissions over the useful life of their vehicles. A manufacturer may only use an A/C Direct Emissions Credit for vehicles within a model type upon approval of the A/C Direct Emissions Credit for that model type by the Executive Officer. The conditions and requirements for obtaining approval of an A/C Direct Emissions Credit are described below.

2.5.6.1 Applications for approval of an A/C Direct Emissions Credit must be organized by model type. The applications must also include:

- vehicle make and
- number of vehicles within the model type that will be equipped with the air conditioning system to which the leakage credit shall apply.

Separate applications must be submitted for any two configurations of an A/C system with differences other than dimensional variation.

2.5.6.2 To obtain approval of the A/C Direct Emissions Credit, the manufacturer must demonstrate through an engineering evaluation that the A/C system under consideration reduces A/C direct emissions. The demonstration must include all of the following elements:

- the amount of A/C Direct Emissions Credit requested, in grams of CO_2-equivalent per mile (gCO_2e/mi);
- the calculations identified in section 1961.3(a)(6)(C) justifying that credit amount,
- schematic of the A/C system;
- specifications of the system components with sufficient detail to allow reproduction of the calculation; and
- an explanation describing what efforts have been made to minimize the number of fittings and joints and to optimize the components in order to minimize leakage.

Calculated values must be carried to at least three significant figures throughout the calculations, and the final credit value must be rounded to one tenth of a gram of CO_2-equivalent per mile (gCO_2e/mi).

2.5.6.3 The calculation of A/C Direct Emissions Credit depends on the refrigerant or type of system, and is defined in paragraphs E. 2.5.6.3.1, E. 2.5.6.3.2, and E. 2.5.6.3.3.

2.5.6.3.1 HFC-134a vapor compression systems

For A/C systems that use HFC-134a refrigerant, the A/C Direct Emissions Credit shall be calculated using the following formula:

$$A/C\ Direct\ Credit = Direct\ Credit\ Baseline \times (1 - \frac{LR}{Avg\ LR})$$

Where:
Direct Credit Baseline = 12.6 gCO_2e/mi for passenger cars;
Direct Credit Baseline = 15.6 gCO2e/mi for light-duty trucks and medium-duty passenger vehicles;
Avg LR = 16.6 grams/year for passenger cars;
Avg LR = 20.7 grams/year for light-duty trucks and medium-duty passenger vehicles;

LR = the larger of *SAE LR* or *Min LR*;

Where:
SAE LR = initial leak rate evaluated using SAE International's Surface Vehicle Standard SAE J2727 (Revised August 2008) incorporated by reference in section 1961.2, title 13, CCR;
Min LR = 8.3 grams/year for passenger car A/C systems with belt-driven compressors;
Min LR = 10.4 grams/year for light-duty truck and medium-duty passenger vehicle A/C systems with belt-driven compressors;
Min LR = 4.1 grams/year for passenger car A/C systems with electric compressors;
Min LR = 5.2 grams/year for light-duty truck and medium-duty passenger vehicle A/C systems with electric compressors.

Note: Initial leak rate is the rate of refrigerant leakage from a newly manufactured A/C system in grams of refrigerant per year. The Executive Officer may allow a manufacturer to use an updated version of the August 2008 version of SAE J2727 or an alternate method if s/he determines that the updated SAE J2727 or the alternate method provides more accurate estimates of the initial leak rate of A/C systems than the August 2008 version of SAE J2727 does.

2.5.6.3.2 Low-GWP vapor compression systems

For A/C systems that use a refrigerant having a GWP of 150 or less, the A/C Direct Emissions Credit shall be calculated using the following formula:

$$A/C\ Direct\ Credit = Low\ GWP\ Credit - High\ Leak\ Penalty$$

Where:

$$Low\ GWP\ Credit = Max\ Low\ GWP\ Credit \times (1 - \frac{GWP}{1{,}430}),$$

and

$$High\ Leak\ Penalty = \begin{cases} Max\ High\ Leak\ Penalty, & \text{if } SAE\ LR > Avg\ LR; \\ Max\ High\ Leak\ Penalty \times \dfrac{SAE\ LR - Min\ LR}{Avg\ LR - Min\ LR}, & \text{if } Min\ LR < SAE\ LR \le Avg\ LR; \\ 0, & \text{if } SAE\ LR \le Min\ LR. \end{cases}$$

Where:

Max Low GWP Credit = 13.8 gCO_2e/mi for passenger cars;

Max Low GWP Credit = 17.2 gCO_2e/mi for light-duty trucks and medium-duty passenger vehicles;

GWP = the global warming potential of the refrigerant over a 100-year horizon, as specified in section E.2.5.6.6;

Max High Leak Penalty = 1.8 gCO_2e/mi for passenger cars;

Max High Leak Penalty = 2.1 gCO_2e/mi for light-duty trucks and medium-duty passenger vehicles;

Avg LR = 13.1 g/yr for passenger cars;

Avg LR = 16.6 g/yr for light-duty trucks and medium-duty passenger vehicles;

and where:

SAE LR = initial leak rate evaluated using SAE International's Surface Vehicle Standard SAE J2727 (Revised August 2008);

Min LR = 8.3 g/yr for passenger cars;

Min LR = 10.4 g/yr for light-duty trucks and medium-duty passenger vehicles.

Note: Initial leak rate is the rate of refrigerant leakage from a newly manufactured A/C system in grams of refrigerant per year. The Executive Officer may allow a manufacturer to use an updated version of SAE J2727 or an alternate applicable test method if s/he finds the update or the alternate method provides more accurate estimates of the initial leak rate of A/C systems than the August 2008 version of SAE J2727 does.

2.5.6.3.3 Other A/C systems

For an A/C system that uses a technology other than vapor compression cycles, an A/C Direct Emissions Credit may be approved by the Executive Officer. The amount of credit requested must be based on demonstration of the reduction of A/C direct emissions of the technology using an engineering evaluation that includes verifiable laboratory test data, and cannot exceed 13.8 gCO_2e/mi for passenger cars and 17.2 gCO_2e/mi for light-duty trucks and medium-duty passenger vehicles.

2.5.6.4 The total leakage reduction credits generated by the air conditioning system shall be calculated separately for passenger cars and for light-duty trucks and medium-duty passenger vehicles according to the following formula:

$$Total\ Credits\ (g/mi) = A/C\ Direct\ Credit \times Production$$

Where:

A/C Direct Credit is calculated as specified in section E.2.5.6.3.

Production = The total number of passenger cars or light-duty trucks plus medium-duty passenger vehicles, whichever is applicable, produced and delivered for sale in California, with the air conditioning system to which the *A/D Direct Credit* value from section E.2.5.6.3 applies.

2.5.6.5 The results of section E.2.5.6.4, rounded to the nearest whole gram per mile, shall be included in the manufacturer's credit/debit totals calculated in section E.3.2.1.2.

2.5.6.6 The following values for refrigerant global warming potential (GWP), or alternative values as determined by the Administrator, shall be used in the calculations of this section E.2.5.6. The Executive Officer shall determine values for refrigerants not included in this section E.2.5.6.6 upon request by a manufacturer, based on findings by the Intergovernmental Panel on Climate Change (IPCC) or from other applicable research studies.

Refrigerant	*GWP*
HFC–134a	1,430
HFC–152a	124
HFO–1234yf	4
CO_2	1

2.5.7 *Credits for Improving Air Conditioning System Efficiency.* Manufacturers may generate CO_2 credits by implementing specific air conditioning system technologies designed to reduce air conditioning-related CO_2 emissions over the useful life of their passenger cars, light-duty trucks, and/or medium-duty passenger vehicles. Credits shall be calculated according to this section E.2.5.7 for each air conditioning system that the manufacturer is using to generate CO_2 credits. The eligibility requirements specified in section E.2.5.7.5 must be met before an air conditioning system is allowed to generate credits.

2.5.7.1 Air conditioning efficiency credits are available for the following technologies in the gram per mile amounts indicated for each vehicle category in the following table:

Air Conditioning Technology	***Passenger Cars (g/mi)***	***Light-Duty Trucks and Medium-Duty Passenger Vehicles (g/mi)***
Reduced reheat, with externally-controlled, variable-displacement compressor (*e.g.* a compressor that controls displacement based on temperature setpoint and/or cooling demand of the air conditioning system control settings inside the passenger compartment).	1.5	2.2
Reduced reheat, with externally-controlled, fixed-displacement or pneumatic variable displacement compressor (*e.g.* a compressor that controls displacement based on conditions within, or internal to, the air conditioning system, such as head pressure, suction pressure, or evaporator outlet temperature).	1.0	1.4
Default to recirculated air with closed-loop control of the air supply (sensor feedback to control interior air quality) whenever the ambient temperature is 75 °F or higher: Air conditioning systems that operated with closed-loop control of the air supply at different temperatures may receive credits by submitting an engineering analysis to the Administrator for approval.	1.5	2.2
Default to recirculated air with open-loop control air supply (no sensor feedback) whenever the ambient temperature is 75 °F or higher. Air conditioning systems that operate with open-loop control of the air supply at different temperatures may receive credits by submitting an engineering analysis to the Administrator for approval.	1.0	1.4
Blower motor controls which limit wasted electrical energy (*e.g.* pulse width modulated power controller).	0.8	1.1
Internal heat exchanger (*e.g.* a device that transfers heat from the high-pressure, liquid-phase refrigerant entering the evaporator to the low-pressure, gas-phase refrigerant exiting the evaporator).	1.0	1.4
Improved condensers and/or evaporators with system analysis on the component(s) indicating a coefficient of performance improvement for the system of greater than 10% when compared to previous industry standard designs).	1.0	1.4
Oil separator. The manufacturer must submit an engineering analysis demonstrating the increased improvement of the system relative to the baseline design, where the baseline component for comparison is the version which a manufacturer most recently had in production on the same vehicle design or in a similar or related vehicle model. The characteristics of the baseline component shall be compared to the new component to demonstrate the improvement.	0.5	0.7

2.5.7.2 Air conditioning efficiency credits are determined on an air conditioning system basis. For each air conditioning system that is eligible for a credit based on the use of one or more of the items listed in section E.2.5.7.1, the total credit value is the sum of the gram per mile values listed in section E.2.5.7.1 for each item that applies to the air conditioning system. The total credit value for an air conditioning system may not be greater than 5.0 grams per mile for any passenger car or 7.2 grams per mile for any light-duty truck or medium-duty passenger vehicle.

2.5.7.3 The total efficiency credits generated by an air conditioning system shall be calculated separately for passenger cars and for light-duty trucks plus medium-duty passenger vehicles according to the following formula:

Total Credits (g/mi) = Credit × Production

Where:

Credit = the CO_2 efficiency credit value in grams per mile determined in section E.2.5.7.2 or E. 2.5.7.5, whichever is applicable.

Production = The total number of passenger cars or light-duty trucks plus medium-duty passenger vehicles, whichever is applicable, produced and delivered for sale in California, with the air conditioning system to which to the efficiency credit value from section E.2.5.7.2 applies.

2.5.7.4 The results of section E.2.5.7.3, rounded to the nearest whole gram per mile, shall be included in the manufacturer's credit/debit totals calculated in section E.3.2.1.2.

2.5.7.5 For the purposes of this section E.2.5.7.5, the AC17 Test Procedure shall mean the AC17 Air Conditioning Efficiency Test Procedure set forth in Part II, Section A.100.5.6 of these test procedures

2.5.7.5.1 For each air conditioning system selected by the manufacturer to generate air conditioning efficiency credits, the manufacturer shall perform the AC17 Test Procedure.

2.5.7.5.2 Using good engineering judgment, the manufacturer must select the vehicle configuration to be tested that is expected to result in the greatest increased CO_2 emissions as a result of the operation of the air conditioning system for which efficiency credits are being sought. If the air conditioning system is being installed in passenger cars, light-duty trucks, and medium-duty passenger vehicles, a separate determination of the quantity of credits for passenger cars and for light-duty trucks and medium-duty passenger vehicles must be made, but only one test vehicle is required to represent the air conditioning system, provided it represents the worst-case impact of the system on CO_2 emissions.

2.5.7.5.3 For each air conditioning system selected by the manufacturer to generate air conditioning efficiency credits, the manufacturer shall perform the AC17 Test Procedure according to the following requirements. Each air conditioning system shall be tested as follows:

a. Perform the AC17 test on a vehicle that incorporates the air conditioning system with the credit-generating technologies.

b. Perform the AC17 test on a vehicle which does not incorporate the credit-generating technologies. The tested vehicle must be similar to the vehicle tested under section E.2.5.7.5.3.a.

c. Subtract the CO_2 emissions determined from testing under section E.2.5.7.5.3.a from the CO_2 emissions determined from testing under subsection E.2.5.7.5.3.b and round to the nearest 0.1 grams/mile. If the result is less than or equal to zero, the air conditioning system is not eligible to generate credits. If the result is greater than or equal to the total of the gram per mile credits determined under section E.2.5.7.2, then the air conditioning system is eligible to generate the maximum allowable value determined under section E.2.5.7.2. If the result is greater than zero but less than the total of the gram per mile credits determined under section E.2.5.7.2, then the air conditioning system is eligible to generate credits in the amount determined by subtracting the CO_2 emissions determined from testing under section E.2.5.7.5.3.a from the CO_2 emissions determined from testing under section E.2.5.7.5.3.b and rounding to the nearest 0.1 grams/mile.

2.5.7.5.4 For the first model year for which an air conditioning system is expected to generate credits, the manufacturer must select for testing the highest-selling subconfiguration within each vehicle platform that uses the air conditioning system. Credits may continue to be generated by the air conditioning system installed in a vehicle platform provided that:

a. The air conditioning system components and/or control strategies do not change in any way that could be expected to cause a change in its efficiency;

b. The vehicle platform does not change in design such that the changes could be expected to cause a change in the efficiency of the air conditioning system; and

c. The manufacturer continues to test at least one sub-configuration within each platform using the air conditioning system, in each model year, until all sub-configurations within each platform have been tested.

2.5.7.5.5 Each air conditioning system must be tested and must meet the testing criteria in order to be allowed to generate credits. Using good engineering judgment, in the first model year for which an air conditioning system is expected to generate credits, the manufacturer must select for testing the highest-selling subconfiguration within each vehicle platform using the air conditioning system. Credits may continue to be generated by an air conditioning system in subsequent model years if the manufacturer continues to test at least one sub-configuration within each platform on an annual basis, as long as the air conditioning system and vehicle platform do not change substantially.

2.5.8 *Off-Cycle Credits.* Manufacturers may generate credits for CO_2-reducing technologies where the CO_2 reduction benefit of the technology is not adequately captured on the FTP and/or the HWFET. These technologies must have a measurable, demonstrable, and verifiable real-world CO_2 reduction that occurs outside the conditions of the FTP and the HWFET. These optional credits are referred to as "off-cycle" credits. Off-cycle technologies used to generate emission credits are considered emission-related components subject to applicable requirements, and must be demonstrated to be effective for the full useful life of the vehicle. Unless the manufacturer demonstrates that the technology is not subject to in-use deterioration, the manufacturer must account for the deterioration in their analysis. The manufacturer must use one of the three options specified in this section E.2.5.8 to determine the CO_2 gram per mile credit applicable to an off-cycle technology. The manufacturer should notify the Executive Officer in its pre-model year report of its intention to generate any credits under this section E.2.5.8.

2.5.8.1 *Credit available for certain off-cycle technologies*.

2.5.8.1.1 The manufacturer may generate a CO_2 gram/mile credit for certain technologies as specified in the following table, provided that each technology is applied to the minimum percentage of the manufacturer's total U.S. production of passenger cars, light-duty trucks, and medium-duty passenger vehicles specified in the table in each model year for which credit is claimed. Technology definitions are in section B.

Off-Cycle Technology	**Passenger Cars (g/mi)**	**Light-Duty Trucks and Medium-Duty Passenger Vehicles (g/mi)**	**Minimum percent of U.S. production**
Active aerodynamics	0.6	1.0	10
High efficiency exterior lighting	1.1	1.1	10
Engine heat recovery	0.7 per 100W of capacity	0.7 per 100W of capacity	10
Engine start-stop (idle-off)	2.9	4.5	10
Active transmission warm-up	1.8	1.8	10
Active engine warm-up	1.8	1.8	10
Electric heater circulation pump	1.0	1.5	n/a
Solar roof panels	3.0	3.0	n/a
Thermal control	≤3.0	≤4.3	n/a

As Adopted: March 22, 2012
Date of Hearing: January 26-27, 2012

a. Credits may also be accrued for thermal control technologies as defined in section B in the amounts shown in the following table:

Thermal Control Technology	**Credit value: Passenger Cars (g/mi)**	**Credit Value: Light-Duty Trucks and Medium-Duty Passenger Vehicles (g/mi)**
Glass or glazing	≤2.9	≤3.9
Active seat ventilation	1.0	1.3
Solar reflective paint	0.4	0.5
Passive cabin ventilation	1.7	2.3
Active cabin ventilation	2.1	2.8

b. The maximum credit allowed for thermal control technologies is limited to 3.0 g/mi for passenger cars and to 4.3 g/mi for light-duty trucks and medium-duty passenger vehicles. The maximum credit allowed for glass or glazing is limited to 2.9 g/mi for passenger cars and to 3.9 g/mi for light-duty trucks and medium-duty passenger vehicles.

c. Glass or glazing credits are calculated using the following equation:

$$\text{Credit} = \left[Z \times \sum_{i=1}^{n} \frac{T_i \times G_i}{G} \right]$$

Where:

Credit = the total glass or glazing credits, in grams per mile, for a vehicle, which may not exceed 3.0 g/mi for passenger cars or 4.3 g/mi for light-duty trucks and medium-duty passenger vehicles;

Z = 0.3 for passenger cars and 0.4 for light-duty trucks and medium-duty passenger vehicles;

G_i = the measured glass area of window i, in square meters and rounded to the nearest tenth;

G = the total glass area of the vehicle, in square meters and rounded to the nearest tenth;

Ti = the estimated temperature reduction for the glass area of window i, determined using the following formula:

$$T_i = 0.3987 \times (Tts_{base} - Tts_{new})$$

Where:

Tts_{new} = the total solar transmittance of the glass, measured according to ISO 13837, “Safety glazing materials – Method for determination of solar transmittance” (incorporated by reference in section 1961.2, title 13, CCR).

Tts_{base} = 62 for the windshield, side-front, side-rear, rear-quarter, and backlite locations, and 40 for rooflite locations.

2.5.8.1.2 The maximum allowable decrease in the manufacturer's combined passenger car and light-duty truck plus medium-duty passenger vehicle fleet average CO_2 emissions attributable to use of the default credit values in section E.2.5.8.1.1 is 10 grams per mile. If the total of the CO_2 g/mi credit values from the table in section E.2.5.8.1.1 does not exceed 10 g/mi for any passenger automobile or light truck in a manufacturer's fleet, then the total off-cycle credits may be calculated according to section E.2.5.8.4. If the total of the CO_2 g/mi credit values from the table in section E.2.5.8.1 exceeds 10 g/mi for any passenger car, light-duty truck, or medium-duty passenger vehicle in a manufacturer's fleet, then the gram per mile decrease for the combined passenger car and light-duty truck plus medium-duty passenger vehicle fleet must be determined according to section E.2.5.8.1.2.a to determine whether the 10 g/mi limitation has been exceeded.

a. Determine the gram per mile decrease for the combined passenger car and light-duty truck plus medium-duty passenger vehicle fleet using the following formula:

$$\text{Decrease} = \frac{Credits \times 1{,}000{,}000}{[(\text{Prod}_\text{C} \times 195{,}264) + (\text{Prod}_\text{T} \times 225{,}865)]}$$

Where:

Credits = The total of passenger car and light-duty truck plus medium-duty passenger vehicles credits, in Megagrams, determined according to section E.2.5.8.4 and limited to those credits accrued by using the default gram per mile values in section E.2.5.8.1.1.

Prod_C = The number of passenger cars produced by the manufacturer and delivered for sale in the U.S.

Prod_T = The number of light-duty trucks and medium-duty passenger vehicles produced by the manufacturer and delivered for sale in the U.S.

b. If the value determined in section E.2.5.8.1.2.a is greater than 10 grams per mile, the total credits, in Megagrams, that may be accrued by a manufacturer using the default gram per mile values in section E.2.5.8.1.1 shall be determined using the following formula:

$$\text{Credit (Megagrams)} = \frac{\left[10 \times \left((\text{Prod}_\text{C} \times 195{,}264) + (\text{Prod}_\text{T} \times 225{,}865)\right)\right]}{1{,}000{,}000}$$

Where:

Prod_C = The number of passenger cars produced by the manufacturer and delivered for sale in the U.S.

Prod_T = The number of light-duty trucks and medium-duty passenger vehicles produced by the manufacturer and delivered for sale in the U.S.

c. If the value determined in section E.2.5.8.1.2.a is not greater than 10 grams per mile, then the credits that may be accrued by a manufacturer using the default gram per mile values in section E.2.5.8.1.1 do not exceed the allowable limit, and total credits may be determined for each category of vehicles according to section E.2.5.8.4.

d. If the value determined in section E.2.5.8.1.2.a is greater than 10 grams per mile, then the combined passenger car and light-duty truck plus medium-duty passenger vehicle credits, in Megagrams, that may be accrued using the calculations in section E.2.5.8.4 must not exceed the value determined in section E.2.5.8.1.2.b. This limitation should generally be done by reducing the amount of credits attributable to the vehicle category that caused the limit to be exceeded such that the total value does not exceed the value determined in section E.2.5.8.1.2.b.

2.5.8.1.3. In lieu of using the default gram per mile values specified in section E.2.5.8.1.1 for specific technologies, a manufacturer may determine an alternative value for any of the specified technologies. An alternative value must be determined using one of the methods specified in section 2.5.8.2 or section 2.5.8.3.

2.5.8.2 *Technology demonstration using EPA 5-cycle methodology.* To demonstrate an off-cycle technology and to determine a CO_2 credit using the EPA 5-cycle methodology, the manufacturer shall determine the off-cycle city/highway combined carbon-related exhaust emissions benefit by using the EPA 5-cycle methodology described in 40 CFR Part 600. Testing shall be performed on a representative vehicle, selected using good engineering judgment, for each model type for which the credit is being demonstrated. The emission benefit of a technology is determined by testing both with and without the off-cycle technology operating. Multiple off-cycle technologies may be demonstrated on a test vehicle. The manufacturer shall conduct the following steps and submit all test data to the Executive Officer.

2.5.8.2.1 Testing without the off-cycle technology installed and/or operating. Determine carbon-related exhaust emissions over the FTP, the HWFET, the US06, the SC03, and the cold temperature FTP test procedures according to the test procedure provisions specified in 40 CFR part 600 subpart B and using the calculation procedures specified in §600.113–08 of this chapter. Run each of these tests a minimum of three times without the off-cycle technology installed and operating and average the per phase (bag) results for each test procedure. Calculate the 5-cycle weighted city/highway combined carbon-related exhaust emissions from the averaged per phase results, where the 5-cycle city value is weighted 55% and the 5-cycle highway value is weighted 45%. The resulting combined city/highway value is the baseline 5-cycle carbon-related exhaust emission value for the vehicle.

2.5.8.2.2 Testing with the off-cycle technology installed and/or operating. Determine carbon-related exhaust emissions over the US06, the SC03, and the cold temperature FTP test procedures according to the test procedure provisions specified in 40 CFR part 600 subpart B and using the calculation procedures specified in 40 CFR §600.113–08. Run each of these tests a minimum of three times with the off-cycle technology installed and operating and average the per phase (bag) results for each test procedure. Calculate the 5-cycle weighted city/highway combined carbon-related exhaust emissions from the averaged per phase results, where the 5-cycle city value is weighted 55% and the 5-cycle highway value is weighted 45%. Use the averaged per phase results for the FTP and HWFET determined in section E.2.5.8.2.1 for operation without the off-cycle technology in this calculation. The resulting combined city/highway value is the 5-cycle carbon-related exhaust emission value showing the off-cycle benefit of the technology but excluding any benefit of the technology on the FTP and HWFET.

2.5.8.2.3 Subtract the combined city/highway value determined in section E.2.5.8.2.1 from the value determined in section E.2.5.8.2.2. The result is the off-cycle benefit of the technology or technologies being evaluated. If this benefit is greater than or equal to three percent of the value determined in section E.2.5.8.2.1 then the manufacturer may use this value, rounded to the nearest tenth of a gram per mile, to determine credits under section E.2.5.8.3.

2.5.8.2.4 If the value calculated in section E.2.5.8.2.3 is less than two percent of the value determined in section E.2.5.8.2.1, then the manufacturer must repeat the testing required under sections E.2.5.8.2.1 and E.2.5.8.2.2, except instead of running each test three times they shall run each test two additional times. The off-cycle benefit of the technology or technologies being evaluated shall be calculated as in section E.2.5.8.2.3 using all the tests conducted under sections E.2.5.8.2.1, E.2.5.8.2.2, and E.2.5.8.2.4. If the value calculated in section E.2.5.8.2.3 is less than two percent of the value determined in section E.2.5.8.2.1, then the manufacturer must verify the emission reduction potential of the off-cycle technology or technologies using the EPA Vehicle Simulation Tool, and if the results support a credit value that is less than two percent of the value determined in section E.2.5.8.2.1 then the manufacturer may use the off-cycle benefit of the technology or technologies calculated as in section E.2.5.8.2.3 using all the tests conducted under sections E.2.5.8.2.1, E.2.5.8.2.2, and E.2.5.8.2.4, rounded to the nearest tenth of a gram per mile, to determine credits under section E.2.5.8.3.

2.5.8.3 *Review and approval process for off-cycle credits*.

2.5.8.3.1 *Initial steps required*.

a. A manufacturer requesting off-cycle credits under the provisions of section E.2.5.8.2 must conduct the testing and/or simulation described in that paragraph.

b. A manufacturer requesting off-cycle credits under section E.2.5.8.2 must conduct testing and/or prepare engineering analyses that demonstrate the in-use durability of the technology for the full useful life of the vehicle.

2.5.8.3.2 *Data and information requirements*. The manufacturer seeking off-cycle credits must submit an application for off-cycle credits determined under section E.2.5.8.2. The application must contain the following:

a. A detailed description of the off-cycle technology and how it functions to reduce CO_2 emissions under conditions not represented on the FTP and HWFET.

b. A list of the vehicle model(s) which will be equipped with the technology.

c. A detailed description of the test vehicles selected and an engineering analysis that supports the selection of those vehicles for testing.

d. All testing and/or simulation data required under section 2.5.8.2, as applicable, plus any other data the manufacturer has considered in the analysis.

e. An estimate of the off-cycle benefit by vehicle model and the fleetwide benefit based on projected sales of vehicle models equipped with the technology.

f. An engineering analysis and/or component durability testing data or whole vehicle testing data demonstrating the in-use durability of the off-cycle technology components.

2.5.8.3.3 R*eview of the off-cycle credit application*. Upon receipt of an application from a manufacturer, the Executive Officer will do the following:

a. Review the application for completeness and notify the manufacturer within 30 days if additional information is required.

b. Review the data and information provided in the application to determine if the application supports the level of credits estimated by the manufacturer.

2.5.8.3.4 *Decision on off-cycle application.* The Executive Officer will notify the manufacturer in writing of its decision to approve or deny the application within 60 days of receiving a complete application, and if denied, the Executive Officer will provide the reasons for the denial.

2.5.8.4 *Calculation of total off-cycle credits.* Total off-cycle credits in grams per mile of CO_2 (rounded to the nearest tenth of a gram per mile) shall be calculated separately for passenger cars and light-duty trucks plus medium-duty passenger vehicles according to the following formula:

Total Credits (g/mi) = Credit × Production

Where:

Credit = the credit value in grams per mile determined in section E.2.5.8.1 or section E.2.5.8.2.

Production = The total number of passenger cars or light-duty trucks plus medium-duty passenger vehicles, whichever is applicable, produced and delivered for sale in California, produced with the off-cycle technology to which to the credit value determined in section E.2.5.8.1 or section E.2.5.8.2 applies.

2.5.9 *Credits for certain full-size pickup trucks.* Full-size pickup trucks may be eligible for additional credits based on the implementation of hybrid technologies or on exhaust emission performance, as described in this section E.2.5.9. Credits may be generated under either section E.2.5.9.1 or section E.2.5.9.2 for a qualifying pickup truck, but not both.

2.5.9.1 *Credits for implementation of gasoline-electric hybrid technology.* Full-size pickup trucks that implement hybrid gasoline-electric technologies may be eligible for an additional credit under this section E.2.5.9.1. Pickup trucks using the credits under this section E.2.5.9.1 may not use the credits described in section E.2.5.9.2.

2.5.9.1.1 Full-size pickup trucks that are mild hybrid gasoline-electric vehicles and that are produced in the 2017 through 2021 model years are eligible for a credit of 10 grams/mile. To receive this credit, the manufacturer must produce a quantity of mild hybrid full-size pickup trucks such that the proportion of production of such vehicles, when compared to the manufacturer's total production of full-size pickup trucks, is not less than the amount specified in the table below for each model year.

Model year	Required minimum percent of full-size pickup trucks
2017	30%
2018	40%
2019	55%
2020	70%
2021	80%

2..5.9.1.2 Full-size pickup trucks that are strong hybrid gasoline-electric vehicles and that are produced in the 2017 through 2025 model years are eligible for a credit of 20 grams/mile. To receive this credit, the manufacturer must produce a quantity of strong hybrid full-size pickup trucks such that the proportion of production of such vehicles, when compared to the manufacturer's total production of full-size pickup trucks, is not less than 10 percent for each model year.

2.5.9.2 *Credits for emission reduction performance.* Full-size pickup trucks that achieve carbon-related exhaust emission values below the applicable target value determined in section E.2.5.9.2 may be eligible for an additional credit. Pickup trucks using the credits under this section E.2.5.9.2 may not use the credits described in section E.2.5.9.1.

2.5.9.2.1 Full-size pickup trucks that achieve carbon-related exhaust emissions less than or equal to the applicable target value determined in section E.2.5.1.2 multiplied by 0.85 (rounded to the nearest gram per mile) and greater than the applicable target value determined in section E.2.5.1.2 multiplied by 0.80 (rounded to the nearest gram per mile) in a model year are eligible for a credit of 10 grams/mile. A pickup truck that qualifies for this credit in a model year may claim this credit for subsequent model years through the 2021 model year if the carbon-related exhaust emissions of that pickup truck do not increase relative to the emissions in the model year in which the pickup truck qualified for the credit. To qualify for this credit in each model year, the manufacturer must produce a quantity of full-size pickup trucks that meet the emission requirements of this section E.2.5.9.2.1 such that the proportion of production of such vehicles, when compared to the manufacturer's total production of full-size pickup trucks, is not less than the amount specified in the table below for each model year.

Model year	*Required minimum percent of full-size pickup trucks*
2017	15%
2018	20%
2019	28%
2020	35%
2021	40%

2.5.9.2.2 Full-size pickup trucks that achieve carbon-related exhaust emissions less than or equal to the applicable target value determined in section E.2.5.1.2 multiplied by 0.80 (rounded to the nearest gram per mile) in a model year are eligible for a credit of 20 grams/mile. A pickup truck that qualifies for this credit in a model year may claim this credit for a maximum of five subsequent model years if the carbon-related exhaust emissions of that pickup truck do not increase relative to the emissions in the model year in which the pickup truck first qualified for the credit. This credit may not be claimed in any model year after 2025. To qualify for this credit, the manufacturer must produce a quantity of full-size pickup trucks that meet the emission requirements of section E.2.5.9.2.1 such that the proportion of production of such vehicles, when compared to the manufacturer's total production of full-size pickup trucks, is not less than 10 percent in each model year.

2.5.9.3 *Calculation of total full-size pickup truck credits*. Total credits in grams per mile of CO_2 (rounded to the nearest whole gram per mile) shall be calculated for qualifying full-size pickup trucks according to the following formula:

$$\text{Total Credits (g/mi)} = (10 \times \text{Production}_{10}) + (20 \times \text{Production}_{20})$$

Where:

Production$_{10}$ = The total number of full-size pickup trucks produced and delivered for sale in California with a credit value of 10 grams per mile from section E.2.5.9.1 and section E.2.5.9.2.

Production$_{20}$ = The total number of full-size pickup trucks produced and delivered for sale in California with a credit value of 20 grams per mile from section E.2.5.9.1 and section E.2.5.9.2.

3. Calculation of Credits/Debits

3.1 Calculation of NMOG+NOx Credits/Debits

3.1.1 **Calculation of NMOG+NOx Credits and Debits for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.**

3.1.1.1 In 2015 and subsequent model years, a manufacturer shall calculate its credits or debits using the following equation.

[(Fleet Average NMOG+NOx Requirement) - (Manufacturer's Fleet Average NMOG+NOx Value)] x
(Total No. of Vehicles Produced and Delivered for Sale in California, Including ZEVs and HEVs).

3.1.1.2 In 2015 and subsequent model years, a manufacturer that achieves fleet average NMOG+NOx values lower than the fleet average NMOG+NOx requirement for the corresponding model year shall receive credits in units of g/mi NMOG+NOx . A manufacturer with 2015 and subsequent model year fleet average NMOG+NOx values greater than the fleet average requirement for the corresponding model year shall receive debits in units of g/mi NMOG+NOx equal to the amount of negative credits determined by the aforementioned equation. The total g/mi NMOG+NOx credits or debits earned for PCs and LDTs 0 3750 lbs. LVW, for LDTs 3751-5750 lbs. LVW and for LDTs 3751 lbs. LVW - 8500 lbs. GVWR shall be summed together. The resulting amount shall constitute the g/mi NMOG+NOx credits or debits accrued by the manufacturer for the model year.

3.1.2 **Calculation of Vehicle-Equivalent NMOG+NOx Credits for Medium-Duty Vehicles Other than MDPVs.**

3.1.2.1 In 2016 and subsequent model years, a manufacturer that produces and delivers for sale in California MDVs, other than MDPVs, in excess of the equivalent requirements for LEV III vehicles certified to the exhaust emission standards set forth in section E.1 of these test procedures shall receive “Vehicle-Equivalent Credits” (or “VECs”) calculated in accordance with the following equation, where the term “produced” means produced and delivered for sale in California:

(1.00) x {[(No. of LEV395s and LEV630s Produced excluding HEVs) +
(No. of LEV395 HEVs x HEV VEC factor for LEV395s) +
(No. of LEV630 HEVs x HEV VEC factor for LEV630s)] –
(No. of LEV395s and LEV630s Required to be Produced)} +

(1.14) x {[(No. of ULEV340s and ULEV570s Produced excluding HEVs) +
(No. of ULEV340 HEVs x HEV VEC factor for ULEV340s) +
(No. of ULEV570 HEVs x HEV VEC factor for ULEV570s)] –
(No. of ULEV340s and ULEV570s Required to be Produced)} +

(1.37) x {[(No. of ULEV250s and ULEV400s Produced excluding HEVs) +
(No. of ULEV250 HEVs x HEV VEC factor for ULEV250s) +
(No. of ULEV400 HEVs x HEV VEC factor for ULEV400s)] -
(No. of ULEV250s and ULEV270s Required to be Produced)} +

(1.49) x {[(No. of ULEV200s and ULEV270s Produced excluding HEVs) +
(No. of ULEV200 HEVs x HEV VEC factor for ULEV200s) +
(No. of ULEV270 HEVs x HEV VEC factor for ULEV270s)] -
(No. of ULEV200s and ULEV270s Required to be Produced)} +

(1.57) x {[(No. of SULEV170s and SULEV230s Produced excluding HEVs) +
(No. of SULEV170 HEVs x HEV VEC factor for SULEV170s) +
(No. of SULEV230 HEVs x HEV VEC factor for SULEV230s)] -
(No. of SULEV170s and SULEV230s Required to be Produced)} +

(1.62) x {[(No. of SULEV150s and SULEV200s Produced excluding HEVs) +
(No. of SULEV150 HEVs x HEV VEC factor for SULEV150s) +
(No. of SULEV200 HEVs x HEV VEC factor for SULEV200s)] -
(No. of SULEV150s and SULEV200s Required to be Produced)} +

[(2.00) x (No. of ZEVs Certified and Produced as MDVs)].

3.1.2.2 The MDV HEV VEC factor is calculated as follows:

For LEV395s: $$1+\left[\frac{(LEV395\ standard - ULEV340\ standard)\times Zero-emission\ VMT\ Allowance}{LEV395\ standard}\right];$$

For ULEV340s: $$1+\left[\frac{(ULEV340\ standard - ULEV250\ standard)\times Zero-emission\ VMT\ Allowance}{ULEV340\ standard}\right];$$

For ULEV250s: $$1+\left[\frac{(ULEV250\ standard - ULEV200\ standard)\times Zero-emission\ VMT\ Allowance}{ULEV250\ standard}\right];$$

For ULEV200s: $$1+\left[\frac{(ULEV200\ standard-SULEV170\ standard)\times Zero-emission\ VMT\ Allowance}{ULEV3200\ standard}\right];$$

For SULEV170s: $$1+\left[\frac{(SULEV170\ standard-SULEV150\ standard)\times Zero-emission\ VMT\ Allowance}{SULEV170\ standard}\right];$$

For SULEV150s: $$1+\left[\frac{(SULEV150\ standard-ZEV\ standard)\times Zero-emission\ VMT\ Allowance}{SULEV150\ standard}\right];$$

For LEV630s: $$1+\left[\frac{(LEV630\ standard-ULEV570\ standard)\times Zero-emission\ VMT\ Allowance}{LEV630\ standard}\right];$$

For ULEV570s: $$1+\left[\frac{(ULEV570\ standard-ULEV400\ standard)\times Zero-emission\ VMT\ Allowance}{ULEV570\ standard}\right];$$

For ULEV400s: $$1+\left[\frac{(ULEV400\ standard-ULEV270\ standard)\times Zero-emission\ VMT\ Allowance}{ULEV400\ standard}\right];$$

For ULEV270s: $$1+\left[\frac{(ULEV270\ standard-SULEV230\ standard)\times Zero-emission\ VMT\ Allowance}{ULEV270\ standard}\right];$$

For SULEV230s: $$1+\left[\frac{(SULEV230\ standard-SULEV200\ standard)\times Zero-emission\ VMT\ Allowance}{SULEV230\ standard}\right]$$

For SULEV200s: $$1+\left[\frac{(SULEV200\ standard-ZEV\ standard)\times Zero-emission\ VMT\ Allowance}{SULEV200\ standard}\right]$$

where “Zero-emission VMT Allowance” for an HEV is determined in accordance with section C of the “California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes” or the “California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes,” applicable, except that for the purposes of this section E.3.1.2.2, the maximum allowable Zero-emission VMT Allowance that may be used in these equations is 1.0.

3.1.2.3 A manufacturer that fails to produce and deliver for sale in California the equivalent quantity of MDVs certified to LEV III exhaust emission standards, shall receive “Vehicle-Equivalent Debits” (or “VEDs”) equal to the amount of negative VECs determined by the aforementioned equation.

3.1.2.4 Only ZEVs certified as MDVs and not used to meet the ZEV requirement shall be included in the calculation of VECs.

3.1.2.5 For a manufacturer that elects to certify engines to the optional medium-duty engine standards in title 13, CCR §1956.8(c) or (h), all such engines used in MDVs, including those produced by a small volume manufacturer, shall be subject to the emissions averaging provisions applicable to heavy-duty diesel or Otto-cycle engines as set forth in the "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Otto-Cycle Engines," or the "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Diesel Engines, incorporated by reference in title 13, CCR, §1956.8(b) or (d), as applicable.

3.1.3 **Procedure for Offsetting NMOG+NOx Debits.**

3.1.3.1 A manufacturer shall equalize emission debits by earning g/mi NMOG+NOx emission credits or VECs in an amount equal to the g/mi NMOG+NOx debits or VEDs, or by submitting a commensurate amount of g/mi NMOG+NOx credits or VECs to the Executive Officer that were earned previously or acquired from another manufacturer. A manufacturer shall equalize NMOG+NOx debits for PCs, LDTs, and MDPVs and VEC debits for MDVs within three model years. If emission debits are not equalized within the specified time period, the manufacturer shall be subject to the Health and Safety Code §43211 civil penalty applicable to a manufacturer which 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 emission debits are not equalized by the end of the specified time period. A manufacturer demonstrating compliance under Option 2 in section E.2.1.1.1.a, must calculate the emission debits that are subject to a civil penalty under Health and Safety Code section 43211 separately for California, the District of Columbia, and for each individual state that is included in the fleet average greenhouse gas requirements in section E.2.1.1.1.a. The manufacturer must calculate these emission debits separately for California, the District of Columbia, and each individual state using the formula in sections E.3.1.1 and E.3.1.2, except that the "Total No. of Vehicles Produced and Delivered for Sale in California, Including ZEVs and HEVs" shall be calculated separately for the District of Columbia and each individual state.

For the purposes of Health and Safety Code §43211, the number of passenger cars, light-duty trucks, and medium-duty passenger vehicles not meeting the state board's emission standards shall be determined by dividing the total amount of g/mi NMOG+NOx emission debits for the model year by the g/mi NMOG+NOx fleet average requirement for PCs and LDTs 0-3750 lbs. LVW and for LDTs 3751 lbs. LVW - 8500 lbs. GVW and MDPVs applicable for the model year in which the debits were first incurred; and the number of medium-duty vehicles not meeting the state board's emission standards shall be equal to the amount of VEDs incurred.

3.1.3.2 The emission credits earned in any given model year shall retain full value through five subsequent model years. Credits will have no value if not used by the beginning of the sixth model year after being earned.

3.1.4 **Changing NMOG Credits and Debits to NMOG+NOx Credits and Debits.** The value of any emission credits that have not been used prior to the start of the 2015 model year and any emission debits that have not been equalized prior to the start of the 2015 model year earned shall be converted to NMOG+NOx credits at the start of the 2015 model year by multiplying their values by a factor of 3.0. These credits and debits are subject to the provisions in subsection 1961(c)(3), title 13, CCR.

3.2 Calculation of Greenhouse Gas Credits/Debits.

Credits and debits that are earned as part of the 2012 through 2016 MY National greenhouse gas program shall not be applicable to California's greenhouse gas program.

3.2.1 **Calculation of Greenhouse Gas Credits for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.**

3.2.1.1 A manufacturer that achieves fleet average CO_2 values lower than the fleet average CO_2 requirement for the corresponding model year shall receive credits for each model year in units of g/mi. A manufacturer that achieves fleet average CO_2 values higher than the fleet average CO_2 requirement for the corresponding model year shall receive debits for each model year in units of g/mi. Manufacturers must calculate greenhouse gas credits and greenhouse gas debits separately for passenger cars and for combined light-duty trucks and medium-duty passenger vehicles as follows:

CO_2 Credits or Debits = (CO_2 Standard - Manufacturer's Fleet Average CO_2 Value) × (Total No. of Vehicles Produced and Delivered for Sale in California, Including ZEVs and HEVs).

Where:

CO_2 Standard = the applicable standard for the model year as determined in section E.2.5.1.3;

Manufacturer's Fleet Average CO_2 Value = average calculated according to section E.2.5.5;

3.2.1.2 A manufacturer's total Greenhouse Gas credits or debits generated in a model year shall be the sum of its CO_2 credits or debits and any of the following credits, if applicable. The manufacturer shall calculate, maintain, and report Greenhouse Gas credits or debits separately for its passenger car fleet and for its light-duty truck plus medium-duty passenger vehicle fleet.

3.2.1.2.1 Air conditioning leakage credits earned according to the provisions of section E.2.5.6;

3.2.1.2.2 Air conditioning efficiency credits earned according to the provisions of section E.2.5.7;

3.2.1.2.3 Off-cycle technology credits earned according to the provisions of section E.2.5.8.

3.2.1.2.4 CO_2-equivalent debits earned according to the provisions of section E.2.5.2.4.

3.2.2 A manufacturer with 2017 and subsequent model year fleet average Greenhouse Gas values greater than the fleet average CO_2 standard applicable for the corresponding model year shall receive debits in units of g/mi Greenhouse Gas equal to the amount of negative credits determined by the aforementioned equation. For the 2017 and subsequent model years, the total g/mi Greenhouse Gas credits or debits earned for passenger cars and for light-duty trucks and medium-duty passenger vehicles shall be summed together. The resulting amount shall constitute the g/mi Greenhouse Gas credits or debits accrued by the manufacturer for the model year.

3.2.3 **Procedure for Offsetting Greenhouse Gas Debits.**

3.2.3.1 A manufacturer shall equalize Greenhouse Gas emission debits by earning g/mi Greenhouse Gas emission credits in an amount equal to the g/mi Greenhouse Gas debits, or by submitting a commensurate amount of g/mi Greenhouse Gas credits to the Executive Officer that were earned previously or acquired from another manufacturer. A manufacturer shall equalize Greenhouse Gas debits for passenger cars, light-duty trucks, and medium-duty passenger vehicles within five model years after they are earned. If emission debits are not equalized within the specified time period, the manufacturer shall be subject to the Health and Safety Code section 43211 civil penalty applicable to a manufacturer which 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 emission debits are not equalized by the end of the specified time period. For a manufacturer demonstrating compliance under Option 2 in section E.2.5.5.4, the emission debits that are subject to a civil penalty under Health and Safety Code section 43211 shall be calculated separately for California, the District of Columbia, and each individual state that is included in the fleet average greenhouse gas requirements in section E.2.5.1. These emission debits shall be calculated for each individual state using the formula in sections E.3.2.1 and E.3.2.2, except that the “Total No. of Vehicles Produced and Delivered for Sale in California, including ZEVs and HEVs” shall be calculated separately for the District of Columbia and each individual state.

For the purposes of Health and Safety Code section 43211, the number of passenger cars not meeting the state board’s emission standards shall be determined by dividing the total amount of g/mi Greenhouse Gas emission debits for the model year calculated for California by the g/mi Greenhouse Gas fleet average requirement for passenger car applicable for the model year in which the debits were first incurred. For the purposes of

Health and Safety Code section 43211, the number of light-duty trucks and medium-duty passenger vehicles not meeting the state board's emission standards shall be determined by dividing the total amount of g/mi Greenhouse Gas emission debits for the model year calculated for California by the g/mi Greenhouse Gas fleet average requirement for light-duty trucks and medium-duty passenger vehicles, applicable for the model year in which the debits were first incurred.

3.2.3.2 Greenhouse Gas emission credits earned in the 2017 and subsequent model years shall retain full value through the fifth model year after they are earned, and will have no value if not used by the beginning of the sixth model year after being earned.

3.2.4 **Use of Greenhouse Gas Emission Credits to Offset a Manufacturer's ZEV Obligations**.

3.2.4.1 For a given model year, a manufacturer that has Greenhouse Gas credits remaining after equalizing all of its Greenhouse Gas debits may use those Greenhouse Gas credits to comply with its ZEV obligations for that model year, in accordance with the provisions set forth in the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," incorporated by reference in section 1962.1, title 13, CCR, or the "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," incorporated by reference in section 1962.2, title 13, CCR.

3.2.4.2 Any Greenhouse Gas credits used by a manufacturer to comply with its ZEV obligations shall retain no value for the purposes of complying with these test procedures.

3.2.5 Credits and debits that are earned as part of the 2012 through 2016 MY National Greenhouse Gas Program, shall have no value for the purpose of complying with these test procedures.

4. LEV III Criteria Pollutant Interim In-Use Compliance Standards.

The following interim in-use compliance standards shall apply for the first two model years that a test group is certified to the LEV III standards.

4.1 **LEV III NMOG+NOx Interim In-Use Compliance Standards.**

4.1.1 **NMOG+NOx Interim In-Use Compliance Standards for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.** For the 2015 through 2019 model years, these standards shall apply.

Emission Category	Durability Vehicle Basis (miles)	LEV III PCs, LDTs, and MDPVs
		NMOG + NOx (g/mi)
LEV160	150,000	n/a
ULEV125	150,000	n/a
ULEV70	150,000	0.098
ULEV50	150,000	0.070
SULEV30	150,000	0.042[1]
SULEV20	150,000	0.028[1]

[1]not applicable to test groups that receive PZEV credits

4.1.2 **NMOG+NOx Interim In-Use Compliance Standards for Medium-Duty Vehicles, Excluding Medium-Duty Passenger Vehicles.** For the 2015 through 2020 model years, these standards shall apply.

Emission Category	Durability Vehicle Basis (miles)	LEV III MDVs (excluding MDPVs) 8,501 - 10,000 lbs. GVW	LEV III MDVs 10,001 - 14,000 lbs. GVW
		NMOG + NOx (g/mi)	NMOG + NOx (g/mi)
LEV395	150,000	n/a	n/a
ULEV340	150,000	n/a	n/a
ULEV250	150,000	0.370	n/a
ULEV200	150,000	0.300	n/a
SULEV170	150,000	0.250	n/a
SULEV150	150,000	0.220	n/a
LEV630	150,000	n/a	n/a
ULEV570	150,000	n/a	n/a
ULEV400	150,000	n/a	0.600
ULEV270	150,000	n/a	0.400
SULEV230	150,000	n/a	0.340
SULEV200	150,000	n/a	0.300

4.2 **LEV III Particulate Interim In-Use Compliance Standards.**

4.2.1 **LEV III Particulate Interim In-Use Compliance Standards for Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles.** For the 2017 through 2021 model years, the interim in-use compliance standard for vehicles certifying to the 3 mg/mi particulate standard is 6 mg/mi. For the 2025 through 2028 model years, the interim in-use compliance standard for vehicles certifying to the 1 mg/mi particulate standard is 2 mg/mi.

4.2.2 **LEV III Particulate Interim In-Use Compliance Standards for Medium-Duty Vehicles, excluding Medium-Duty Passenger Vehicles.** For the 2017 through 2021 model years, the interim in-use compliance standard for vehicles certifying to the 8 mg/mi particulate standard is 16 mg/mi and the interim in-use compliance standard for vehicles certifying to the 10 mg/mi particulate standard is 20 mg/mi.

4.3 **SFTP Interim In-Use Compliance Emission Standards.**

4.3.1 Test groups certified prior to the 2020 model year may use an in-use compliance standard for NMOG+NOx for the first two model years that they are certified to new standards.

(a) For light-duty vehicle test groups and medium-duty passenger vehicle test groups certifying to the standards in section E.1.2.2.1.1, in-use compliance emission standards for NMOG+NOx shall be 1.4 times the applicable certification standard.

(b) For light-duty vehicle test groups and medium-duty passenger vehicle test groups certifying to the standards in section E.1.2.2.1.2, in-use compliance emission standards for NMOG+NOx shall be 1.4 times the Composite Value of the bin to which a test group is certified.

(c) For medium-duty vehicle tests groups certifying to the standards in section E.1.2.2.3, in-use compliance emission standards for NMOG+NOx shall be 1.4 times the applicable certification standard.

4.3.2 Test groups certified prior to the 2021 model year will be allowed an in-use compliance standard for PM for the first five model years that they are certified to the SFTP PM standard.

(a) For light-duty vehicle test groups and medium-duty passenger vehicle test groups certifying to SFTP PM exhaust emission standards in section E.1.2.2.2, in-use compliance emission standards for PM shall be 5.0 mg/mi higher than the applicable certification standard.

(b) For medium-duty vehicle test groups certifying to SFTP PM Exhaust Emission Standards in section E.1.2.2.4, in-use compliance emission standards for PM shall be 5.0 mg/mi higher than the applicable certification standard.

5. LEV III Greenhouse Gas In-Use Compliance Standards.

The in-use exhaust CO_2 emission standard shall be the combined city/highway exhaust emission value calculated according to the provisions of section E.2.5.5.1 for the vehicle model type and footprint value multiplied by 1.1 and rounded to the nearest whole gram per mile. For vehicles that are capable of operating on multiple fuels, a separate value shall be determined for each fuel that the vehicle is capable of operating on. These standards apply to in-use testing performed by the manufacturer pursuant to the regulations at §86.1845-04 and §86.1846-01 and to in-use testing performed by the Air Resources Board.

6. 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.

F. Requirements and Procedures for Durability Demonstration

1. §86.1820 Durability group determination.

1.1 §86.1820-01. [No change.]

2. §86.1821 Evaporative/refueling emission family determination.

[Delete. (The provisions of this section are set forth in the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks, Medium-Duty Vehicles, Heavy-Duty Vehicles and Motorcycles," and "California Refueling Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles.")]

3. §86.1822 Durability data vehicle selection. [No change.]

4. §86.1823 Durability demonstration procedures for exhaust emissions.

4.1 §86.1823-01. February 26, 2007.

4.2 §86.1823-08. [Insert Federal Register for the 2017 and subsequent MY National Greenhouse Gas Final Rule as proposed at 76 Fed. Reg. 74854, 75371 (December 1, 2011)]. [No change, except that subparagraph (m) applies only to vehicles certifying to the 2012 through 2016 MY National greenhouse gas program.]

4.3 **SFTP**. These procedures are not applicable to vehicles certified to the SFTP standards set forth in section E.1.2.2.

4.4 **HEVs**. A manufacturer shall consider expected customer usage as well as emissions deterioration when developing its durability demonstration for HEVs.

5. §86.1824 Durability demonstration procedures for evaporative emissions.

[Delete. (The provisions of this section are set forth in the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks, Medium-Duty Vehicles, Heavy-Duty Vehicles and Motorcycles.")]

6. §86.1825 Durability demonstration procedures for refueling emissions.

[Delete. (The provisions of this section are set forth in the "California Refueling Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles.")]

7. §86.1826 Assigned Deterioration Factors for Small Volume Manufacturers and Small Volume Test Groups.

7.1 §86.1826-01. January 17, 2006. [No change.]

G. Procedures for Demonstration of Compliance with Emission Standards

1. §86.1827 Test Group Determination.

1.1 §86.1827-01. May 7, 2010. [No change, except that for the 2012 through 2016 MYs, subparagraphs (a)(5) and (f) shall only apply to vehicles certifying to the 2012 through 2016 MY National greenhouse gas program.]

2. §86.1828 Emission data vehicle selection

2.1 §86.1828-10. February 26, 2007. Amend as follows:

2.1.1 Add the following sentence to (a): Incomplete medium-duty Otto-cycle and diesel vehicles 8,501-10,000 lbs. GVW certifying to LEV III standards shall be tested in a configuration that represents the maximum curb weight, frontal area, and gross vehicle weight rating affecting the emission certification applicable to that vehicle.

2.2 **50°F Requirements.**

2.2.1 Vehicle Selection. A manufacturer shall select at least three emission data and/or engineering development vehicles each year from PC or LDT test groups and at least three emission data and/or engineering development vehicles from MDV test groups.

2.2.2 The same test group shall not be selected in the succeeding two years unless the manufacturer produces fewer than three test groups. If the manufacturer produces more than three LEV, LEV630, LEV395, LEV160, ULEV, ULEV570, ULEV400, ULEV340, ULEV270, ULEV250, ULEV200, ULEV125, ULEV70, ULEV50, SULEV, SULEV230, SULEV200, SULEV170, SULEV150, SULEV30, or SULEV20 test groups per model year, the Executive Officer may request 50°F testing of specific test groups. If the manufacturer provides a list of the LEV, LEV630, LEV395, LEV160, ULEV, ULEV570, ULEV400, ULEV340, ULEV270, ULEV250, ULEV200, ULEV125, ULEV70, ULEV50, SULEV, SULEV230, SULEV200, SULEV170, SULEV150, SULEV30, or SULEV20 test groups that it will certify for a model year and provides a description of the technologies used on each test group (including the information in section G.2.3.1), the Executive Officer shall select the test groups subject to 50°F testing within a 30 day period after receiving such a list and description. The Executive Officer may revise the test groups selected after the 30 day period if the information provided by the manufacturer does not accurately reflect the test groups actually certified by the manufacturer.

3. §86.1829 Durability data and emission data testing requirements; waivers.

3.1 §86.1829-01. May 7, 2010. Amend as follows:

3.1.1 Delete (b)(1)(ii) and replace with: For Otto-cycle vehicles or hybrid vehicles that use Otto-cycle engines, evidence shall be supplied showing that the air/fuel metering system or secondary air injection system is capable of providing sufficient oxygen to theoretically allow enough oxidation to attain the CO emission standards at barometric pressures equivalent to those expected at altitudes ranging from sea level to an elevation of

6000 feet. For fuel injected vehicles or hybrid electric vehicles that use fuel-injected engines, compliance may be demonstrated upon a showing by the manufacturer that the fuel injection system distributes fuel based on mass air flow, rather than volume flow, and is therefore self-compensating. All submitted test proposals will be evaluated on their acceptability by the Executive Officer. As an alternative to the demonstration described above, a manufacturer may demonstrate compliance by testing California vehicle configurations as part of its federal high altitude certification requirements. Engine families that meet all the applicable California low altitude emission standards when tested at the EPA test elevation are deemed to be in compliance. The SFTP standards do not apply to testing at high altitude.

3.1.2 (b)(1)(iii)(E) [No change, except that references to Tier 2 or interim non-Tier 2 vehicles shall mean California LEV II and LEV III vehicles.]

3.1.3 (b)(1)(iii)(G) [n/a]

3.1.4 Amend (b)(4)(i) as follows: All 2015 and subsequent model-year emission-data vehicles shall be required to be tail-pipe tested at 4,000 miles or at the mileage at which the vehicle is stabilized as determined in §86.1827-01 and demonstrate compliance with the California Inspection and Maintenance ("I/M") emission standards as specified in the "Mandatory Exhaust Emissions Inspection Standards and Test Procedures," title 16, California Code of Regulations, Section 3340.42. A manufacturer shall have the option of using the I/M test procedures in place at the time of certification or, if the I/M test procedures have been amended within two years of the time of certification, a manufacturer may use the preceding procedures. Test vehicles shall undergo preconditioning procedures prior to the tail-pipe test, which consist of idle conditions for a minimum period of ten minutes after the thermostat is open. Preconditioning and test procedures shall be conducted at an ambient temperature from 68^{o} to 86^{o} F. The manufacturer shall, in accordance with good engineering practices, attest that such test vehicles will meet the requirements of this section when preconditioned and tested at ambient temperatures from 35^{o} to 68^{o} F.

3.1.5 Amend (b)(4)(ii) as follows: In lieu of testing vehicles according to the provisions of §86.1829(b)(4)(i), a manufacturer may provide a statement in its application for certification that, based on the manufacturer's engineering evaluation of such I/M testing as the manufacturer deems appropriate, all passenger cars and light-duty trucks comply with the I/M emission standards.

3.1.6 Delete (b)(5). Idle CO Testing.

3.2 50^{o}F Requirements.

A manufacturer shall demonstrate compliance with the 50^{o}F requirement each year by testing at least three PC or LDT and three MDV emission data and/or engineering development vehicles (with at least 4000 miles) as determined under the provisions of section G.2.3 of these test procedures. It is not necessary to apply deterioration factors (DFs) to the 50^{o}F test results to comply with this requirement.

3.3 Highway Fuel Economy Test.

The exhaust emissions, including non-methane organic gas emissions, shall be measured from all exhaust emission data vehicles tested in accordance with the federal Highway Fuel Economy Test (HWFET; 40 CFR Part 600, Subpart B). The oxides of nitrogen emissions measured during such tests shall be multiplied by the oxides of nitrogen deterioration factor computed in accordance with 40 CFR §86.1823 and added to the non-methane organic gas emissions. This sum shall be rounded and compared with the NMOG+NOx certification level, as required in section E.1.6. All data obtained pursuant to this paragraph shall be reported in accordance with procedures applicable to other exhaust emissions data required pursuant to these procedures. In the event that one or more of the manufacturer's emission data vehicles fail the HWFET standard listed in section E of these test procedures, the manufacturer may submit to the Executive Officer engineering data or other evidence showing that the system is capable of complying with the standard. If the Executive Officer finds, on the basis of an engineering evaluation, that the system can comply with the HWFET standard, he or she may accept the information supplied by the manufacturer in lieu of vehicle test data.

3.4 SC03 Test.

Except for medium-duty passenger vehicles, in lieu of testing a medium-duty vehicle for SC03 emissions for certification, the manufacturer may submit to the Executive Officer engineering data or other evidence showing that the system is capable of complying with the standard. If the Executive Officer finds, on the basis of an engineering evaluation, that the system can comply with the SC03 standard, he or she may accept the information supplied by the manufacturer in lieu of vehicle test data. In that event, the manufacturer shall use FTP results in lieu of SC03 results when calculating compliance with the composite emission standards.

3.5 LEV III PM Testing Requirements.

For the 2017 and subsequent model years, a manufacturer must submit test data for test groups certifying to the LEV III PM standards in section E.1.1.2.1 according to the following table. Once a test group has been used to meet the requirements of this section G.3.5 for a model year, that same test group shall not be selected in the succeeding two model years unless the manufacturer produces fewer than four test groups that are certified to LEV III PM standards. For all test groups that are certified to LEV III PM standards for which test data is not submitted, the manufacturer must, in accordance with good engineering practices, attest that such test groups will comply with the applicable LEV III PM standards.

Number of Test Groups Certified to LEV III PM Standards	Number of Test Groups That Must Be Tested to Demonstrate Compliance with LEV III PM Standards
1 or 2	All test groups certifying to LEV III PM standards
3	2
4 or more	25% of test groups certifying to LEV III PM standards

4. §86.1830 Acceptance of Vehicles for Testing.

4.1 §86.1830-01. January 17, 2006. [No change.]

5. §86.1831 Mileage accumulation requirements for test vehicles.

5.1 §86.1831-01. January 17, 2006. [No change.]

6. §86.1832-01 Optional equipment and air conditioning. [No change.]

7. §86.1833-01 Adjustable parameters. [No change.]

8. §86.1834 Allowable maintenance.

8.1 §86.1834-01. July 13, 2005. [No change except that the first allowable maintenance interval under subparagraphs (b)(3)(v) and (b)(4)(ii) shall be at the full useful life of the vehicle.]

8.2 **HEVs.**

The manufacturer shall equip the vehicle with a maintenance indicator consisting of a light that shall activate automatically by illuminating the first time the minimum performance level is observed for all battery system components. Possible battery system components requiring monitoring are: (i) battery water level; (ii) temperature control; (iii) pressure control; and (iv) other parameters critical for determining battery condition.

9. §86.1835 Confirmatory certification testing.

9.1 §86.1835-01. May 7, 2010. [No change.]

10. §86.1836-01 Manufacturer-supplied production vehicles for testing. [Delete.]

11. §86.1837 Rounding of emission measurements.

11.1 §86.1837-01. February 10, 2000. [No change.]

11.2 Fleet average NMOG value calculations shall be rounded, in accordance with ASTM E29-67, to four significant figures before comparing with fleet average NMOG requirements.

12. §86.1838 Small volume manufacturers certification procedures.

12.1 §86.1838-01. January 17, 2006. [No change, except that the reference to 15,000 units shall mean 4,500 units in California and the reference to 14,999 units shall mean 4,499 units in California.]

13. §86.1839 Carryover of certification data.

13.1 §86.1839-01. January 17, 2006. [No change.]

14. §86.1840 Special test procedures.

14.1 §86.1840-01. August 30, 2006. [No change.]

H. Certification, Information and Reporting Requirements.

1. §86.1841 Compliance with emission standards for the purpose of certification

1.1 §86.1841-01. July 6, 2011. [No Change.]

1.2 **Scope of Certification**. Certification, if granted, is effective only for the vehicle/test group described in the original manufacturer's certification application. Modifications by a secondary manufacturer to vehicles/engines shall be deemed not to increase emissions above the standards under which those vehicles/engines were certified and to be within the original certification if such modifications do not: (1) increase vehicle weight more than 10 percent above the curb weight, increase frontal area more than 10 percent, or result in a combination increase of weight plus frontal area of more than 14 percent; or (2) include changes in axle ratio, tire size, or tire type resulting in changes in the drive train ratio of more than 5 percent; or (3) include any modification to the emission control system. No originally certified vehicle/engine which is modified by a secondary manufacturer in a manner described in items (1) through (3) of the preceding sentence may be sold to an ultimate purchaser, offered or delivered for sale to an ultimate purchaser, or registered in California unless the modified vehicle/engine is certified by the state board in accordance with applicable test procedures to meet emission standards for the model year for which the vehicle/engine was originally certified. For the purposes of this section, "secondary manufacturer" means any person, other than the original manufacturer, who modifies a new motor vehicle prior to sale to the ultimate purchaser.

1.3 **SFTP.** For vehicles certified to the SFTP standards in section E.1.2, full useful life shall mean 15 years or 150,000 miles, whichever occurs first.

1.4 **Certification of a Federal Vehicle in California.** Whenever a manufacturer federally-certifies a 2015 or subsequent model-year passenger car, light-duty truck or medium-duty vehicle model to the standards for a particular emissions bin that are more stringent than the standards for an applicable California vehicle emissions category, the equivalent California model may only be certified to (i) the California standards for a vehicle emissions category that are at least as stringent as the standards for the corresponding federal emissions bin, or (ii) the exhaust emission standards to which the federal model is certified. However, where the federal exhaust emission standards for the particular emissions bin and the California standards for a vehicle emissions category are equally stringent, the California model may only be certified to either the California standards for that vehicle emissions category or more stringent California standards. The federal emission bins are those contained Tables S04-1 and S04-2 of 40 CFR section 86.1811-04(c) as adopted February 10, 2000. A California vehicle model is to be treated as equivalent to a federal vehicle model if all of the following characteristics are identical:

(a) Vehicle make and model;
(b) Cylinder block configuration (e.g., L-6, V-8);
(c) Displacement;
(d) Combustion cycle;
(e) Transmission class;
(f) Aspiration method (e.g., naturally aspirated, turbocharged); and
(g) Fuel (e.g., gasoline, natural gas, methanol).

The comparative stringency of the standards for the federal exhaust emissions bin and for the California vehicle emissions category shall be based on a comparison of the sum of the 150,000 mile federal standards to the LEV III NMOG+NOx standards or the sum of the 120,000 mile federal standards to the sum of the 120,000 mile LEV II NMOG and NOx standards, as applicable.

1.4.1 If a federally-certified vehicle model is certified in California in accordance with subparagraph 1.4, the model shall be subject to the federal requirements for FTP exhaust emissions and cold CO emissions. The vehicle model shall be subject to all other California requirements including evaporative emissions, OBD II, SFTP emissions, 50^{o}F exhaust emissions, highway NMOG+NOx emissions, greenhouse gas emissions, and emissions warranty.

1.4.2 Prior to certification of a 2015 or subsequent model-year vehicle, a manufacturer must submit information sufficient to enable the Executive Officer to determine whether there is a federally-certified vehicle model for that model year that is equivalent to the California vehicle model based on the criteria listed in subparagraph 1.5.

1.4.3 If the Executive Officer determines that there is a federally-certified vehicle model for that model year that is equivalent to the California vehicle model, the following information shall be submitted with the Part I or Part II Application for Certification as set forth below:

(a) Part I Application for Certification: (i) Evidence of federal certification including, but not limited to, federal certification FTP exhaust emission levels and cold CO emission levels; and (ii) evidence of compliance with California evaporative and SFTP emission requirements, California 50^{o}F exhaust emissions, California OBD II requirements, California highway NMOG+NOx emissions, and California greenhouse gas requirements.

(b) Part II Application for Certification: evidence of a warranty on emission-related parts in accordance with sections 2035 et seq., title 13 CCR as they apply to vehicles certified under the primary California standard.

1.4.4 For purposes of meeting the California NMOG+NOx fleet average phase-in requirements or for determining vehicle equivalent credits, the applicable California NMOG+NOx value for passenger cars and light-duty trucks or vehicle equivalent credits for medium-duty vehicles shall be the sum of the federal full useful life (150,000 miles or 120,000 miles, as applicable) NMOG and NOx values.

1.4.5 The vehicle shall be subject to the federal in-use requirements and the emission standard applicable for in-use compliance purposes shall be the federal standard to which the vehicle was federally-certified.

1.4.6 The tune up label shall meet the federal requirements applicable to such a vehicle with an additional sentence which reads: "This vehicle conforms to federal regulations and is certified for sale in California." The value used in the California Environmental Performance Label shall be the California emission category to which the vehicle was deemed certified for fleet average NMOG purposes.

1.4.7 The requirements in section H.1.4 do not apply in the case of a federally-certified vehicle model that is only marketed to fleet operators for applications that are subject to clean fuel fleet requirements established pursuant to section 246 of the federal Clean Air Act (42 U.S.C. sec. 7586). In addition, the Executive Officer shall exclude from the requirements a federally-certified vehicle model where the manufacturer demonstrates to the Executive Officer's reasonable satisfaction that the model will primarily be sold or leased to clean fuel fleet operators for such applications, and that other sales or leases of the model will be incidental to marketing to those clean fuel fleet operators.

2. §86.1842 Addition of a vehicle after certification; and changes to a vehicle covered by certification.

2.1 §86.1842-01. Amend as follows: Add the following sentence: Changes proposed by a manufacturer in accordance with this section shall be deemed "approved" after 30 days unless the Executive Officer has requested additional information from the manufacturer or has denied the proposed changes.

3. §86.1843 General information requirements

3.1 §86.1843-01 [No change.]

3.2 **Alternative Fuel Information.**

For passenger cars, light-duty trucks, and medium-duty vehicles not certified exclusively on gasoline or diesel, except for vehicles that use hydrogen fuel, the manufacturer shall submit projected California sales and fuel economy data nineteen months prior to January 1 of the model year for which the vehicles are certified. For vehicles that use hydrogen fuel, the manufacturer shall submit projected California sales and leases, fuel economy data, vehicle fuel pressure rating, name of air basin(s) where vehicles will be delivered for sale or lease, and number of vehicles projected to be delivered to each air basin, thirty-three months prior to January 1 of the model year for which the vehicles are certified.

3.3 **Credit Reporting.**

In order to verify the status of a manufacturer's compliance with the fleet average and phase-in requirements in sections E.2.1 through E.2.4, or the greenhouse gas requirements in section E.2.5 for a given model year, and in order to confirm the accrual of credits or debits, each manufacturer shall submit an annual report to the Executive Officer which sets forth the production data used to establish compliance, by no later than March 1 or May 1, respectively, of the calendar year following the close of the model year.

3.4 **SFTP.**

Prior to the 2016 model year, a manufacturer that introduces MDVs certified to the SFTP requirements set forth in E.1.2.2 must submit the implementation information required for vehicles produced in subsequent model years.

4. §86.1844 Information Requirements: Application for Certification and Submittal of Information Upon Request.

4.1 §86.1844-01. September 15, 2011. Amend as follows:

4.1.1 All NMOG test results and certification levels and all NOx test results and certification levels must be reported as separate values and as NMOG plus NOx values for the purpose of complying with this section H.4.

4.1.2 Modify §86.1844-01(d) as follows:

(a) Delete §86.1844-01(d)(9).

(b) Delete §86.1844-01(d)(15)(ii) and replace it with the following: For vehicles with fuel fired heaters, a manufacturer must include the information specified in section H.4.4.

4.1.3 Add the following requirements to §86.1844-01(e):

(a) The information required in sections 2037, 2038 and 2039, title 13, CCR.
(b) The NMOG/NMHC and/or formaldehyde to NMHC ratios established according to section I.1.2 of these test procedures.

4.2 **OBD Requirements.**

For 2015 and subsequent model-year passenger cars, light-duty trucks and medium-duty vehicles, information shall be submitted in the application for certification according to the requirements of section 1968, et seq., title 13, CCR, as applicable.

4.3 **HEVs.**

For HEVs, the information required in the "California Exhaust Emission Standards and Test Procedures for 2009 through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes" and the "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," must be supplied with the Part I application for certification.

4.4 **Fuel-Fired Heaters.**

For vehicles that use fuel-fired heaters, the manufacturer shall provide with the Part I application for certification:

(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^{o}F and 86^{o}F; and

(c) the test plan which describes the procedure used to determine the mass emissions of the fuel-fired heater.

4.5 **Greenhouse Gas Reporting Requirements.**

(a) For the purpose of demonstrating compliance with greenhouse gas requirements, the manufacturer shall provide by May 1 of the calendar year following the close of the model year:

(i) all data in accordance with the reporting requirements as required under 40 CFR §86.1865-12; and

(ii) final combined and individual state volumes of vehicles produced and delivered for sale for each model type and footprint for California, the District of Columbia, and all states that have adopted California's greenhouse gas emission standards for that model year pursuant to section 177 of the federal Clean Air Act (42 U.S.C. § 7507).

(b) All data submitted in accordance with this section H.4.5, must be submitted electronically and organized in a format specified by the Executive Officer to clearly demonstrate compliance with California's greenhouse gas exhaust emission requirements in section E.2.5.

I. In-Use Compliance Requirements and Procedures

1. §86.1845 Manufacturer in-use verification testing requirements.

1.1 §86.1845-04. May 7, 2010. Amend as follows:

1.1.1 Table S04-5 - California Small Volume Manufacturers and Small Volume Test Groups

California only test group annual sales[1]	1-1,500	1,501-4,500
Low Mileage	Voluntary	0
High Mileage	Voluntary	2[2]

[1] Total annual production of groups eligible for testing under small volume sampling plan is capped at a maximum of 4,500 California-only production volume per model year, per large volume manufacturer. All other remaining large volume manufacturers' small volume test groups shall meet the requirements in Table S04-06 below.
[2] Particulate emissions must be measured for one vehicle per test group that certifies to the LEV III particulate standards in section E.1.1.2.1.

1.1.2 Table S04-6 - California Large Volume Manufacturers

California only test groups - annual sales	4,500-15,000	15,001-25,000	>25,000
Low Mileage	2[1]	3[2]	4[2]
High Mileage	4[2]	5[3]	6[3]

[1] Particulate emissions must be measured for one vehicle per test group that certifies to the LEV III particulate standards in section E.1.1.2.1.
[2] Particulate emissions must be measured for two vehicles per test group that certifies to the LEV III particulate standards in section E.1.1.2.1.
[3] Particulate emissions must be measured for three vehicles per test group that certifies to the LEV III particulate standards in section E.1.1.2.1.

1.1.3 **High Mileage Testing.** Amend subparagraph (c)(2) of 40 CFR §86.1845-04 to read as follows: All test vehicles certified to the emission standards in Part I, Section E.1.1.1 of these procedures must have a minimum odometer mileage of 50,000 miles. At least one vehicle of each test group certified to the emission standards in Part I, Section E.1.1.1 of these procedures must have a minimum age and odometer mileage of 75,000 for light-duty vehicles and 90,000 miles for medium-duty vehicles. All test vehicles certified to the emission standards in Part I, Section E.1.1.2 of these test procedures must have a minimum age and odometer mileage of 112,500 miles. See §86.1838-01(c)(2) for small volume manufacturer mileage requirements.

1.1.4 **High Altitude Testing.** Amend subparagraph (c)(5)(i) of 40 CFR §86.1845-01 to read: Each test vehicle shall be tested in accordance with the Federal Test Procedure and the US06 portion of the Supplemental Federal Test Procedure (if applicable) as described in subpart B of this part, when such test vehicle is tested for compliance with the applicable exhaust emission standards under this subpart. High altitude testing shall not apply.

1.2 **Test Ratios.**

(a) As an alternative to measuring the NMOG content, the Executive Officer may approve, upon submission of supporting data by a manufacturer, the use of NMOG to NMHC ratios. To request the use of NMOG to NMHC ratios, a manufacturer shall establish during certification testing the ratio of measured NMOG exhaust emissions to measured NMHC exhaust emissions for each emission data vehicle for the applicable test group. The results shall be submitted to the Executive Officer in the Part II application for certification. A manufacturer may conduct in-use testing on the test group by measuring NMHC exhaust emissions rather than NMOG exhaust emissions. After approval by the Executive Officer, the measured NMHC exhaust emissions shall be multiplied by the NMOG to NMHC ratio submitted in the application for certification for the test group to determine the equivalent NMOG exhaust emission values for the test vehicle. For LEV II vehicles, the equivalent NMOG exhaust emission value shall be compared to the NMOG exhaust emission standard applicable to the vehicle emission category (LEV, ULEV, or SULEV) in which the test group was certified. For LEV III vehicles, the equivalent NMOG exhaust emission value shall be added to the measured NOx exhaust emissions and compared to the NMOG+NOx exhaust emission standard applicable to the vehicle emission category (LEV630, LEV395, LEV160, ULEV570, ULEV400, ULEV340, ULEV270, ULEV250, ULEV200, ULEV125, ULEV70, ULEV50, SULEV230, SULEV200, SULEV170, SULEV150, SULEV30, or SULEV20) in which the test group was certified.

(b) For fuel-flexible vehicles certified to NMOG standards or NMOG+NOx standards, the manufacturer may request from the Executive Officer the use of a methanol (M85) or ethanol (E85) NMOG exhaust emission to gasoline NMHC exhaust emission ratio which shall be established during certification testing for each emission data vehicle for the applicable test group. The results shall be submitted to the Executive Officer in the Part II application for certification. After approval by the Executive Officer, the measured gasoline NMHC exhaust emissions shall be multiplied by the M85 or E85 NMOG to gasoline NMHC ratio submitted in the application for certification for the test group to determine the equivalent NMOG exhaust emission values for the test vehicle. For LEV II vehicles, the equivalent NMOG exhaust emission value shall be compared to the NMOG exhaust emission standard applicable to the vehicle emission category (LEV, ULEV, SULEV) in which the test group was certified. For LEV III vehicles, the equivalent NMOG exhaust emission value shall be added to the measured NOx exhaust emissions and compared to the NMOG+NOx exhaust emission standard applicable to the vehicle emission category (LEV630, LEV395, LEV160, ULEV570, ULEV400, ULEV340, ULEV270, ULEV250, ULEV200, ULEV125, ULEV70, ULEV50, SULEV230, SULEV200, SULEV170, SULEV150, SULEV30, or SULEV20) in which the test group was certified.

(c) As an alternative to measuring the HCHO content, the Executive Officer may approve, upon submission of supporting data by a manufacturer, the use of HCHO to NMHC ratios. To request the use of HCHO to NMHC ratios, the manufacturer shall establish during certification testing the ratio of measured HCHO exhaust emissions to measured NMHC exhaust emissions for each emission data vehicle for the applicable test group. The results shall be submitted to the Executive Officer in the Part II application for certification. Following approval of the application for certification, the manufacturer may conduct in-use testing on the test group by measuring NMHC exhaust emissions rather than HCHO exhaust emissions. The measured NMHC exhaust emissions shall be multiplied by the HCHO to NMHC ratio submitted in the application for certification for the test group to determine the equivalent HCHO exhaust emission values for the test vehicle. The equivalent HCHO exhaust emission values shall be compared to the HCHO exhaust emission standard applicable to the test group.

2. §86.1846 Manufacturer in-use confirmatory testing requirements.

2.1 §86.1846-01. May 7, 2010. [No Change.]

2.2 If a gasoline vehicle test group that is certified according to the provisions of section D.1 (p) fails in-use verification testing, as set forth in section I, NMOG and formaldehyde exhaust emissions must be measured for that test group in accordance with section D.1.1 for the purpose of in-use confirmatory testing.

3. §86.1847 Manufacturer in-use verification and in-use confirmatory testing; submittal of information and maintenance of records. .

3.1 §86.1847-01. Amend as follows:

3.1.1 Amend subparagraph (a)(3) of 40 CFR §86.1847-01 to add: Procurement documentation. A description of the procurement area, a record of the source(s) of any list(s) of vehicles used as a basis for procurement, and a complete record of the number of vehicles rejected after positive vehicle owner response, reason(s) for manufacturer rejection of each rejected vehicles and the method used for random selection of positive owner response vehicles. A complete record of the number of vehicle owners/lessees in which attempt to contact was made and the number of vehicle owners/lessees actually contacted, the number of owners/lessees not contacted and the reasons and number of each for failure to contact, and the number of owners contacted who declined to participate.

3.1.2 Amend subparagraph (b)(1) of 40 CFR §86.1847-01 to read: A complete printout of each and every emission test performed, including, but not limited to, all test results, the date of each test, the full useful life emission standards to which the test group is certified, and the phase mass values for fuel economy, carbon dioxide and each pollutant measured by the Federal Test Procedure and Supplemental Test Procedure as prescribed by subpart B of this part.

3.1.3 Amend subparagraph (f)(1) of 40 CFR §86.1847-01 to read: A complete printout of each and every emission test performed, including, but not limited to, all test results, the date of each test, the full useful life emission standards to which the test group is certified, and the phase mass values for fuel economy, carbon dioxide and each pollutant measured by the Federal Test Procedure and Supplemental Test Procedure as prescribed by subpart B of this part.

Appendices I, II, and III to §86.1845-01 [No change.]

J. Procedural Requirements

1. §86.1848-10 Certification. July 6, 2011. [No change.]
2. §86.1849-01 Right of entry. [No change.]
3. §86.1850-01 Denial, Suspension or Revocation of Certificate of Conformity. [No change.]
4. §86.1851 Application of good engineering judgment to manufacturers' decisions. [No change.]
5. §86.1852 Waivers for good in-use emission performance. [No change.]
6. §86.1853 Certification hearings. [No change.]
7. §86.1854-12 Prohibited acts. May 7, 2010. [No change.]
8. §§86.1855 - 86.1859. [Reserved]
9. §86.1860-04 How to comply with the Tier 2 and interim Tier 2 fleet average NOx standards. [n/a]
10. §86.1861-04 How do the Tier 2 and interim Tier 2 NOx averaging, banking and trading programs work? [n/a]
11. §86.1862-04 Maintenance of records and submittal of information relevant to compliance with fleet average NOx standards. [n/a]
12. §86.1863-07 Optional Chassis Certification for Diesel Vehicles. September 15, 2011. [No change]
13. §86.1865-12 How to comply with the fleet average CO_2 standards. [Insert Federal Register for the 2017 and subsequent MY National Greenhouse Gas Final Rule as proposed at 76 Fed. Reg. 74854, 75371 (December 1, 2011)]. [No change, except that this section shall only apply to vehicles certifying under the 2012 through 2016 MY National greenhouse gas program.]
14. §86.1866-12 CO_2 fleet average credit programs. [Insert Federal Register for the 2017 and subsequent MY National Greenhouse Gas Final Rule as proposed at 76 Fed. Reg. 74854, 75372 (December 1, 2011)]. [No change, except that for the 2012 through 2016 model years this section shall only apply to vehicles certifying under the 2012 through 2016 MY National greenhouse gas program.]
15. §86.1867-12 Optional early CO_2 credit programs. [Insert Federal Register for the 2017 and subsequent MY National Greenhouse Gas Final Rule as proposed at 76 Fed. Reg. 74854, 75387 (December 1, 2011)]. [No change, except that this section shall only apply to vehicles certifying under the 2012 through 2016 MY National greenhouse gas program.]

PART II: CALIFORNIA EXHAUST AND PARTICULATE EMISSION TEST PROCEDURES FOR PASSENGER CARS, LIGHT-DUTY TRUCKS AND MEDIUM-DUTY VEHICLES

This part describes the equipment required and the procedures necessary to perform gaseous and particulate exhaust emission tests (40 CFR Part 86, Subpart B); cold temperature test procedures (40 CFR Part 86, Subpart C); the California 50^{o}F test procedure; and the supplemental federal test procedure (40 CFR Part 86, Subpart B) on passenger cars, light-duty trucks and medium-duty vehicles.

A. 40 CFR Part 86, Subpart B - Emission Regulations for 1977 and Later Model Year New Light-Duty Vehicles and New Light-Duty Trucks and New Otto-Cycle Complete Heavy-Duty Vehicles; Test Procedures.

100.1 General applicability.

86.101	General applicability. October 6, 2000.
86.102	Definitions. March 5, 1980.
86.103	Abbreviations. March 5, 1980.
86.104	Section numbering, construction. September 21, 1994.
86.105	Introduction; structure of subpart. September 21, 1994.

100.2 Equipment and Facility Requirements.

86.106-00	Equipment required; overview. October 22, 1996.
86.107-98	Sampling and analytical system, evaporative emissions. August 23, 1995.
86.108-00	Dynamometer. October 22, 1996.
86.109-94	Exhaust gas sampling system; Otto-cycle vehicles not requiring particulate emission measurements. June 30, 1995.
86.110-94	Exhaust gas sampling system; diesel-cycle vehicles, and Otto-cycle vehicles requiring particulate emissions measurements. June 30, 1995.
86.111-94	Exhaust gas analytical-system. [Insert Federal Register for the 2017 and subsequent MY National Greenhouse Gas Final Rule as proposed at 76 Fed. Reg. 74854, 75357 (December 1, 2011)].
86.112-91	Weighing chamber (or room) and microgram balance specifications. June 5, 1991.

100.3 Certification Fuel Specifications.

86.113-94	Fuel Specifications. February 18, 2000.
86.113-04	Fuel Specifications. February 10, 2000.
86.113-07	Fuel Specifications. January 18, 2001.

100.3.1 California Certification Gasoline Specification.

100.3.1.1 Certification Gasoline Fuel Specifications for LEV II Light-Duty Vehicles and Medium-Duty Vehicles.

Add the following subparagraph which reads: For light-duty vehicles and medium-duty vehicles certified to the LEV II exhaust emission standards set forth in section E.1.1.1, gasoline having the specifications listed below or gasoline having the specifications listed in section 100.3.1.2 may be used in exhaust and evaporative emission testing as an option to the specifications referred to in §86.113-04(a)(1). If a manufacturer elects to utilize gasoline having the specifications listed below for LEV II vehicles, exhaust emission testing shall be conducted by the manufacturer with gasoline having the specifications listed below, and the Executive Officer shall conduct exhaust emission testing with gasoline having the specifications listed below. If a manufacturer elects to utilize gasoline having the specifications listed in section 100.3.1.2, exhaust emission testing shall be conducted by the manufacturer with gasoline having the specifications listed in section 100.3.1.2, and the Executive Officer shall conduct exhaust emission testing with gasoline having the specifications listed in section 100.3.1.2. Use of this fuel for evaporative emission testing shall be required as specified in the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles."

California Certification Gasoline Specifications for LEV II Light-Duty Vehicles and Medium-Duty Vehicles

Fuel Property[a]	**Limit**	**Test Method [b]**
Octane (R+M)/2	91 (min)	D 2699-88, D 2700-88
Sensitivity	7.5 (min)	D 2699-88, D 2700-88
Lead	0-0.01g/gal (max); no lead added	§2253.4(c), title 13 CCR
Distillation Range:		§2263, title 13 CCR[c]
10% point	130-150 °F	
50% point [d]	200-210 °F	
90% point [e]	290-300 °F	
EP, maximum	390 °F	
Residue	2.0 vol. % (max)	
Sulfur	30-40 ppm by wt.	§2263, title 13 CCR
Phosphorous	0.005 g/gal (max)	§2253.4(c), title 13 CCR
RVP	6.7-7.0 psi	§2263, title 13 CCR
Olefins	4.0-6.0 vol. %	§2263, title 13 CCR
Total Aromatic Hydrocarbons	22-25 vol. %	§2263, title 13 CCR
Benzene	0.8-1.0 vol. %[f]	§2263, title 13 CCR
Multi-substituted Alkyl Aromatic Hydrocarbons	12-14 vol. %[g]	
MTBE	10.8-11.2 vol. %	§2263, title 13 CCR
Additives	Sufficient to meet requirements of §2257, title 13 CCR	
Copper Corrosion	No. 1	D 130-88

Gum, washed	3.0 mg/100 mL (max)	D 381-86
Oxidation Stability	1000 minutes (min)	D 525-88
Specific Gravity	Report [(h)]	
Heat of Combustion	Report [(h)]	
Carbon	Report wt. % [(h)]	
Hydrogen	Report wt. % [(h)]	

[(a)] The gasoline must be blended from typical refinery feedstocks.

[(b)] ASTM specification unless otherwise noted. A test method other than that specified may be used following a determination by the Executive Officer that the other method produces results equivalent to the results with the specified method.

[(c)] Although §2263, title 13, CCR refers to the temperatures of the 50 and 90 percent points, this procedure can be extended to the 10 percent and end point temperatures, and to the determination of the residue content.

[(d)] The range for interlaboratory testing is 195-215^o F.

[(e)] The range for interlaboratory testing is 285-305^o F.

[(f)] The range for interlaboratory testing is 0.7-1.1 percent by volume.

[(g)] "Detailed Hydrocarbon Analysis of Petroleum Hydrocarbon Distillates, Reformates, and Gasoline by Single Column High Efficiency (Capillary) Column Gas Chromatography," by Neil Johansen, 1992, Boulder, CO.

[(h)] The fuel producer should report this fuel property to the fuel purchaser. Any generally accepted test method may be used and shall be identified in the report.

100.3.1.2 Certification Gasoline Fuel Specifications for LEV III Light-Duty Vehicles and Medium-Duty Vehicles.

Add the following subparagraph which reads: For all light-duty vehicles and medium-duty vehicles certifying to the LEV III standards in section E.1.1.2, gasoline having the specifications listed below shall be used in exhaust emission testing, and the Executive Officer shall conduct exhaust emission testing with gasoline having the specifications listed below. Use of this fuel for evaporative emission testing shall be required as specified in the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles."

California Certification Gasoline Specifications for LEV III Light-Duty Vehicles and Medium-Duty Vehicles

Fuel Property[(a)]	**Limit**	**Test Method [(b)]**
Octane (R+M)/2 [(c)]	87-88.4; 91 (min)	D 2699-88, D 2700-88
Sensitivity	7.5 (min)	D 2699-88, D 2700-88
Lead	0-0.01g/gal (max); no lead added	§2253.4(c), title 13 CCR
Distillation Range:		§2263, title 13 CCR[(d)]
10% point	130-150 ^{o}F	
50% point	205-215 ^{o}F	
90% point	310-320 ^{o}F	

EP, maximum	390 ^{o}F	
Residue	2.0 vol. % (max)	
Sulfur	8-11 ppm by wt.	§2263, title 13 CCR
Phosphorous	0.005 g/gal (max)	§2253.4(c), title 13 CCR
RVP	6.9-7.2 psi	§2263, title 13 CCR
Olefins	4.0-6.0 vol. %	§2263, title 13 CCR
Total Aromatic Hydrocarbons	19.5-22.5 vol. %	§2263, title 13 CCR
Benzene	0.6-0.8 vol. %	§2263, title 13 CCR
Multi-substituted Alkyl Aromatic Hydrocarbons	13-15 vol. %[(e)]	
MTBE	0.05 vol. %	§2263, title 13 CCR
Ethanol	9.8-10.2 vol. %	
Total Oxygen	3.3-3.7 wt. %	§2263, title 13 CCR
Additives	Sufficient to meet requirements of §2257, title 13 CCR	
Copper Corrosion	No. 1	D 130-88
Gum, washed	3.0 mg/100 mL (max)	D 381-86
Oxidation Stability	1000 minutes (min)	D 525-88
Specific Gravity	Report [(f)]	
Heat of Combustion	Report [(f)]	
Carbon	Report wt. % [(f)]	
Hydrogen	Report wt. % [(f)]	

[(a)] The gasoline must be blended from typical refinery feedstocks.

[(b)] ASTM specification unless otherwise noted. A test method other than that specified may be used following a determination by the Executive Officer that the other method produces results equivalent to the results with the specified method.

[(c)] For vehicles/engines that require the use of premium gasoline as part of their warranty, the Octane ((R+M)/2) may be a 91 minimum. All other certification gasoline specifications, as shown in this table, must be met. For all other vehicles/engines, the Octane ((R+M)/2) shall be 87-88.4.

[(d)] Although §2263, title 13, CCR refers to the temperatures of the 50 and 90 percent points, this procedure can be extended to the 10 percent and end point temperatures, and to the determination of the residue content.

[(e)] "Detailed Hydrocarbon Analysis of Petroleum Hydrocarbon Distillates, Reformates, and Gasoline by Single Column High Efficiency (Capillary) Column Gas Chromatography," by Neil Johansen, 1992, Boulder, CO.

[(f)] The fuel producer should report this fuel property to the fuel purchaser. Any generally accepted test method may be used and shall be identified in the report.

100.3.2 Certification Diesel Fuel Specifications.

100.3.2.1 Certification Diesel Fuel Specifications for the 2015 and Subsequent Model Years.

Amend subparagraphs §86.113-07(b)(2) and (b)(3) as follows:

(b)(2) Except as noted below, petroleum fuel for diesel vehicles meeting the specifications referenced in 40 CFR §86.113-07(b)(2), or substantially equivalent specifications approved by the Executive Officer, shall be used in exhaust emission testing. The grade of petroleum fuel recommended by the engine manufacturer, commercially designated as "Type 2-D" grade diesel, shall be used. The petroleum fuel used in exhaust emission testing may meet the specifications listed below, or substantially equivalent specifications approved by the Executive Officer, as an option to the specifications in 40 CFR §86.113-07(b)(2). Where a manufacturer elects pursuant to this subparagraph to conduct exhaust emission testing using the specifications of §86.113-07(b)(2), or the specifications listed below, the Executive Officer shall conduct exhaust emission testing with the diesel fuel meeting the specifications elected by the manufacturer.

California Certification Diesel Fuel Specifications For the 2015 and Subsequent Model Years		
Fuel Property	**Limit**	**Test Method [(a)]**
Natural Cetane Number	47-55	D 613-86
Distillation Range		§2282(g)(3), title 13, CCR
IBP	340-420 ^{o}F	
10% point	400-490 ^{o}F	
50% point	470-560 ^{o}F	
90% point	550-610 ^{o}F	
EP	580-660 ^{o}F	
API Gravity	33-39^{o}	D 287-82
Total Sulfur	7-15 ppm	§2282(g)(3), title 13, CCR
Nitrogen Content	100-500 ppmw	§2282(g)(3), title 13, CCR
Total Aromatic Hydrocarbons	8-12 vol. %	§2282(g)(3), title 13, CCR
Polycyclic Aromatic Hydrocarbons	1.4 wt. % (max)	§2282(g)(3), title 13, CCR
Flashpoint	130 ^{o}F (max)	D 93-80
Viscosity @ 40^{o}F	2.0-4.1 centistokes	D 445-83

[(a)] ASTM specifications unless otherwise noted. A reference to a subsection of §2282, title 13, CCR, means the test method identified in that subsection for the particular property. A test method other than that specified may be used following a determination by the Executive Officer that the other method produces results equivalent to the results of the specified method.

(b)(3) Diesel fuel representative of commercial diesel fuel which will be generally available through retail outlets shall be used in service accumulation.

As Adopted: March 22, 2012
Date of Hearing: January 26-27, 2012

100.3.3 Alcohol Fuels.

Amend §86.113-94(c) as follows:

1. Delete subparagraphs (c)(1) and (c)(2); replace with:

(c)(1) **Emission test fuel.** For Otto-cycle or diesel alcohol vehicles and hybrid electric vehicles which use Otto-cycle or diesel alcohol engines, methanol or ethanol fuel used for exhaust and evaporative emission testing shall meet the specifications set forth in section 2292.1, title 13, CCR, (Specifications for M-100 Fuel Methanol) or section 2292.3 (Specification for E-100 Fuel Ethanol) as modified by the following:

Specification	Limit
M-100 Fuel Methanol	
Methanol	98.0 ± 0.5 vol. percent
Ethanol	1.0 vol. percent max.
Petroleum fuel meeting the specifications of section 100.3.1.1	1.0 ± 0.1 vol. percent
E-100 Fuel Ethanol	
Ethanol	98.0 ± 0.5 vol. percent
Methanol	1.0 vol. percent max.
Petroleum fuel meeting the specifications of section 100.3.1.1	1.0 ± 0.1 vol. percent

(c)(2) **Mileage accumulation fuel.** For Otto-cycle or diesel alcohol vehicles and hybrid electric vehicles which use Otto-cycle or diesel alcohol engines, methanol or ethanol fuel used for service accumulation shall meet the applicable specifications set forth in section 2292.1, title 13, CCR, (Specifications for M-100 Fuel Methanol) or section 2292.3 (Specification for E-100 Fuel Ethanol).

2. Subparagraph (c)(3) [No Change.]

3. Add the following subparagraph. Fuel additives and ignition improvers intended for use in alcohol test fuels shall be subject to the approval of the Executive Officer. In order for such approval to be granted, a manufacturer must demonstrate that emissions will not be adversely affected by the use of the fuel additive or ignition improver.

100.3.4 Mixtures of Petroleum and Alcohol Fuels for Flexible Fuel Vehicles.

Amend §86.113-94(d) as follows:

1. Delete subparagraphs (d)(1) and (d)(2); replace with:

(d)(1) **Exhaust emission test fuel for emission-data and durability-data vehicles.** For Otto-cycle or diesel alcohol vehicles and hybrid electric vehicles which use Otto-cycle or diesel alcohol engines, methanol or ethanol fuel used for exhaust emission testing shall meet the applicable specifications set forth in section 2292.2, title 13, CCR, (Specifications for M-85 Fuel Methanol) or section 2292.4 (Specifications for E-85 Fuel Ethanol) as modified by the following:

Specification	Limit
M-85 Fuel Methanol	
Petroleum fuel meeting the specifications of section 100.3.1.1	13-16 vol. percent
Reid vapor pressure	8.0-8.5 psi, using common blending components from the gasoline stream.
E-85 Fuel Ethanol	
Petroleum fuel meeting the specifications of section 100.3.1.1	15-21 vol. percent
Reid vapor pressure	8.0-8.5 psi, using common blending components from the gasoline stream.

(d)(2) **Mileage accumulation fuel.** For flexible fuel Otto-cycle or diesel alcohol vehicles and hybrid electric vehicles that use Otto-cycle or diesel alcohol engines, petroleum fuel shall meet the applicable specifications in Part II, Sections A.100.3.1.1 or 100.3.2 and methanol or ethanol fuel shall meet the applicable specifications set forth in section 2292.2, title 13, CCR, (Specifications for M-85 Fuel Methanol) or section 2292.4 (Specification for E-85 Fuel Ethanol). Mileage accumulation procedures shall be subject to the requirements set forth in 40 CFR §86.1831-01(a) and (b) and are subject to the prior approval of the Executive Officer. A manufacturer shall consider expected customer fuel usage as well as emissions deterioration when developing its durability demonstration.

2. Subparagraph (d)(3) [No Change.]

3. Add the following subparagraphs. **Evaporative emission test fuel for emission-data and durability-data vehicles.** For Otto-cycle or diesel alcohol vehicles and hybrid electric vehicles which use Otto-cycle or diesel alcohol engines, the fuel for evaporative emission testing shall be the gasoline set forth in Part II, Section A.100.3.1.2 of these test procedures. Alternative alcohol-gasoline blends may be used in place of E10 if demonstrated to result in equivalent or higher evaporative emissions, subject to prior approval of the Executive Officer.

Additive requirements. Fuel additives and ignition improvers intended for use in alcohol test fuels shall be subject to the approval of the Executive Officer. In order for such approval to be granted, a manufacturer must demonstrate that emissions will not be adversely affected by the use of the fuel additive or ignition improver.

100.3.5 Natural Gas Fuels.

Amend §86.113-94(e) as follows:

1. Delete subparagraphs (e)(1), (e)(2) and (e)(3); replace with:

(e)(1) **Exhaust emission test fuel.** For dedicated, dual-fueled or hybrid electric vehicles which use natural gas, fuel used for exhaust and evaporative emission testing shall meet the specifications listed in section 2292.5, title 13, CCR, (Specifications for Compressed Natural Gas) as modified by the following:

Specification	Limit
Compressed Natural Gas Certification Test Fuel	
Methane	90.0 ± 1.0 mole percent
Ethane	4.0 ± 0.5 mole percent
C_3 and higher hydrocarbon content	2.0 ± 0.3 mole percent
Oxygen	0.5 mole percent maximum
Inert gases (CO_2 + N_2)	3.5 ± 0.5 vol. percent

(e)(2) **Mileage accumulation fuel.** For dedicated, dual-fueled or hybrid electric vehicles which use natural gas, fuel used for service accumulation shall meet the specifications listed in section 2292.5, title 13, CCR, (Specifications for Compressed Natural Gas).

100.3.6 Liquefied Petroleum Gas Fuels.

Amend §86.113-94(f) as follows:

1. Delete subparagraphs (f)(1) and (f)(2); replace with:

(f)(1) **Evaporative and exhaust emission test fuel.** For dedicated, dual-fueled or hybrid electric vehicles which use liquefied petroleum gas, fuel used for exhaust and evaporative emission testing shall meet the specifications listed in section 2292.6, title 13, CCR, (Specifications for Liquefied Petroleum Gas) as modified by the following:

Specification	Limit
Liquefied Petroleum Gas Certification Test Fuel	
Propane	93.5 ± 1.0 volume percent
Propene	3.8 ± 0.5 volume percent
Butane and heavier components	1.9 ± 0.3 volume percent

(f)(2) **Mileage accumulation fuel.** For dedicated, dual-fueled or hybrid electric vehicles which use liquefied petroleum gas, fuel used for service accumulation shall meet the specifications listed in section 2292.6, title 13, CCR, (Specifications for Liquefied Petroleum Gas).

2. Subparagraph (f)(3). [No Change.]

100.3.7 §86.113-94(g). [No Change.]

100.3.8 §86.113-07(h). [No Change.]

100.3.9 Identification of New Clean Fuels to be Used in Certification Testing.

Any person may petition the state board to establish by regulation certification testing specifications for a new clean fuel for which specifications for a new clean fuel are not specifically set forth in paragraphs 86.113-94, 86.113-04, or 86.113-07, as amended herein. Prior to adopting such specifications, the state board shall consider the relative cost-effectiveness of use of the fuel in reducing emissions compared to the use of other fuels. Whenever the state board adopts specifications for a new clean fuel for certification testing, it shall also establish by regulation specifications for the fuel as it is sold commercially to the public.

(a) If the proposed new clean fuel may be used to fuel existing motor vehicles, the state board shall not establish certification specifications for the fuel unless the petitioner has demonstrated that:

(1) Use of the new clean fuel in such existing motor vehicles would not increase emissions of NMOG, NOx, CO, and the potential risk associated with toxic air contaminants, as determined pursuant to the procedures set forth in "California Test Procedures for Evaluating Substitute Fuels and New Clean Fuels in 2015 and Subsequent Years." In the case of fuel-flexible vehicles or dual-fuel vehicles which were not certified on the new clean fuel but are capable of being operated on it, emissions during operation with the new clean fuel shall not increase compared to emissions during vehicle operation on gasoline.

(2) Use of the new clean fuel in such existing motor vehicles would not result in increased deterioration of the vehicle and would not void the warranties of any such vehicles.

(b) Whenever the state board designates a new clean fuel pursuant to this section, the state board shall also establish by regulation required specifications for the new clean fuel sold commercially in California.

86.114-94 Analytical gases. June 30, 1995.
86.115-00 EPA urban dynamometer driving schedules. October 22, 1996.

100.4 Calibration methods and frequency.

86.116-94 Calibrations, frequency and overview. June 30, 1995.
86.117-96 Evaporative emission enclosure calibrations. December 8, 2005.
86.118-00 Dynamometer calibrations. October 22, 1996.
86.119-90 CVS calibration. February 18, 2000.
86.120-94 Gas meter or flow instrumentation calibration, particulate, methanol and formaldehyde measurement. June 30, 1995.
86.121-90 Hydrocarbon analyzer calibration. July 13, 2005.
86.122-78 Carbon monoxide analyzer calibration. June 28, 1977.
86.123-78 Oxides of nitrogen analyzer calibration. June 30, 1995.
86.124-78 Carbon dioxide analyzer calibration. June 28, 1977.
86.125-94 Methane analyzer calibration. June 5, 1991.

86.126-90 Calibration of other equipment. April 11, 1989.

100.5 Test Procedures and Data Requirements.

86.127-12 Test procedures; overview. May 7, 2010.
86.128-00 Transmissions. October 22, 1996.
86.129-00 Road load power, test weight, inertia weight class determination, and fuel temperature profile. October 6, 2000.

100.5.1 California Road Load Power, Test Weight and Inertia Weight Class Determination.

100.5.1.1 Amend §86.129-00(b) to add the following specifications for medium-duty vehicles: **Power absorption unit adjustment - medium-duty vehicles.**

(1) The power absorption unit shall be adjusted to reproduce road load power at 50 miles per hour true speed. The dynamometer power absorption shall take into account the dynamometer friction, as discussed in paragraph 86.118-78.

(2) The dynamometer road load setting is determined from the loaded test weight, the reference frontal area, vehicle protuberances, and an aerodynamic drag coefficient as determined appropriate by the Executive Officer. The vehicle manufacturer shall submit the procedure by which the aerodynamic drag coefficient was determined in the test vehicle information section in the certification application. The dynamometer road load setting shall be determined by the following equation.

(i) For medium-duty vehicles to be tested on twin or single large roll dynamometers:

$$Hp = (0.00182)V((0.015)(W)+(0.0375)(Cd)(A)(V^2)/(32.2ft/s^2))+P$$

where:
Hp = the dynamometer power absorber setting at 50 mph (horsepower).
0.00182 = conversion factor to horsepower.
V = velocity in feet/sec.
0.015 = coefficient of rolling resistance.
W = loaded vehicle weight in pounds.
0.0375 = air density in lbm/cubic ft.
Cd = aerodynamic drag coefficient.
A = reference frontal area in square ft.
32.2 ft/s^2 = gravitational acceleration
P = protuberance power (horsepower)

(ii) The protuberance power, P shall be determined per subparagraph 86.129-80(c)(2)(i).

(iii) The dynamometer power absorber setting for medium-duty vehicles shall be rounded to the nearest 0.1 horsepower.

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(3) The road load power calculated above shall be used or the vehicle manufacturer may determine the road load power by an alternate procedure requested by the manufacturer and approved in advance by the Executive Officer.

(4) Where it is expected that more than 33 percent of a vehicle line within an engine-system combination will be equipped with air conditioning, per §86.1828-01, the road load power as determined in paragraph (2) or (3) of this section shall be increased by 10 percent up to a maximum increment of 1.4 horsepower, for testing all test vehicles of that vehicle line within that engine-system combination if those vehicles are intended to be offered with air conditioning in production. This power increment shall be added to the indicated dynamometer power absorption setting prior to rounding off this value.

86.130-00 Test sequence; general requirements. October 22, 1996.

100.5.2 California test sequence; general requirements.

100.5.2.1 Delete subparagraph (a) of §86.130-00 and replace with:

For purposes of determining conformity with 50°F test requirements, the procedures set forth in Part II, Section C. For all hybrid electric vehicles and all 2001 and subsequent model-year vehicles certifying to running loss and useful life evaporative emission standards, the test sequence specified in “California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles” as incorporated by reference in section 1976, title 13, CCR shall apply.

100.5.2.2 Add the following:

A manufacturer has the option of simulating air conditioning operation during testing at other ambient test conditions provided it can demonstrate that the vehicle tailpipe exhaust emissions are representative of the emissions that would result from the SC03 cycle test procedure and the ambient conditions of paragraph 86.161-00. The Executive Officer has approved two optional air conditioning test simulation procedures, AC1 and AC2, for the 2001 to 2003 model years only. If a manufacturer desires to conduct an alternative SC03 test simulation other than AC1 and AC2, or the AC1 and AC2 simulations for the 2004 and subsequent model years, the simulation test procedure must be approved in advance by the Executive Officer (see paragraphs 86.162-00 and 86.162-03).

100.5.2.3 Greenhouse Gas Requirements.

For the purpose of determining conformity with greenhouse gas fleet average requirements, the CO_2, CH_4, and N_2O emissions from all passenger cars, light-duty trucks and medium-duty passenger vehicles shall be measured in accordance with the Federal Test Procedure as set forth in Subpart B, 40 CFR Part 86, as modified in Part II of these test procedures. Emissions shall be measured using both the EPA Urban Dynamometer Driving Schedule as set forth in Appendix I to Part 86, 40 CFR to determine “City” emission values and the Highway Driving Schedule as set forth in Part II, Section F of these test procedures to determine “Highway” emission values.

86.131-00 Vehicle preparation. October 22, 1996.

86.132-00 Vehicle preconditioning. October 22, 1996.

100.5.3 California Vehicle Preconditioning Requirements.

100.5.3.1 Add the following subparagraph: For all hybrid electric vehicles and all 2015 and subsequent model-year vehicles subject to running loss and useful life evaporative emission standards, the preconditioning sequence for the Federal Test Procedure specified in "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" shall apply. In addition, the preconditioning sequence for the SFTP described in subparagraphs (n) and (o) of paragraph 86.132-00 shall apply.

100.5.3.2 Add the following subparagraph: The preconditioning sequence described in §86.132-00 shall apply to all vehicles tested for the purpose of demonstrating compliance with greenhouse gas requirements with the following addition. The dynamometer procedure used to precondition a vehicle being tested to measure "highway" emission values shall consist of one cycle of the Highway Driving Schedule followed by 15 seconds of idle prior to initiation of a second Highway Driving Schedule, which is driven to test the vehicle. As an alternative, emission testing may be conducted using the Highway Driving Schedule within three hours following the Federal Test Procedure, if the soak temperature is maintained between $68^{o}F$ – $86^{o}F$, without additional preconditioning required.

86.133-96 Diurnal breathing loss test. August 23, 1995.
86.134-96 Running loss test. December 8, 2005.
86.135-12 Dynamometer procedure. [Insert Federal Register for the 2017 and subsequent MY National Greenhouse Gas Final Rule as proposed at 76 Fed. Reg. 74854, 75357 (December 1, 2011)]. [No change.]
86.136-90 Engine starting and restarting. September 21, 1994.
86.137-96 Dynamometer test run, gaseous and particulate emissions. March 24, 1993.
86.138-96 Hot soak test. August 23, 1995.
86.139-90 Diesel particulate filter handling and weighing. April 11, 1989.
86.140-94 Exhaust sample analysis. June 30, 1995.
86.142-90 Records required. June 30, 1995.
86.143-96 Calculations; evaporative emissions. August 23, 1995.
86.144-94 Calculations; exhaust emissions. July 13, 2005.

100.5.4 Calculations; exhaust emissions.

100.5.4.1 The exhaust emission calculations for California are set forth in the "California Non-Methane Organic Gas Test Procedures."

100.5.4.2 Add the following calculation:

Organic material non-methane hydrocarbon equivalent mass for ethanol-fueled vehicles:

$$OMNMHCE_{mass} = NMHC_{mass} + (13.8756/32.042) \times (CH_3OH)_{mass} + (13.8756/23.035) \times (CH_3CH_2OH)_{mass} + (13.8756/30.0262) \times (HCHO)_{mass} + (13.8756/22.027) \times (CH_3CHO)_{mass}$$

86.145-82 Calculations; particulate emissions. November 2, 1982.
86.146-96 to 85.157-98 [n/a; (ORVR)]
86.158-08 Supplemental Federal Test Procedures; overview. December 27, 2006.
86.159-08 Exhaust emission test procedures for US06 emissions. December 27, 2006.

100.5.5 California exhaust emission test procedures for US06 emissions.

100.5.5.1 Amend §86.159-08 as follows: Add the following sentence: The exhaust PM emissions shall be measured using equivalent measurement techniques as those used to measure exhaust PM emissions on the FTP cycle except that provisions accounting for the cold start portion of the FTP cycle (including factors used to weight emission values from the different phases) shall be ignored.

100.5.5.2 Delete subparagraph (b)(9) of §86.159-08 and replace with: During dynamometer operation, a fixed speed cooling fan or a road speed modulated fan as specified in §86.107–96(d)(1) may be used. The fan shall be positioned so as to direct cooling air to the vehicle in an appropriate manner. The engine compartment cover shall remain open if a fixed speed cooling fan is used and closed if a road speed modulated fan is used. In the case of vehicles with front engine compartments, the fan shall be squarely positioned within 24 inches (61 centimeters) of the vehicle. In the case of vehicles with rear engine compartments (or if special designs make the above impractical), the cooling fan shall be placed in a position to provide sufficient air to maintain vehicle cooling. The Executive Officer may approve modified cooling configurations or additional cooling if necessary to satisfactorily perform the test. In approving requests for additional or modified cooling, the Executive Officer will consider such items as actual road cooling data and whether such additional cooling is needed to provide a representative test.

100.5.5.3 **Hot 1435 LA92 (Hot 1435 Unified Cycle) Test Procedure.**

Amend §86.159-08 as follows: Add the following sentences: The exhaust PM emissions shall be measured using equivalent measurement techniques as those used to measure exhaust PM emissions on the FTP cycle except that provisions accounting for the cold start portion of the FTP cycle (including factors used to weight emission values from the different phases) shall be ignored. The NMOG, CO, NOx, and formaldehyde emissions shall be measured according to the US06 Test Procedure as set forth in Subpart B, 40 CFR 86.159-08 with the following modifications:

1. Replace all references to “US06” with “Hot 1435 Unified Cycle.” Where §86.159-08 references another section of 40 CFR part 86, replace all mention of “US06” with “Hot 1435 Unified Cycle” in referenced sections.

2. Amend 40 CFR 86.159-08 as follows:

2.1 Delete Paragraph (a); replace with: **Overview.**

The dynamometer operation consists of a single test starting from second 0 and ending at second 1435 in the driving schedule shown in Part II, Section G. This cycle will herein be referred to as “Hot 1435 Unified Cycle.” The vehicle is preconditioned in accordance with the instructions in this section to bring it up to a warmed-up, stabilized condition. This preconditioning is followed by a 1 to 2 minute idle period that proceeds directly into the Hot 1435 Unified Cycle driving schedule during which continuous proportional samples of gaseous emissions are collected for analysis.

2.2 Paragraph (b)

2.2.1 Subparagraphs (1) through (8) [No change.]

2.2.2 Delete subparagraph (9); replace with: **Dynamometer activities.**

During dynamometer operation, a fixed speed cooling fan or a road speed modulated fan as specified in §86.107–96(d)(1) may be used. The fan shall be positioned so as to direct cooling air to the vehicle in an appropriate manner. The engine compartment cover shall remain open if a fixed speed cooling fan is used and closed if a road speed modulated fan is used. In the case of vehicles with front engine compartments, the fan shall be squarely positioned within 24 inches (61 centimeters) of the vehicle. In the case of vehicles with rear engine compartments (or if special designs make the above impractical), the cooling fan shall be placed in a position to provide sufficient air to maintain vehicle cooling. The Executive Officer may approve modified cooling configurations or additional cooling if necessary to satisfactorily perform the test. In approving requests for additional or modified cooling, the Executive Officer will consider such items as actual road cooling data and whether such additional cooling is needed to provide a representative test.

2.3 Paragraph (c) through (f) [No change.]

100.5.5.4 **US06 Bag 2 Test Procedure.**
Amend §86.159-08 as follows: Add the following sentences: The exhaust PM emissions shall be measured using equivalent measurement techniques as those used to measure exhaust PM emissions on the FTP cycle except that provisions accounting for the cold start portion of the FTP cycle (including factors used to weight emission values from the different phases) shall be ignored. The NMOG, CO, NOx, and formaldehyde emissions shall be measured according to the US06 Test Procedure as set forth in Subpart B, 40 CFR §86.159-08 with the following modifications:

1. Replace all references to "US06" with "US06 Bag 2." Where §86.159-08 references another section of 40 CFR part 86, replace all mention of "US06" with "US06 Bag 2" in referenced sections.

2. Amend 40 CFR 86.159-08 as follows:

2.1 Delete Paragraph (a); replace with: **Overview.**

The dynamometer operation consists of a single, 365 second test starting as shown in Part II, Section F. This cycle will herein be referred to as "US06 Bag 2." The vehicle is preconditioned in accordance with the instructions in this section to bring it up to a warmed-up, stabilized condition. This preconditioning is followed by a 1 to 2 minute idle period that proceeds directly into the US06 Bag 2 driving schedule during which continuous proportional samples of gaseous emissions are collected for analysis.

2.2 Paragraph (b)

2.2.1 Subparagraphs (1) through (8) [No change.]

2.2.2 Delete subparagraph (9); replace with: **Dynamometer activities.**

During dynamometer operation, a fixed speed cooling fan or a road speed modulated fan as specified in § 86.107–96(d)(1) may be used. The fan shall be positioned so as to direct cooling air to the vehicle in an appropriate manner. The engine compartment cover shall remain open if a fixed speed cooling fan is used and closed if a road speed modulated fan is used. In the case of vehicles with front engine compartments, the fan shall be squarely positioned within 24 inches (61 centimeters) of the vehicle. In the case of vehicles with rear engine compartments (or if special designs make the above impractical), the cooling fan shall be placed in a position to provide sufficient air to maintain vehicle cooling.

The Executive Officer may approve modified cooling configurations or additional cooling if necessary to satisfactorily perform the test. In approving requests for additional or modified cooling, the Executive Officer will consider such items as actual road cooling data and whether such additional cooling is needed to provide a representative test.

2.3 Paragraph (c) through (f) [No change.]

86.160-00 Exhaust emission test procedure for SC03 emissions. December 8, 2005.

86.161-00 Air conditioning environmental test facility ambient requirements. July 13, 2005.

86.162-00 Approval of alternative air conditioning test simulations and descriptions of AC1 and AC2. October 22, 1996.

86.162-03 Approval of alternative air conditioning test simulations. October 22, 1996.

86.163-00 Spot check correlation procedures for vehicles tested using a simulation of the environmental test cell for air conditioning emission testing. October 22, 1996.

86.164-08 Supplemental federal test procedure calculations. December 27, 2006.

86.165-12 Air Conditioning idle test procedure. [Insert Federal Register for the 2017 and subsequent MY National Greenhouse Gas Final Rule as proposed at 76 Fed. Reg. 74854, 75357 (December 1, 2011)]. [No change, except that for the 2016 model years, this section shall only apply to vehicles certifying under the 2012 through 2016 MY National greenhouse gas program.]

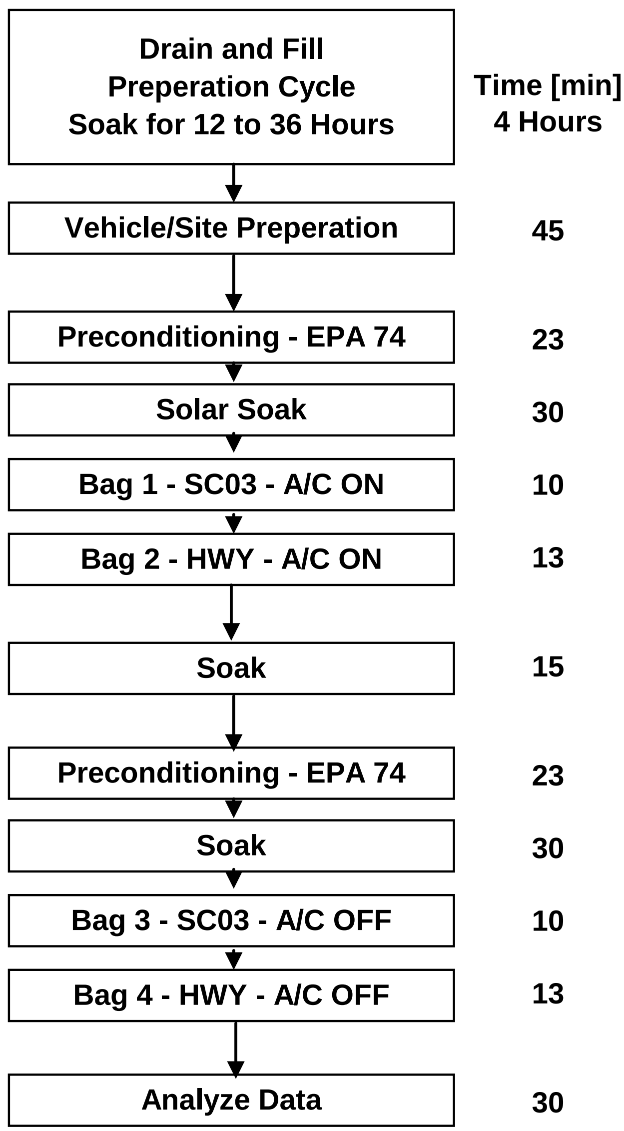
86.166-12 Method for calculating emissions due to air conditioning leakage. [Insert Federal Register for the 2017 and subsequent MY National Greenhouse Gas Final Rule as proposed at 76 Fed. Reg. 74854, 75357 (December 1, 2011)]. [No change, except that this section shall only apply to vehicles certifying under the 2012 through 2016 MY National greenhouse gas program.]

86.167-17 AC17 Air Conditioning Efficiency Test Procedure. [Insert Federal Register for the 2017 and subsequent MY National Greenhouse Gas Final Rule as proposed at 76 Fed. Reg. 74854, 75358 (December 1, 2011)]. [No change, except that for the 2012 through 2016 model years, this section shall only apply to vehicles certifying under the 2012 through 2016 MY National greenhouse gas program.]

100.5.6 AC17 Air Conditioning Efficiency Test Procedure.

1. Overview. The dynamometer operation consists of four elements: a pre-conditioning cycle, a 30-minute soak period under simulated solar heat, an SC03 drive cycle, and a Highway Fuel Economy Test (HWFET) drive cycle. The vehicle is preconditioned with the UDDS to bring the vehicle to a warmed-up stabilized condition. This preconditioning is followed by a 30 minute vehicle soak (engine off) that proceeds directly into the SC03 driving schedule, during which continuous proportional samples of gaseous emissions are collected for analysis. The SC03 driving schedule is followed immediately by the HWFET cycle, during which continuous proportional samples of gaseous emissions are collected for analysis. The entire test, including the preconditioning driving, vehicle soak, and SC03 and HWFET official test cycles, is conducted in an environmental test facility. The environmental test facility must be capable of providing the following nominal ambient test conditions of: 77 °F air temperature, 50 percent relative humidity, a solar heat load intensity of 850 W/m2, 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 entire test sequence is run twice; with and without the vehicle's air conditioner operating during the SC03 and HFET test cycles. For gasoline-fueled Otto-cycle vehicles, the composite samples collected in bags are analyzed for THC, CO, CO_2, and CH_4. For petroleum-fueled diesel-cycle vehicles, 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, and CH_4. The following figure shows the basic sequence of the test procedure.



2. **Dynamometer requirements**.

2.1 Tests shall be run on a large single roll electric dynamometer or an equivalent dynamometer configuration that satisfies the requirements of §86.108–00.

2.2 Position (vehicle can be driven) the test vehicle on the dynamometer and restrain.

2.3 Required dynamometer inertia weight class selections are determined by the test vehicle's test weight basis and corresponding equivalent weight as listed in the tabular information of §86.129–00(a) and discussed in §86.129–00 (e) and (f).

2.4 Set the dynamometer test inertia weight and roadload horsepower requirements for the test vehicle (see §86.129–00 (e) and (f)). The dynamometer's horsepower adjustment settings shall be set such that the force imposed during dynamometer operation matches actual road load force at all speeds.

2.5 The vehicle speed as measured from the dynamometer rolls shall be used. A speed vs. time recording, as evidence of dynamometer test validity, shall be supplied at request of the Executive Officer.

2.6 The drive wheel tires may be inflated up to a gauge pressure of 45 psi (310 kPa), or the manufacturer's recommended pressure if higher than 45 psi, in order to prevent tire damage. The drive wheel tire pressure shall be reported with the test results.

2.7 The driving distance, as measured by counting the number of dynamometer roll or shaft revolutions, shall be determined for the test.

2.8 Four-wheel drive and all-wheel drive vehicles may be tested either in a four-wheel drive or a two-wheel drive mode of operation. In order to test in the two-wheel drive mode, four-wheel drive and all-wheel drive vehicles may have one set of drive wheels disengaged; four-wheel and all-wheel drive vehicles which can be shifted to a two-wheel mode by the driver may be tested in a two-wheel drive mode of operation.

3. **Test cell ambient conditions**.

3.1 **Ambient air temperature**.

3.1.1 Ambient air temperature is controlled, within the test cell, during all phases of the test sequence to 77 ±2 °F on average and 77 ±5 °F as an instantaneous measurement.

3.1.2 Air temperature is recorded continuously at a minimum of 30 second intervals. Records of cell air temperatures and values of average test temperatures are maintained by the manufacturer for all certification related programs.

3.2 **Ambient humidity**.

3.2.1 Ambient humidity is controlled, within the test cell, during all phases of the test sequence to an average of 69 ±5 grains of water/pound of dry air.

3.2.2 Humidity is recorded continuously at a minimum of 30 second intervals. Records of cell humidity and values of average test humidity are maintained by the manufacturer for all certification related programs.

3.3 **Solar heat loading**. The requirements of 86.161-00(d) regarding solar heat loading specifications shall apply. The solar load of 850 W/m^2 is applied only during specified portions of the test sequence.

4. **Interior temperature measurement**. The interior temperature of the vehicle shall be measured during the emission sampling phases of the test(s).

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4.1 Interior temperatures shall be measured by placement of thermocouples at the following locations:

4.1.1 The outlet of the center duct on the dash.

4.1.2 Behind the driver and passenger seat headrests. The location of the temperature measuring devices shall be 30 mm behind each headrest and 330 mm below the roof.

4.2 The temperature at each location shall be recorded a minimum of every 5 seconds.

5. **Air conditioning system settings**. For the portion of the test where the air conditioner is required to be operating the settings shall be as follows:

5.1 Automatic systems shall be set to automatic and the temperature control set to 72 °F.

5.2 Manual systems shall be set at the start of the SC03 drive cycle to full cool with the fan on the highest setting and the airflow setting to "recirculation." Within the first idle period of the SC03 drive cycle (186 to 204 seconds) the fan speed shall be reduced to the setting closest to 6 volts at the motor, the temperature setting shall be adjusted to provide 55 °F at the center dash air outlet, and the airflow setting changed to "outside air."

6. **Vehicle and test activities**. The AC17 air conditioning test in an environmental test cell is composed of the following sequence of activities.

6.1 Drain and fill the vehicle's fuel tank to 40 percent capacity with test fuel. If a vehicle has gone through the drain and fuel sequence less than 72 hours previously and has remained under laboratory ambient temperature conditions, this drain and fill operation can be omitted (see §86.132–00(c)(2)(ii)).

6.2.1 Position the variable speed cooling fan in front of the test vehicle with the vehicle's hood down. This air flow should provide representative cooling at the front of the test vehicle (air conditioning condenser and engine) during the driving cycles. See §86.161–00(e) for a discussion of cooling fan specifications.

6.2.2 In the case of vehicles with rear engine compartments (or if this front location provides inadequate engine cooling), an additional cooling fan shall be placed in a position to provide sufficient air to maintain vehicle cooling. The fan capacity shall normally not exceed 5300 cfm (2.50 m^3/s). If, however, it can be demonstrated that during road operation the vehicle receives additional cooling, and that such additional cooling is needed to provide a representative test, the fan capacity may be increased or additional fans used if approved in advance by the Executive Officer.

6.3 Open all vehicle windows.

6.4 Connect the emission test sampling system to the vehicle's exhaust tail pipe(s).

6.5 Set the environmental test cell ambient test conditions to the conditions defined in paragraph (c) of this section, except that the solar heat shall be off.

6.6 Set the air conditioning system controls to off.

6.7 Start the vehicle (with air conditioning system off) and conduct a preconditioning EPA urban dynamometer driving cycle (§86.115).

6.7.1 If engine stalling should occur during any air conditioning test cycle operation, follow the provisions of §86.136–90 (Engine starting and restarting).

6.7.2 For manual transmission vehicles, the vehicle shall be shifted according the provisions of §86.128–00.

6.8 Following the preconditioning cycle, the test vehicle and cooling fan(s) are turned off, all windows are rolled up, and the vehicle is allowed to soak in the ambient conditions of paragraph (c)(1) of this section for 30 ±1 minutes. The solar heat system must be turned on and generating 850 W/m^2 within 1 minute of turning the engine off.

6.9 **Air conditioning on test**.

6.9.1 Start engine (with air conditioning system also running). Fifteen seconds after the engine starts, place vehicle in gear.

6.9.2 Eighteen seconds after the engine starts, begin the initial vehicle acceleration of the SC03 driving schedule.

6.9.3 Operate the vehicle according to the SC03 driving schedule, as described in 40 CFR Part 86 Appendix I, paragraph (h), while sampling the exhaust gas.

6.9.4 At the end of the deceleration which is scheduled to occur at 594 seconds, simultaneously switch the sample flows from the SC03 bags and samples to the "HWFET" bags and samples, switch off gas flow measuring device No. 1, switch off the No. 1 petroleum-fueled diesel hydrocarbon integrator, mark the petroleum-fueled diesel hydrocarbon recorder chart, and start gas flow measuring device No. 2, and start the petroleum-fueled diesel hydrocarbon integrator No. 2.

6.9.5 Allow the vehicle to idle for 14-16 seconds. Before the end of this idle period, record the measured roll or shaft revolutions and reset the counter or switch to a second counter. As soon as possible transfer the SC03 exhaust and dilution air samples to the analytical system and process the samples according to §86.140 obtaining a stabilized reading of the bag exhaust 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 collection phase of the test.

6.9.6 Operate the vehicle according to the HWFET driving schedule, as described in 40 CFR 600.109-08, while sampling the exhaust gas.

6.9.7 Turn the engine off 2 seconds after the end of the last deceleration.

6.9.8 Five seconds after the engine stops running, simultaneously turn off gas flow measuring device No. 2 and if applicable, turn off the petroleum-fueled diesel hydrocarbon integrator No. 2, mark the hydrocarbon recorder chart, 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 re-set the counter. As soon as possible, transfer the HWFET exhaust and dilution air samples to the analytical system and process the samples according 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.

6.10 **Air conditioning off test**. The air conditioning off test is identical to the steps identified in paragraphs 6.1 through 6.9 of this section, except that the air conditioning system and fan speeds are set to complete off or the lowest. It is preferred that the air conditioning off test be conducted sequentially after the air conditioning on test, following a 10-15 minute soak.

B. Subpart C - Emission Regulations for 1994 and Later Model Year Gasoline-Fueled New Light-Duty Vehicles, New Light-Duty Trucks and New Medium-Duty Passenger Vehicles; Cold Temperature Test Procedures.

86.201-11 General applicability. December 27, 2006.

200.1 California applicability.

Amend subparagraph 86.201-94(a) as follows: This subpart describes procedures for determining the cold temperature carbon monoxide (CO) emissions from 2015 and later model year new passenger cars, light-duty trucks, and medium-duty vehicles (excluding natural gas, diesel-fueled, and zero-emission vehicles).

86.202-94 Definitions. July 17, 1992.
86.203-94 Abbreviations. July 17, 1992.
86.204-94 Section number construction. July 17, 1992.
86.205-11 Introduction; structure of subpart. December 27, 2006.
86.206-11 Equipment required; overview. December 27, 2006.

200.2 California Equipment Required; Overview.

Amend §86.206-11, as follows:

This subpart contains procedures for exhaust emission tests on passenger cars, light-duty trucks, and medium-duty vehicles (excluding natural gas, diesel-fueled, and zero-emission vehicles.) Equipment required and specifications are as follows:

(a)(1) **Exhaust emission tests**. Exhaust from vehicles (excluding natural gas, diesel-fueled, and zero-emission vehicles) is tested for gaseous emissions using the Constant Volume Sampler (CVS) concept (§86.209). Equipment necessary and specifications appear in 40 CFR Part 86, §§86.208 through 86.214.

(a)(2) **Fuel, analytical gas, and driving schedule specifications**. Fuel specifications for exhaust emission testing for gasoline-fueled vehicles are specified in 40 CFR Part 86, §86.213. As an option, a manufacturer may utilize the fuel specified in §86.213 with the sulfur content limited to 30-40 ppm by weight. Fuel specifications for exhaust emission testing for alcohol-fueled vehicles and liquefied petroleum gas vehicles are specified in Part II, Section A.100.3 of these test procedures. Analytical gases are specified in 40 CFR Part 86, §86.214. The EPA Urban Dynamometer Driving Schedule (UDDS) for use in emission tests is specified in 40 CFR Part 86, §86.215 and appendix I to this part.

86.208-94 Dynamometer. July 17, 1992.
86.209-94 Exhaust gas sampling system; gasoline-fueled vehicles. July 17, 1992.
86.211-94 Exhaust gas analytical system. December 27, 2006.
86.213-11 Fuel specifications. December 27, 2006.
86.214-94 Analytical gases. July 17, 1992.
86.215-94 EPA urban dynamometer driving schedule. July 17, 1992.
86.216-94 Calibrations, frequency and overview. July 17, 1992.
86.218-94 Dynamometer calibration. July 17, 1992.
86.219-94 CVS calibration. July 17, 1992.

86.221-94 Hydrocarbon analyzer calibration. July 17, 1992.
86.222-94 Carbon monoxide analyzer calibration. July 17, 1992.
86.223-94 Oxides of nitrogen analyzer calibration. July 17, 1992.
86.224-94 Carbon dioxide analyzer calibration. July 17, 1992.
86.226-94 Calibration of other equipment. July 17, 1992.
86.227-94 Test procedures; overview. July 17, 1992.
86.228-94 Transmissions. July 17, 1992.
86.229-94 Road load force, test weight, and inertia weight class determination. July 17, 1992.
86.230-94 Test Sequence; general requirements. July 17, 1992.
86.230-11 Test Sequence; general requirements. December 27, 2006.
86.231-94 Vehicle Preparation. July 17, 1992.
86.232-94 Vehicle Preconditioning. July 17, 1992.
86.235-94 Dynamometer procedure. July 17, 1992.
86.236-94 Engine starting and restarting. July 17, 1992.
86.237-08 Dynamometer test run, gaseous emissions. December 27, 2006.
86.240-94 Exhaust sample analysis. July 17, 1992.
86.242-94 Records required. July 17, 1992.
86.244-94 Calculations; exhaust emissions. February 21, 2007.
86.246-94 Intermediate temperature testing. July 17, 1992.

Appendix I to Part 86 -- Urban Dynamometer Schedules. April 29, 1998.

C. 50°F Emission Test Procedure.

The NMOG, CO, NOx, and formaldehyde emissions from all light- and medium-duty vehicles shall be measured according to the Federal Test Procedure as set forth in Subpart B, 40 CFR Part 86 at a nominal temperature of 50°F with the following modifications:

(1) Test Procedure.

(a) The test vehicles shall not be subject to a diurnal heat build prior to the cold start exhaust test or evaporative emission testing.

(b) Following a 12 to 36 hour cold soak at a nominal temperature of 50°F, the nominal preconditioning, soak, and test temperatures shall be maintained within 3°F of the nominal temperature on an average basis and within 5°F of the nominal temperature on a continuous basis. The temperature shall be sampled at least once every 15 seconds during the preconditioning and test periods and at least once each 5 minutes during the soak period. A continuous strip chart recording of the temperature with these minimum time resolutions is an acceptable alternative to employing a data acquisition system.

(c) The test site temperature shall be measured at the inlet of the vehicle cooling fan used for testing.

(d) The test vehicle may be fueled before the preconditioning procedure in a fueling area maintained within a temperature range of 68 to 86°F. The requirement to saturate the evaporative control canister(s) shall not apply.

(e) If a soak area remote from the test site is used, the vehicle may pass through an area maintained within a temperature range of 68 to 86°F during a time interval not to exceed 10 minutes. In such cases, the vehicle shall be restabilized to 50°F by soaking the vehicle in the nominal 50°F test area for six times as long as the exposure time to the higher temperature area, prior to starting the emission test.

(f) The vehicle shall be approximately level during all phases of the test sequence to prevent abnormal fuel distribution.

D. Unified Cycle Driving Schedule.

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Unified Test Cycle
(Speed vs Time Sequence)

Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)
1	0	74	12.3	147	20	220	0	293	0	366	45.3	439	60.3	512	28
2	0	75	8.1	148	23	221	0	294	0	367	46.5	440	60.3	513	26.5
3	0	76	6.1	149	25.7	222	0	295	0	368	48	441	60.3	514	24.2
4	0	77	9.6	150	28	223	0	296	0	369	48.8	442	59.5	515	22.7
5	0	78	12.7	151	30.7	224	0	297	0	370	49.5	443	58.8	516	20.4
6	0	79	15.7	152	32.6	225	0	298	0	371	49.9	444	59.1	517	17.7
7	0	80	18	153	34.2	226	0	299	0	372	49.9	445	58.8	518	15.7
8	0	81	20.4	154	35.3	227	0	300	0	373	49.9	446	58.8	519	13.1
9	0	82	21.9	155	36.9	228	0	301	0	374	49.5	447	58.8	520	10.8
10	0	83	23.4	156	36.9	229	0	302	0	375	49.5	448	58.4	521	8.4
11	0	84	23.8	157	37.2	230	0	303	0	376	48.8	449	58	522	7.3
12	0	85	24.6	158	37.6	231	0	304	0	377	48.8	450	58	523	5
13	0	86	25	159	37.6	232	0	305	0	378	48.8	451	58	524	3.8
14	0	87	26.1	160	37.6	233	0	306	0	379	48.4	452	58.4	525	3.5
15	0	88	26.1	161	37.2	234	0	307	0	380	48.8	453	59.1	526	1.9
16	0	89	26.9	162	37.2	235	0	308	0	381	49.5	454	59.5	527	0.8
17	0	90	26.9	163	36.9	236	0	309	0	382	50.3	455	59.9	528	0
18	0	91	26.9	164	36.5	237	0	310	0	383	50.7	456	59.9	529	0
19	0	92	26.5	165	36.5	238	1.5	311	0	384	51.8	457	60.3	530	0
20	0	93	25.7	166	34.9	239	5	312	0	385	52.6	458	61.1	531	0.8
21	1.2	94	21.9	167	33.4	240	8.8	313	0.4	386	53.4	459	61.1	532	1.9
22	4.2	95	16.5	168	31.9	241	11.5	314	2.7	387	54.1	460	61.1	533	3.8
23	7.3	96	10	169	29.2	242	14.2	315	7.3	388	55.3	461	61.4	534	6.9
24	8.8	97	4.6	170	25	243	15.4	316	11.5	389	55.3	462	61.4	535	9.6
25	10.8	98	1.5	171	25	244	16.1	317	15.4	390	56.1	463	61.1	536	11.1
26	12.3	99	0.4	172	26.1	245	16.1	318	18.4	391	56.4	464	60.7	537	11.1
27	13.1	100	0	173	27.6	246	16.9	319	20.7	392	56.4	465	59.9	538	10.4
28	12.3	101	0	174	29.2	247	16.5	320	24.2	393	56.4	466	59.1	539	8.8
29	12.3	102	0	175	31.1	248	16.9	321	26.9	394	57.2	467	59.1	540	9.2
30	11.5	103	0	176	32.3	249	18	322	29.6	395	56.8	468	59.1	541	10
31	11.5	104	0	177	34.2	250	19.2	323	31.1	396	57.6	469	59.9	542	10.4
32	11.1	105	0	178	34.9	251	20.4	324	32.6	397	57.6	470	59.5	543	10.4
33	11.1	106	0	179	35.7	252	20.4	325	33.8	398	57.6	471	59.9	544	5.4
34	11.1	107	0	180	36.5	253	21.1	326	34.9	399	58	472	58.8	545	1.9
35	13.1	108	0.4	181	36.9	254	21.1	327	36.9	400	58	473	58	546	0
36	15	109	1.2	182	36.9	255	22.3	328	39.2	401	58.4	474	57.6	547	0
37	16.9	110	1.9	183	37.2	256	23	329	41.1	402	58.4	475	56.8	548	0
38	16.9	111	3.8	184	37.6	257	23.8	330	43	403	58.8	476	56.1	549	0
39	16.1	112	7.7	185	37.2	258	24.2	331	43.8	404	59.1	477	55.3	550	0
40	15.7	113	11.5	186	37.6	259	24.6	332	44.5	405	58.8	478	54.1	551	0
41	15.4	114	14.6	187	38	260	25	333	45.3	406	58.8	479	52.6	552	0
42	15	115	18	188	38.4	261	25.7	334	45.3	407	58	480	49.2	553	0
43	13.8	116	21.5	189	39.2	262	25.7	335	44.9	408	58	481	46.1	554	0
44	10.8	117	25	190	39.6	263	26.5	336	44.5	409	57.6	482	43	555	0
45	8.4	118	28.4	191	39.9	264	27.6	337	43.8	410	57.6	483	37.2	556	0
46	6.1	119	30.7	192	40.7	265	28.4	338	43.4	411	57.6	484	29.6	557	0
47	4.2	120	31.9	193	40.3	266	29.2	339	42.6	412	57.6	485	21.5	558	0
48	3.5	121	32.3	194	41.1	267	30.3	340	41.9	413	57.6	486	16.5	559	0
49	3.5	122	32.3	195	41.1	268	31.1	341	41.5	414	59.1	487	15.7	560	0
50	1.5	123	31.9	196	40.7	269	31.1	342	40.7	415	59.5	488	18.4	561	0
51	0	124	30.3	197	31.9	270	30.7	343	40.3	416	59.9	489	21.5	562	0
52	0	125	28	198	23.9	271	31.1	344	41.1	417	60.3	490	25	563	0
53	0	126	24.2	199	15.9	272	29.6	345	41.5	418	60.3	491	27.3	564	0
54	0	127	20	200	7.9	273	29.2	346	42.6	419	61.1	492	29.2	565	0
55	0	128	16.1	201	2.7	274	29.2	347	43.4	420	60.3	493	30.7	566	0
56	0	129	11.5	202	0.4	275	28.8	348	44.2	421	59.9	494	31.5	567	0
57	0	130	8.1	203	0.4	276	28	349	44.9	422	59.5	495	31.1	568	0
58	0	131	5	204	2.7	277	23	350	45.7	423	59.1	496	31.1	569	0
59	0	132	3.5	205	3.8	278	21.1	351	46.5	424	59.1	497	30.3	570	0
60	0	133	1.9	206	3.8	279	21.5	352	46.8	425	59.5	498	30	571	0
61	0	134	0	207	1.5	280	20.7	353	47.2	426	59.5	499	30	572	0.4
62	0	135	0	208	0	281	20.7	354	48	427	59.5	500	29.6	573	1.5
63	1.2	136	0	209	0	282	19.6	355	47.6	428	59.9	501	30	574	3.5
64	3.5	137	0	210	0	283	16.5	356	48.4	429	60.3	502	28.8	575	6.1
65	7.7	138	0	211	0	284	13.1	357	48	430	60.7	503	28.8	576	10.4
66	11.1	139	0	212	0	285	9.6	358	47.2	431	60.7	504	28	577	14.2
67	13.8	140	0	213	0	286	7.3	359	46.1	432	61.4	505	28.4	578	16.9
68	16.5	141	0	214	0	287	3.8	360	45.7	433	61.8	506	28	579	19.2
69	18.4	142	0	215	0	288	0.8	361	44.9	434	61.8	507	28.4	580	20
70	20.4	143	1.5	216	0	289	0	362	44.2	435	61.8	508	28.4	581	21.5
71	20.7	144	6.9	217	0	290	0	363	43.8	436	61.8	509	28.8	582	23.4
72	19.6	145	12.7	218	0	291	0	364	44.5	437	61.1	510	28.4	583	24.6
73	17.3	146	16.5	219	0	292	0	365	44.9	438	60.7	511	28.4	584	24.2

Unified Test Cycle
(Speed vs Time Sequence)

Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)
585	20	658	33	731	4.2	804	20.4	877	62.2	950	16.5	1023	0.4	1096	9.6
586	16.9	659	34.2	732	1.2	805	18.8	878	62.2	951	15	1024	2.7	1097	8.8
587	13.4	660	34.6	733	0	806	17.3	879	62.6	952	11.9	1025	6.1	1098	10.8
588	13.4	661	35.3	734	0	807	15	880	63.7	953	9.6	1026	9.2	1099	12.7
589	15.7	662	36.1	735	0	808	13.1	881	64.5	954	8.4	1027	11.5	1100	14.2
590	18.4	663	36.1	736	0	809	9.2	882	64.9	955	5.8	1028	14.2	1101	14.6
591	21.1	664	36.9	737	0	810	6.9	883	66	956	1.2	1029	16.1	1102	13.1
592	23.4	665	36.9	738	0	811	4.6	884	66	957	0	1030	18	1103	11.1
593	25.3	666	37.6	739	0	812	4.6	885	66.8	958	0	1031	20	1104	11.1
594	27.6	667	37.6	740	0	813	4.6	886	66.4	959	0	1032	21.5	1105	11.1
595	28.8	668	38.4	741	0	814	4.2	887	66.8	960	1.2	1033	23	1106	13.1
596	30.3	669	38	742	0	815	5.4	888	67.2	961	3.1	1034	24.2	1107	15.7
597	30.7	670	37.6	743	0	816	4.6	889	66.4	962	5	1035	25	1108	18.4
598	31.5	671	37.6	744	0	817	3.5	890	66.4	963	8.4	1036	25.7	1109	20.7
599	31.1	672	37.2	745	0	818	2.3	891	66	964	11.5	1037	26.9	1110	23.8
600	31.1	673	36.9	746	0	819	2.3	892	65.7	965	14.6	1038	27.6	1111	25.7
601	30.3	674	36.1	747	0	820	1.9	893	65.7	966	16.9	1039	27.6	1112	28
602	30.3	675	35.7	748	0	821	3.1	894	66.4	967	18.8	1040	28.4	1113	30
603	30.3	676	36.1	749	0	822	6.1	895	66	968	21.1	1041	29.2	1114	31.1
604	30.7	677	35.7	750	0	823	4.6	896	65.7	969	23.8	1042	29.2	1115	32.3
605	31.1	678	35.7	751	0	824	2.7	897	65.3	970	26.5	1043	30	1116	34.2
606	32.3	679	35.7	752	0	825	2.3	898	65.3	971	28	1044	29.6	1117	35.7
607	32.6	680	36.1	753	0	826	2.3	899	64.5	972	29.6	1045	29.6	1118	36.9
608	32.6	681	36.1	754	0	827	3.1	900	64.5	973	30.7	1046	28.8	1119	38.8
609	32.6	682	35.7	755	0	828	4.2	901	64.1	974	32.6	1047	28	1120	40.3
610	31.1	683	35.7	756	0	829	3.5	902	63.7	975	34.2	1048	23.8	1121	41.5
611	26.9	684	34.9	757	0	830	3.8	903	63.7	976	35.3	1049	18.8	1122	42.2
612	22.3	685	34.6	758	0	831	4.2	904	63.7	977	36.1	1050	11.9	1123	43
613	18	686	34.2	759	0	832	3.5	905	64.5	978	36.9	1051	6.1	1124	43.8
614	13.8	687	33.8	760	0	833	3.5	906	64.5	979	38	1052	1.5	1125	43.8
615	9.6	688	33.4	761	0	834	3.5	907	64.9	980	38	1053	1.5	1126	43.4
616	4.6	689	33	762	0	835	4.6	908	64.5	981	38	1054	4.2	1127	43
617	6.1	690	30.3	763	1.5	836	5.8	909	64.1	982	38	1055	8.1	1128	42.2
618	10	691	29.2	764	5.4	837	3.5	910	64.9	983	38	1056	10.4	1129	41.9
619	14.2	692	28.4	765	9.2	838	0.8	911	65.3	984	37.2	1057	13.1	1130	41.5
620	17.3	693	25	766	11.5	839	3.5	912	65.3	985	36.9	1058	15.4	1131	41.9
621	20	694	21.1	767	14.6	840	3.8	913	65.3	986	36.1	1059	18	1132	41.9
622	21.5	695	16.9	768	17.3	841	2.3	914	64.1	987	35.7	1060	20.4	1133	41.9
623	22.3	696	13.4	769	19.2	842	0	915	63.4	988	34.9	1061	23	1134	42.2
624	22.3	697	13.1	770	21.1	843	1.2	916	63	989	34.9	1062	25.3	1135	42.6
625	22.3	698	12.3	771	20.7	844	6.9	917	63.4	990	33.8	1063	27.3	1136	42.6
626	22.3	699	12.7	772	20.7	845	13.8	918	64.1	991	31.5	1064	28.8	1137	42.6
627	23	700	15.7	773	19.6	846	18.8	919	64.9	992	28.8	1065	30.3	1138	42.6
628	23	701	19.2	774	18.4	847	23.8	920	65.3	993	25.7	1066	31.1	1139	42.6
629	22.7	702	22.3	775	16.9	848	27.3	921	64.5	994	24.6	1067	32.3	1140	42.6
630	22.3	703	24.6	776	16.9	849	30.7	922	64.1	995	23.4	1068	31.9	1141	42.6
631	21.9	704	25.7	777	16.5	850	33.8	923	63.4	996	22.3	1069	32.3	1142	42.2
632	22.7	705	26.5	778	16.9	851	37.6	924	63.7	997	21.5	1070	31.9	1143	43
633	23.8	706	26.5	779	16.9	852	40.7	925	63.4	998	20	1071	31.1	1144	43.4
634	25	707	26.9	780	16.9	853	43.8	926	63.4	999	20	1072	28.8	1145	43
635	25.3	708	27.3	781	17.3	854	46.1	927	63.4	1000	19.2	1073	25	1146	42.6
636	25.7	709	27.3	782	19.2	855	48	928	63.4	1001	19.2	1074	22.7	1147	41.9
637	26.5	710	27.6	783	20.4	856	49.5	929	63.7	1002	18	1075	18.8	1148	40.7
638	26.9	711	28.4	784	21.1	857	51.5	930	64.5	1003	11.9	1076	15.4	1149	36.9
639	27.3	712	28.8	785	22.3	858	53	931	65.3	1004	6.9	1077	13.4	1150	32.6
640	28	713	28.8	786	22.3	859	54.5	932	64.9	1005	2.7	1078	11.9	1151	28
641	29.2	714	29.2	787	22.7	860	55.7	933	63.7	1006	0.8	1079	8.8	1152	23.4
642	30	715	28.8	788	22.3	861	56.8	934	63	1007	0.4	1080	5	1153	18.4
643	30	716	28.8	789	22.7	862	58	935	59.9	1008	0	1081	1.9	1154	14.6
644	29.6	717	28	790	22.3	863	59.1	936	55.3	1009	0	1082	2.3	1155	12.3
645	29.6	718	28	791	23.8	864	60.3	937	50.7	1010	0	1083	2.7	1156	9.2
646	28.8	719	27.6	792	25.7	865	61.1	938	49.2	1011	0	1084	3.5	1157	5.8
647	28.4	720	26.5	793	27.6	866	61.8	939	48	1012	0	1085	6.5	1158	1.9
648	28	721	24.6	794	29.6	867	61.8	940	46.1	1013	0	1086	10.8	1159	0.4
649	27.3	722	20.7	795	30	868	61.8	941	44.2	1014	0	1087	13.8	1160	0
650	25.7	723	16.5	796	29.2	869	61.8	942	41.1	1015	0	1088	16.1	1161	0
651	24.6	724	15	797	27.6	870	62.6	943	39.9	1016	0	1089	18.4	1162	0
652	25	725	14.2	798	25	871	63.4	944	36.1	1017	0	1090	20.4	1163	0
653	26.5	726	14.2	799	23.8	872	63	945	32.6	1018	0	1091	21.9	1164	0
654	28	727	13.8	800	23.4	873	63	946	29.2	1019	0	1092	21.9	1165	0.4
655	29.6	728	13.8	801	24.2	874	62.6	947	24.6	1020	0	1093	20.7	1166	4.2
656	30.7	729	11.9	802	23.4	875	61.8	948	20.7	1021	0	1094	17.3	1167	9.2
657	32.3	730	8.4	803	23	876	61.8	949	19.2	1022	0	1095	13.1	1168	11.9

Unified Test Cycle
(Speed vs Time Sequence)

Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)
1169	14.2	1240	3.5	1311	40.7	1382	2.7	1453	0	1524	26.9	1595	37.6	1666	0
1170	15.7	1241	10.4	1312	40.3	1383	2.3	1454	0	1525	26.9	1596	37.2	1667	0
1171	15	1242	15.4	1313	39.6	1384	1.5	1455	0	1526	26.9	1597	37.2	1668	0
1172	14.2	1243	17.3	1314	39.2	1385	1.2	1456	1.2	1527	26.5	1598	36.9	1669	0
1173	13.4	1244	17.3	1315	38.8	1386	0	1457	4.2	1528	25.7	1599	36.5	1670	0
1174	13.8	1245	18.4	1316	38	1387	1.2	1458	7.3	1529	21.9	1600	36.5	1671	0
1175	14.6	1246	21.5	1317	37.6	1388	4.2	1459	8.8	1530	16.5	1601	34.9	1672	0
1176	14.6	1247	24.6	1318	37.2	1389	7.3	1460	10.8	1531	10	1602	33.4	1673	1.5
1177	14.2	1248	27.3	1319	36.5	1390	8.8	1461	12.3	1532	4.6	1603	31.9	1674	5
1178	16.1	1249	30	1320	34.6	1391	10.8	1462	13.1	1533	1.5	1604	29.2	1675	8.8
1179	15.7	1250	31.5	1321	31.5	1392	12.3	1463	12.3	1534	0.4	1605	25	1676	11.5
1180	15.7	1251	31.9	1322	29.6	1393	13.1	1464	12.3	1535	0	1606	25	1677	14.2
1181	14.6	1252	32.6	1323	29.2	1394	12.3	1465	11.5	1536	0	1607	26.1	1678	15.4
1182	13.1	1253	33.4	1324	28.8	1395	12.3	1466	11.5	1537	0	1608	27.6	1679	16.1
1183	10	1254	34.9	1325	28.8	1396	11.5	1467	11.1	1538	0	1609	29.2	1680	16.1
1184	7.3	1255	36.5	1326	28	1397	11.5	1468	11.1	1539	0	1610	31.1	1681	16.9
1185	3.5	1256	37.6	1327	28	1398	11.1	1469	11.1	1540	0	1611	32.3	1682	16.5
1186	0.8	1257	39.2	1328	28.4	1399	11.1	1470	13.1	1541	0	1612	34.2	1683	16.9
1187	0	1258	40.3	1329	29.6	1400	11.1	1471	15	1542	0	1613	34.9	1684	18
1188	0	1259	40.7	1330	30	1401	13.1	1472	16.9	1543	0.4	1614	35.7	1685	19.2
1189	0	1260	41.1	1331	30.3	1402	15	1473	16.9	1544	1.2	1615	36.5	1686	20.4
1190	0	1261	40.7	1332	29.2	1403	16.9	1474	16.1	1545	1.9	1616	36.9	1687	20.4
1191	0.4	1262	40.7	1333	26.5	1404	16.9	1475	15.7	1546	3.8	1617	36.9	1688	21.1
1192	2.7	1263	40.7	1334	25.3	1405	16.1	1476	15.4	1547	7.7	1618	37.2	1689	21.1
1193	7.3	1264	41.5	1335	25	1406	15.7	1477	15	1548	11.5	1619	37.6	1690	22.3
1194	11.5	1265	42.6	1336	24.6	1407	15.4	1478	13.8	1549	14.6	1620	37.2	1691	23
1195	15.4	1266	43	1337	24.6	1408	15	1479	10.8	1550	18	1621	37.6	1692	23.8
1196	19.2	1267	44.5	1338	25.3	1409	13.8	1480	8.4	1551	21.5	1622	38	1693	24.2
1197	21.9	1268	45.3	1339	26.1	1410	10.8	1481	6.1	1552	25	1623	38.4	1694	24.6
1198	23.8	1269	45.3	1340	27.3	1411	8.4	1482	4.2	1553	28.4	1624	39.2	1695	25
1199	25	1270	44.9	1341	28.4	1412	6.1	1483	3.5	1554	30.7	1625	39.6	1696	25.7
1200	26.1	1271	43.4	1342	29.2	1413	4.2	1484	3.5	1555	31.9	1626	39.9	1697	25.7
1201	27.3	1272	40.3	1343	29.2	1414	3.5	1485	1.5	1556	32.3	1627	40.7	1698	26.5
1202	28.8	1273	38	1344	29.6	1415	3.5	1486	0	1557	32.3	1628	40.3	1699	27.6
1203	30	1274	36.1	1345	30	1416	1.5	1487	0	1558	31.9	1629	41.1	1700	28.4
1204	29.6	1275	36.5	1346	31.1	1417	0	1488	0	1559	30.3	1630	41.1	1701	29.2
1205	29.6	1276	38	1347	32.6	1418	0	1489	0	1560	28	1631	40.7	1702	30.3
1206	28.8	1277	39.2	1348	33.8	1419	0	1490	0	1561	24.2	1632	31.9	1703	31.1
1207	26.1	1278	40.7	1349	34.6	1420	0	1491	0	1562	20	1633	23.9	1704	31.1
1208	22.3	1279	42.2	1350	34.9	1421	0	1492	0	1563	16.1	1634	15.9	1705	30.7
1209	19.2	1280	43.4	1351	34.6	1422	0	1493	0	1564	11.5	1635	7.9	1706	31.1
1210	16.5	1281	44.9	1352	34.9	1423	0	1494	0	1565	8.1	1636	2.7	1707	29.6
1211	12.7	1282	45.7	1353	34.6	1424	0	1495	0	1566	5	1637	0.4	1708	29.2
1212	9.6	1283	46.1	1354	34.9	1425	0	1496	0	1567	3.5	1638	0.4	1709	29.2
1213	6.9	1284	46.8	1355	34.9	1426	0	1497	0	1568	1.9	1639	2.7	1710	28.8
1214	4.2	1285	46.5	1356	34.9	1427	0	1498	1.2	1569	0	1640	3.8	1711	28
1215	2.3	1286	46.5	1357	34.2	1428	0	1499	3.5	1570	0	1641	3.8	1712	23
1216	0.8	1287	46.5	1358	33.8	1429	0	1500	7.7	1571	0	1642	1.5	1713	21.1
1217	0	1288	46.1	1359	32.6	1430	0	1501	11.1	1572	0	1643	0	1714	21.5
1218	0	1289	46.1	1360	31.5	1431	0	1502	13.8	1573	0	1644	0	1715	20.7
1219	0	1290	46.1	1361	30	1432	0	1503	16.5	1574	0	1645	0	1716	20.7
1220	0	1291	46.8	1362	28.8	1433	0	1504	18.4	1575	0	1646	0	1717	19.6
1221	0	1292	47.6	1363	27.3	1434	0	1505	20.4	1576	0	1647	0	1718	16.5
1222	0	1293	48	1364	23.8	1435	0	1506	20.7	1577	0	1648	0	1719	13.1
1223	0	1294	48.4	1365	23	1436	0	1507	19.6	1578	1.5	1649	0	1720	9.6
1224	0	1295	48	1366	23	1437	0	1508	17.3	1579	6.9	1650	0	1721	7.3
1225	0	1296	48	1367	22.3	1438	0	1509	12.3	1580	12.7	1651	0	1722	3.8
1226	0	1297	47.2	1368	20.4	1439	0	1510	8.1	1581	16.5	1652	0	1723	0.8
1227	0	1298	46.5	1369	18.8	1440	0	1511	6.1	1582	20	1653	0	1724	0
1228	0	1299	46.8	1370	17.7	1441	0	1512	9.6	1583	23	1654	0	1725	0
1229	0	1300	47.2	1371	16.1	1442	0	1513	12.7	1584	25.7	1655	0	1726	0
1230	0	1301	48.4	1372	14.6	1443	0	1514	15.7	1585	28	1656	0	1727	0
1231	0	1302	48.4	1373	12.7	1444	0	1515	18	1586	30.7	1657	0	1728	0
1232	0	1303	48.8	1374	11.1	1445	0	1516	20.4	1587	32.6	1658	0	1729	0
1233	0	1304	48.4	1375	9.2	1446	0	1517	21.9	1588	34.2	1659	0	1730	0
1234	0	1305	47.6	1376	8.8	1447	0	1518	23.4	1589	35.3	1660	0	1731	0
1235	0	1306	46.5	1377	7.3	1448	0	1519	23.8	1590	36.9	1661	0	1732	0
1236	0	1307	44.2	1378	6.1	1449	0	1520	24.6	1591	36.9	1662	0	1733	0
1237	0	1308	42.2	1379	5	1450	0	1521	25	1592	37.2	1663	0	1734	0
1238	0	1309	41.5	1380	4.2	1451	0	1522	26.1	1593	37.6	1664	0	1735	0
1239	0	1310	41.1	1381	3.5	1452	0	1523	26.1	1594	37.6	1665	0		

E. Highway Driving Schedule.

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Highway Test Cycle
(Speed vs Time Sequence)

Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)
1	0	74	47.2	147	42	220	43.1	293	30.6	366	56.9	439	58	512	54
2	0	75	47.3	148	43.1	221	43.2	294	29.6	367	56.9	440	57.9	513	54
3	2.0	76	47.2	149	43.7	222	43.4	295	28.8	368	57	441	57.9	514	54
4	4.9	77	47.1	150	44.1	223	43.9	296	28.4	369	57	442	57.9	515	54
5	8.1	78	47	151	44.3	224	44.3	297	28.6	370	57	443	57.9	516	54
6	11.3	79	46.9	152	44.4	225	44.7	298	29.5	371	57	444	57.9	517	54.1
7	14.5	80	46.9	153	44.6	226	45.1	299	31.4	372	57	445	58	518	54.2
8	17.3	81	46.9	154	44.7	227	45.4	300	33.4	373	57	446	58.1	519	54.5
9	19.6	82	47	155	44.9	228	45.8	301	35.6	374	57	447	58.1	520	54.8
10	21.8	83	47.1	156	45.2	229	46.5	302	37.5	375	57	448	58.2	521	54.9
11	24	84	47.1	157	45.7	230	46.9	303	39.1	376	57	449	58.2	522	55
12	25.8	85	47.2	158	45.9	231	47.2	304	40.2	377	56.9	450	58.2	523	55.1
13	27.1	86	47.1	159	46.3	232	47.4	305	41.1	378	56.8	451	58.1	524	55.2
14	28	87	47	160	46.8	233	47.3	306	41.8	379	56.5	452	58	525	55.2
15	29	88	46.9	161	46.9	234	47.3	307	42.4	380	56.2	453	58	526	55.3
16	30	89	46.5	162	47	235	47.2	308	42.8	381	56	454	58	527	55.4
17	30.7	90	46.3	163	47.1	236	47.2	309	43.3	382	56	455	58	528	55.5
18	31.5	91	46.2	164	47.6	237	47.2	310	43.8	383	56	456	58	529	55.6
19	32.2	92	46.3	165	47.9	238	47.1	311	44.3	384	56.1	457	58	530	55.7
20	32.9	93	46.5	166	48	239	47	312	44.7	385	56.4	458	57.9	531	55.8
21	33.5	94	46.9	167	48	240	47	313	45	386	56.7	459	57.9	532	55.9
22	34.1	95	47.1	168	47.9	241	46.9	314	45.2	387	56.9	460	58	533	56
23	34.6	96	47.4	169	47.8	242	46.8	315	45.4	388	57.1	461	58.1	534	56
24	34.9	97	47.7	170	47.3	243	46.9	316	45.5	389	57.3	462	58.1	535	56
25	35.1	98	48	171	46.7	244	47	317	45.8	390	57.4	463	58.2	536	56
26	35.7	99	48.2	172	46.2	245	47.2	318	46	391	57.4	464	58.3	537	56
27	35.9	100	48.5	173	45.9	246	47.5	319	46.1	392	57.2	465	58.3	538	56
28	35.8	101	48.8	174	45.7	247	47.9	320	46.5	393	57	466	58.3	539	56
29	35.3	102	49.1	175	45.5	248	48	321	46.8	394	56.9	467	58.2	540	56
30	34.9	103	49.2	176	45.4	249	48	322	47.1	395	56.6	468	58.1	541	56
31	34.5	104	49.1	177	45.3	250	48	323	47.7	396	56.3	469	58	542	56
32	34.6	105	49.1	178	45	251	48	324	48.3	397	56.1	470	57.8	543	56
33	34.8	106	49	179	44	252	48	325	49	398	56.4	471	57.5	544	56
34	35.1	107	49	180	43.1	253	48.1	326	49.7	399	56.7	472	57.1	545	56
35	35.7	108	49.1	181	42.2	254	48.2	327	50.3	400	57.1	473	57	546	56
36	36.1	109	49.2	182	41.5	255	48.2	328	51	401	57.5	474	56.6	547	55.9
37	36.2	110	49.3	183	41.5	256	48.1	329	51.7	402	57.8	475	56.1	548	55.9
38	36.5	111	49.4	184	42.1	257	48.6	330	52.4	403	58	476	56	549	55.9
39	36.7	112	49.5	185	42.9	258	48.9	331	53.1	404	58	477	55.8	550	55.8
40	36.9	113	49.5	186	43.5	259	49.1	332	53.8	405	58	478	55.5	551	55.6
41	37	114	49.5	187	43.9	260	49.1	333	54.5	406	58	479	55.2	552	55.4
42	37	115	49.4	188	43.6	261	49.1	334	55.2	407	58	480	55.1	553	55.2
43	37	116	49.1	189	43.3	262	49.1	335	55.8	408	58	481	55	554	55.1
44	37	117	48.9	190	43	263	49.1	336	56.4	409	57.9	482	54.9	555	55
45	37	118	48.6	191	43.1	264	49	337	56.9	410	57.8	483	54.9	556	54.9
46	37	119	48.4	192	43.4	265	48.9	338	57	411	57.7	484	54.9	557	54.6
47	37.1	120	48.1	193	43.9	266	48.2	339	57.1	412	57.7	485	54.9	558	54.4
48	37.3	121	47.7	194	44.3	267	47.7	340	57.3	413	57.8	486	54.9	559	54.2
49	37.8	122	47.4	195	44.6	268	47.5	341	57.6	414	57.9	487	54.9	560	54.1
50	38.6	123	47.3	196	44.9	269	47.2	342	57.8	415	58	488	55	561	53.8
51	39.3	124	47.5	197	44.8	270	46.7	343	58	416	58.1	489	55	562	53.4
52	40	125	47.8	198	44.4	271	46.2	344	58.1	417	58.4	490	55	563	53.3
53	40.7	126	47.9	199	43.9	272	46	345	58.4	418	58.9	491	55	564	53.1
54	41.4	127	48	200	43.4	273	45.8	346	58.7	419	59.1	492	55	565	52.9
55	42.2	128	47.9	201	43.2	274	45.6	347	58.8	420	59.4	493	55	566	52.6
56	42.9	129	47.9	202	43.2	275	45.4	348	58.9	421	59.8	494	55.1	567	52.4
57	43.5	130	47.9	203	43.1	276	45.2	349	59	422	59.9	495	55.1	568	52.2
58	44	131	48	204	43	277	45	350	59	423	59.9	496	55	569	52.1
59	44.3	132	48	205	43	278	44.7	351	58.9	424	59.8	497	54.9	570	52
60	44.5	133	48	206	43.1	279	44.5	352	58.8	425	59.6	498	54.9	571	52
61	44.8	134	47.9	207	43.4	280	44.2	353	58.6	426	59.4	499	54.8	572	52
62	44.9	135	47.3	208	43.9	281	43.5	354	58.4	427	59.2	500	54.7	573	52
63	45	136	46	209	44	282	42.8	355	58.2	428	59.1	501	54.6	574	52.1
64	45.1	137	43.3	210	43.5	283	42	356	58.1	429	59	502	54.4	575	52
65	45.4	138	41.2	211	42.6	284	40.1	357	58	430	58.9	503	54.3	576	52
66	45.7	139	39.5	212	41.5	285	38.6	358	57.9	431	58.7	504	54.3	577	51.9
67	46	140	39.2	213	40.7	286	37.5	359	57.6	432	58.6	505	54.2	578	51.6
68	46.3	141	39	214	40	287	35.8	360	57.4	433	58.5	506	54.1	579	51.4
69	46.5	142	39	215	40	288	34.7	361	57.2	434	58.4	507	54.1	580	51.1
70	46.8	143	39.1	216	40.3	289	34	362	57.1	435	58.4	508	54.1	581	50.7
71	46.9	144	39.5	217	41	290	33.3	363	57	436	58.3	509	54	582	50.3
72	47	145	40.1	218	42	291	32.5	364	57	437	58.2	510	54	583	49.8
73	47.1	146	41	219	42.7	292	31.7	365	56.9	438	58.1	511	54	584	49.3

Highway Test Cycle
(Speed vs Time Sequence)

Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)
585	48.7	608	49.1	631	55.1	654	52.2	677	52.1	700	54.2	723	57.7	746	39.2
586	48.2	609	49	632	55.4	655	52.5	678	51.7	701	54.5	724	57.3	747	35.9
587	48.1	610	48.9	633	55.4	656	52.1	679	51.1	702	54.8	725	57.1	748	32.6
588	48	611	48	634	55	657	51.6	680	50.5	703	55	726	56.8	749	29.3
589	48	612	47.1	635	54.5	658	51.1	681	50.1	704	55.5	727	56.5	750	26.8
590	48.1	613	46.2	636	53.6	659	51	682	49.8	705	55.9	728	56.2	751	24.5
591	48.4	614	46.1	637	52.5	660	51	683	49.7	706	56.1	729	55.5	752	21.5
592	48.9	615	46.1	638	50.2	661	51.1	684	49.6	707	56.3	730	54.6	753	19.5
593	49	616	46.2	639	48.2	662	51.4	685	49.5	708	56.4	731	54.1	754	17.4
594	49.1	617	46.9	640	46.5	663	51.7	686	49.5	709	56.5	732	53.7	755	15.1
595	49.1	618	47.8	641	46.2	664	52	687	49.7	710	56.7	733	53.2	756	12.4
596	49	619	49	642	46	665	52.2	688	50	711	56.9	734	52.9	757	9.7
597	49	620	49.7	643	46	666	52.5	689	50.2	712	57	735	52.5	758	7
598	48.9	621	50.6	644	46.3	667	52.8	690	50.6	713	57.3	736	52	759	5
599	48.6	622	51.5	645	46.8	668	52.7	691	51.1	714	57.7	737	51.3	760	3.3
600	48.3	623	52.2	646	47.5	669	52.6	692	51.6	715	58.2	738	50.5	761	2
601	48	624	52.7	647	48.2	670	52.3	693	51.9	716	58.8	739	49.5	762	0.7
602	47.9	625	53	648	48.8	671	52.3	694	52	717	59.1	740	48.5	763	0
603	47.8	626	53.6	649	49.5	672	52.4	695	52.1	718	59.2	741	47.6	764	0
604	47.7	627	54	650	50.2	673	52.5	696	52.4	719	59.1	742	46.8	765	0
605	47.9	628	54.1	651	50.7	674	52.7	697	52.9	720	58.8	743	45.6		
606	48.3	629	54.4	652	51.1	675	52.7	698	53.3	721	58.5	744	44.2		
607	49	630	54.7	653	51.7	676	52.4	699	53.7	722	58.1	745	42.5		

F. US06 Bag 2 Driving Schedule.

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US06 Bag 2 Driving Schedule
(Speed vs Time Sequence)

Time (Sec.)	Speed (mph)	Time (Sec.)	Speed (mph)	Time (Sec.)	Speed (mph)	Time (Sec.)	Speed (mph)	Time (Sec.)	Speed (mph)
1	0	74	62.8	147	62.1	220	65.9	293	70.9
2	0	75	63	148	62	221	66.2	294	70.2
3	0	76	64.1	149	62.4	222	66.1	295	71
4	0	77	63.9	150	62.2	223	67.1	296	70.2
5	0	78	64.1	151	62.2	224	67.4	297	70.3
6	0	79	64.3	152	62.4	225	68.3	298	69.1
7	2.7	80	64.5	153	62.7	226	68.3	299	68.8
8	9.2	81	64.9	154	62.6	227	68.7	300	68.2
9	16.1	82	65.3	155	63.7	228	68.2	301	68.3
10	22.7	83	66	156	64.3	229	68.1	302	68.2
11	29.2	84	66	157	64.8	230	68	303	67.7
12	34.2	85	66.4	158	65.1	231	67.1	304	67.3
13	38.8	86	64.1	159	65.9	232	66.4	305	67.5
14	43	87	63.6	160	66.1	233	66.1	306	67.6
15	45.3	88	63.9	161	67	234	65.7	307	67.6
16	46.8	89	64.1	162	67.2	235	66	308	67.2
17	48	90	63.7	163	67.5	236	66.4	309	67
18	49.5	91	64.3	164	68.3	237	66	310	66.3
19	50.3	92	64.2	165	68.3	238	66.3	311	66.6
20	51.5	93	63.9	166	68.8	239	67	312	66.2
21	52.2	94	64.2	167	69.1	240	67.5	313	66.4
22	52.6	95	63.4	168	69.4	241	67.9	314	65.9
23	53	96	64	169	71.7	242	68.1	315	66.1
24	53.8	97	63.9	170	72.1	243	68.5	316	65.5
25	53.8	98	64	171	74.9	244	68.9	317	62.2
26	53.8	99	63.8	172	72.6	245	68.6	318	62.2
27	54.6	100	64	173	72.2	246	69.4	319	61.4
28	56.3	101	63.3	174	72.2	247	69.4	320	61.1
29	56.9	102	63.4	175	72	248	69.4	321	61.4
30	58.1	103	63.9	176	72.5	249	70	322	61.1
31	58.4	104	64	177	72.8	250	70.4	323	61.4
32	59.6	105	64.3	178	72.7	251	70.6	324	61.4
33	59.9	106	64.8	179	71.8	252	70.9	325	61.8
34	60.2	107	65.1	180	71.4	253	70.3	326	61.8
35	60.5	108	64	181	71.1	254	70.6	327	61.8
36	59.7	109	64.2	182	71.1	255	70.3	328	61.8
37	58.3	110	63.1	183	70.9	256	69.7	329	62.2
38	58.1	111	63.7	184	71	257	69.9	330	61.8
39	57.8	112	63.1	185	71	258	70.1	331	62.2
40	57.3	113	63.7	186	71.2	259	69.6	332	62.6
41	57.5	114	63.5	187	72.1	260	69.3	333	62.2
42	56.6	115	63	188	72.6	261	69.9	334	62.6
43	57	116	63.1	189	73.6	262	69.7	335	62.2
44	56.6	117	63	190	74.8	263	69.5	336	62.6
45	56.5	118	63.3	191	75.7	264	69.9	337	62.6
46	56.2	119	63.4	192	77.3	265	70.2	338	63
47	56.4	120	63.3	193	78.4	266	70.2	339	62.6
48	56.6	121	62.5	194	79.3	267	70.2	340	62.2
49	56.4	122	62.5	195	78.2	268	71	341	61.1
50	56.1	123	62.9	196	76	269	70.8	342	59.5
51	56	124	62.8	197	75.6	270	70.9	343	58.8
52	55.9	125	62.2	198	76.4	271	70.7	344	56.8
53	54.8	126	62.4	199	77.6	272	70.9	345	55.7
54	54.2	127	62.3	200	78	273	71.2	346	54.1
55	54.6	128	62.3	201	79.1	274	71.3	347	51.5
56	52.2	129	62.4	202	79.5	275	70.8	348	49.2
57	54.7	130	62.1	203	79.9	276	71.2	349	48.8
58	55.7	131	62.5	204	79.9	277	71.7	350	47.6
59	57	132	62.8	205	80.3	278	71.9	351	44.9
60	58	133	62.3	206	80.3	279	72.6	352	41.5
61	58.1	134	62.3	207	79.5	280	72.3	353	37.2
62	59.4	135	62.4	208	79.5	281	72.3	354	34.6
63	59.9	136	61.9	209	79.1	282	72.1	355	33
64	61	137	62.8	210	78.7	283	72	356	29.2
65	61.4	138	62.8	211	77.6	284	71.9	357	22.3
66	61.9	139	62.3	212	76.5	285	72.6	358	17.7
67	62.5	140	62.8	213	74.3	286	72.8	359	17.3
68	62.5	141	62.4	214	72.6	287	73.2	360	14
69	62.7	142	62.1	215	70.8	288	72.1	361	10
70	62.2	143	61.9	216	67.6	289	71.5	362	6
71	62.5	144	61.8	217	66.4	290	70.9	363	2
72	63.1	145	62.1	218	66.7	291	70.4	364	0
73	62.7	146	62.1	219	66.1	292	70.5	365	0

G. Hot 1435 Unified Cycle Driving Schedule.

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Hot 1435 Unified Test Cycle
(Speed vs Time Sequence)

Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)
1	0	74	12.3	147	20	220	0	293	0	366	45.3	439	60.3	512	28
2	0	75	8.1	148	23	221	0	294	0	367	46.5	440	60.3	513	26.5
3	0	76	6.1	149	25.7	222	0	295	0	368	48	441	60.3	514	24.2
4	0	77	9.6	150	28	223	0	296	0	369	48.8	442	59.5	515	22.7
5	0	78	12.7	151	30.7	224	0	297	0	370	49.5	443	58.8	516	20.4
6	0	79	15.7	152	32.6	225	0	298	0	371	49.9	444	59.1	517	17.7
7	0	80	18	153	34.2	226	0	299	0	372	49.9	445	58.8	518	15.7
8	0	81	20.4	154	35.3	227	0	300	0	373	49.9	446	58.8	519	13.1
9	0	82	21.9	155	36.9	228	0	301	0	374	49.5	447	58.8	520	10.8
10	0	83	23.4	156	36.9	229	0	302	0	375	49.5	448	58.4	521	8.4
11	0	84	23.8	157	37.2	230	0	303	0	376	48.8	449	58	522	7.3
12	0	85	24.6	158	37.6	231	0	304	0	377	48.8	450	58	523	5
13	0	86	25	159	37.6	232	0	305	0	378	48.8	451	58	524	3.8
14	0	87	26.1	160	37.6	233	0	306	0	379	48.4	452	58.4	525	3.5
15	0	88	26.1	161	37.2	234	0	307	0	380	48.8	453	59.1	526	1.9
16	0	89	26.9	162	37.2	235	0	308	0	381	49.5	454	59.5	527	0.8
17	0	90	26.9	163	36.9	236	0	309	0	382	50.3	455	59.9	528	0
18	0	91	26.9	164	36.5	237	0	310	0	383	50.7	456	59.9	529	0
19	0	92	26.5	165	36.5	238	1.5	311	0	384	51.8	457	60.3	530	0
20	0	93	25.7	166	34.9	239	5	312	0	385	52.6	458	61.1	531	0.8
21	1.2	94	21.9	167	33.4	240	8.8	313	0.4	386	53.4	459	61.1	532	1.9
22	4.2	95	16.5	168	31.9	241	11.5	314	2.7	387	54.1	460	61.1	533	3.8
23	7.3	96	10	169	29.2	242	14.2	315	7.3	388	55.3	461	61.4	534	6.9
24	8.8	97	4.6	170	25	243	15.4	316	11.5	389	55.3	462	61.4	535	9.6
25	10.8	98	1.5	171	25	244	16.1	317	15.4	390	56.1	463	61.1	536	11.1
26	12.3	99	0.4	172	26.1	245	16.1	318	18.4	391	56.4	464	60.7	537	11.1
27	13.1	100	0	173	27.6	246	16.9	319	20.7	392	56.4	465	59.9	538	10.4
28	12.3	101	0	174	29.2	247	16.5	320	24.2	393	56.4	466	59.1	539	8.8
29	12.3	102	0	175	31.1	248	16.9	321	26.9	394	57.2	467	59.1	540	9.2
30	11.5	103	0	176	32.3	249	18	322	29.6	395	56.8	468	59.1	541	10
31	11.5	104	0	177	34.2	250	19.2	323	31.1	396	57.6	469	59.9	542	10.4
32	11.1	105	0	178	34.9	251	20.4	324	32.6	397	57.6	470	59.5	543	10.4
33	11.1	106	0	179	35.7	252	20.4	325	33.8	398	57.6	471	59.9	544	5.4
34	11.1	107	0	180	36.5	253	21.1	326	34.9	399	58	472	58.8	545	1.9
35	13.1	108	0.4	181	36.9	254	21.1	327	36.9	400	58	473	58	546	0
36	15	109	1.2	182	36.9	255	22.3	328	39.2	401	58.4	474	57.6	547	0
37	16.9	110	1.9	183	37.2	256	23	329	41.1	402	58.4	475	56.8	548	0
38	16.9	111	3.8	184	37.6	257	23.8	330	43	403	58.8	476	56.1	549	0
39	16.1	112	7.7	185	37.2	258	24.2	331	43.8	404	59.1	477	55.3	550	0
40	15.7	113	11.5	186	37.6	259	24.6	332	44.5	405	58.8	478	54.1	551	0
41	15.4	114	14.6	187	38	260	25	333	45.3	406	58.8	479	52.6	552	0
42	15	115	18	188	38.4	261	25.7	334	45.3	407	58	480	49.2	553	0
43	13.8	116	21.5	189	39.2	262	25.7	335	44.9	408	58	481	46.1	554	0
44	10.8	117	25	190	39.6	263	26.5	336	44.5	409	57.6	482	43	555	0
45	8.4	118	28.4	191	39.9	264	27.6	337	43.8	410	57.6	483	37.2	556	0
46	6.1	119	30.7	192	40.7	265	28.4	338	43.4	411	57.6	484	29.6	557	0
47	4.2	120	31.9	193	40.3	266	29.2	339	42.6	412	57.6	485	21.5	558	0
48	3.5	121	32.3	194	41.1	267	30.3	340	41.9	413	57.6	486	16.5	559	0
49	3.5	122	32.3	195	41.1	268	31.1	341	41.5	414	59.1	487	15.7	560	0
50	1.5	123	31.9	196	40.7	269	31.1	342	40.7	415	59.5	488	18.4	561	0
51	0	124	30.3	197	31.9	270	30.7	343	40.3	416	59.9	489	21.5	562	0
52	0	125	28	198	23.9	271	31.1	344	41.1	417	60.3	490	25	563	0
53	0	126	24.2	199	15.9	272	29.6	345	41.5	418	60.3	491	27.3	564	0
54	0	127	20	200	7.9	273	29.2	346	42.6	419	61.1	492	29.2	565	0
55	0	128	16.1	201	2.7	274	29.2	347	43.4	420	60.3	493	30.7	566	0
56	0	129	11.5	202	0.4	275	28.8	348	44.2	421	59.9	494	31.5	567	0
57	0	130	8.1	203	0.4	276	28	349	44.9	422	59.5	495	31.1	568	0
58	0	131	5	204	2.7	277	23	350	45.7	423	59.1	496	31.1	569	0
59	0	132	3.5	205	3.8	278	21.1	351	46.5	424	59.1	497	30.3	570	0
60	0	133	1.9	206	3.8	279	21.5	352	46.8	425	59.5	498	30	571	0
61	0	134	0	207	1.5	280	20.7	353	47.2	426	59.5	499	30	572	0.4
62	0	135	0	208	0	281	20.7	354	48	427	59.5	500	29.6	573	1.5
63	1.2	136	0	209	0	282	19.6	355	47.6	428	59.9	501	30	574	3.5
64	3.5	137	0	210	0	283	16.5	356	48.4	429	60.3	502	28.8	575	6.1
65	7.7	138	0	211	0	284	13.1	357	48	430	60.7	503	28.8	576	10.4
66	11.1	139	0	212	0	285	9.6	358	47.2	431	60.7	504	28	577	14.2
67	13.8	140	0	213	0	286	7.3	359	46.1	432	61.4	505	28.4	578	16.9
68	16.5	141	0	214	0	287	3.8	360	45.7	433	61.8	506	28	579	19.2
69	18.4	142	0	215	0	288	0.8	361	44.9	434	61.8	507	28.4	580	20
70	20.4	143	1.5	216	0	289	0	362	44.2	435	61.8	508	28.4	581	21.5
71	20.7	144	6.9	217	0	290	0	363	43.8	436	61.8	509	28.8	582	23.4
72	19.6	145	12.7	218	0	291	0	364	44.5	437	61.1	510	28.4	583	24.6
73	17.3	146	16.5	219	0	292	0	365	44.9	438	60.7	511	28.4	584	24.2

Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)
585	20	651	24.6	717	28	783	20.4	849	30.7	915	63.4	981	38	1047	28
586	16.9	652	25	718	28	784	21.1	850	33.8	916	63	982	38	1048	23.8
587	13.4	653	26.5	719	27.6	785	22.3	851	37.6	917	63.4	983	38	1049	18.8
588	13.4	654	28	720	26.5	786	22.3	852	40.7	918	64.1	984	37.2	1050	11.9
589	15.7	655	29.6	721	24.6	787	22.7	853	43.8	919	64.9	985	36.9	1051	6.1
590	18.4	656	30.7	722	20.7	788	22.3	854	46.1	920	65.3	986	36.1	1052	1.5
591	21.1	657	32.3	723	16.5	789	22.7	855	48	921	64.5	987	35.7	1053	1.5
592	23.4	658	33	724	15	790	22.3	856	49.5	922	64.1	988	34.9	1054	4.2
593	25.3	659	34.2	725	14.2	791	23.8	857	51.5	923	63.4	989	34.9	1055	8.1
594	27.6	660	34.6	726	14.2	792	25.7	858	53	924	63.7	990	33.8	1056	10.4
595	28.8	661	35.3	727	13.8	793	27.6	859	54.5	925	63.4	991	31.5	1057	13.1
596	30.3	662	36.1	728	13.8	794	29.6	860	55.7	926	63.4	992	28.8	1058	15.4
597	30.7	663	36.1	729	11.9	795	30	861	56.8	927	63.4	993	25.7	1059	18
598	31.5	664	36.9	730	8.4	796	29.2	862	58	928	63.4	994	24.6	1060	20.4
599	31.1	665	36.9	731	4.2	797	27.6	863	59.1	929	63.7	995	23.4	1061	23
600	31.1	666	37.6	732	1.2	798	25	864	60.3	930	64.5	996	22.3	1062	25.3
601	30.3	667	37.6	733	0	799	23.8	865	61.1	931	65.3	997	21.5	1063	27.3
602	30.3	668	38.4	734	0	800	23.4	866	61.8	932	64.9	998	20	1064	28.8
603	30.3	669	38	735	0	801	24.2	867	61.8	933	63.7	999	20	1065	30.3
604	30.7	670	37.6	736	0	802	23.4	868	61.8	934	63	1000	19.2	1066	31.1
605	31.1	671	37.6	737	0	803	23	869	61.8	935	59.9	1001	19.2	1067	32.3
606	32.3	672	37.2	738	0	804	20.4	870	62.6	936	55.3	1002	18	1068	31.9
607	32.6	673	36.9	739	0	805	18.8	871	63.4	937	50.7	1003	11.9	1069	32.3
608	32.6	674	36.1	740	0	806	17.3	872	63	938	49.2	1004	6.9	1070	31.9
609	32.6	675	35.7	741	0	807	15	873	63	939	48	1005	2.7	1071	31.1
610	31.1	676	36.1	742	0	808	13.1	874	62.6	940	46.1	1006	0.8	1072	28.8
611	26.9	677	35.7	743	0	809	9.2	875	61.8	941	44.2	1007	0.4	1073	25
612	22.3	678	35.7	744	0	810	6.9	876	61.8	942	41.1	1008	0	1074	22.7
613	18	679	35.7	745	0	811	4.6	877	62.2	943	39.9	1009	0	1075	18.8
614	13.8	680	36.1	746	0	812	4.6	878	62.2	944	36.1	1010	0	1076	15.4
615	9.6	681	36.1	747	0	813	4.6	879	62.6	945	32.6	1011	0	1077	13.4
616	4.6	682	35.7	748	0	814	4.2	880	63.7	946	29.2	1012	0	1078	11.9
617	6.1	683	35.7	749	0	815	5.4	881	64.5	947	24.6	1013	0	1079	8.8
618	10	684	34.9	750	0	816	4.6	882	64.9	948	20.7	1014	0	1080	5
619	14.2	685	34.6	751	0	817	3.5	883	66	949	19.2	1015	0	1081	1.9
620	17.3	686	34.2	752	0	818	2.3	884	66	950	16.5	1016	0	1082	2.3
621	20	687	33.8	753	0	819	2.3	885	66.8	951	15	1017	0	1083	2.7
622	21.5	688	33.4	754	0	820	1.9	886	66.4	952	11.9	1018	0	1084	3.5
623	22.3	689	33	755	0	821	3.1	887	66.8	953	9.6	1019	0	1085	6.5
624	22.3	690	30.3	756	0	822	6.1	888	67.2	954	8.4	1020	0	1086	10.8
625	22.3	691	29.2	757	0	823	4.6	889	66.4	955	5.8	1021	0	1087	13.8
626	22.3	692	28.4	758	0	824	2.7	890	66.4	956	1.2	1022	0	1088	16.1
627	23	693	25	759	0	825	2.3	891	66	957	0	1023	0.4	1089	18.4
628	23	694	21.1	760	0	826	2.3	892	65.7	958	0	1024	2.7	1090	20.4
629	22.7	695	16.9	761	0	827	3.1	893	65.7	959	0	1025	6.1	1091	21.9
630	22.3	696	13.4	762	0	828	4.2	894	66.4	960	1.2	1026	9.2	1092	21.9
631	21.9	697	13.1	763	1.5	829	3.5	895	66	961	3.1	1027	11.5	1093	20.7
632	22.7	698	12.3	764	5.4	830	3.8	896	65.7	962	5	1028	14.2	1094	17.3
633	23.8	699	12.7	765	9.2	831	4.2	897	65.3	963	8.4	1029	16.1	1095	13.1
634	25	700	15.7	766	11.5	832	3.5	898	65.3	964	11.5	1030	18	1096	9.6
635	25.3	701	19.2	767	14.6	833	3.5	899	64.5	965	14.6	1031	20	1097	8.8
636	25.7	702	22.3	768	17.3	834	3.5	900	64.5	966	16.9	1032	21.5	1098	10.8
637	26.5	703	24.6	769	19.2	835	4.6	901	64.1	967	18.8	1033	23	1099	12.7
638	26.9	704	25.7	770	21.1	836	5.8	902	63.7	968	21.1	1034	24.2	1100	14.2
639	27.3	705	26.5	771	20.7	837	3.5	903	63.7	969	23.8	1035	25	1101	14.6
640	28	706	26.5	772	20.7	838	0.8	904	63.7	970	26.5	1036	25.7	1102	13.1
641	29.2	707	26.9	773	19.6	839	3.5	905	64.5	971	28	1037	26.9	1103	11.1
642	30	708	27.3	774	18.4	840	3.8	906	64.5	972	29.6	1038	27.6	1104	11.1
643	30	709	27.3	775	16.9	841	2.3	907	64.9	973	30.7	1039	27.6	1105	11.1
644	29.6	710	27.6	776	16.9	842	0	908	64.5	974	32.6	1040	28.4	1106	13.1
645	29.6	711	28.4	777	16.5	843	1.2	909	64.1	975	34.2	1041	29.2	1107	15.7
646	28.8	712	28.8	778	16.9	844	6.9	910	64.9	976	35.3	1042	29.2	1108	18.4
647	28.4	713	28.8	779	16.9	845	13.8	911	65.3	977	36.1	1043	30	1109	20.7
648	28	714	29.2	780	16.9	846	18.8	912	65.3	978	36.9	1044	29.6	1110	23.8
649	27.3	715	28.8	781	17.3	847	23.8	913	65.3	979	38	1045	29.6	1111	25.7
650	25.7	716	28.8	782	19.2	848	27.3	914	64.1	980	38	1046	28.8	1112	28

Hot 1435 Unified Test Cycle
(Speed vs Time Sequence)

Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)	Time (sec.)	Speed (mph)
1113	30	1154	14.6	1195	15.4	1236	0	1277	39.2	1318	37.2	1359	32.6	1400	11.1
1114	31.1	1155	12.3	1196	19.2	1237	0	1278	40.7	1319	36.5	1360	31.5	1401	13.1
1115	32.3	1156	9.2	1197	21.9	1238	0	1279	42.2	1320	34.6	1361	30	1402	15
1116	34.2	1157	5.8	1198	23.8	1239	0	1280	43.4	1321	31.5	1362	28.8	1403	16.9
1117	35.7	1158	1.9	1199	25	1240	3.5	1281	44.9	1322	29.6	1363	27.3	1404	16.9
1118	36.9	1159	0.4	1200	26.1	1241	10.4	1282	45.7	1323	29.2	1364	23.8	1405	16.1
1119	38.8	1160	0	1201	27.3	1242	15.4	1283	46.1	1324	28.8	1365	23	1406	15.7
1120	40.3	1161	0	1202	28.8	1243	17.3	1284	46.8	1325	28.8	1366	23	1407	15.4
1121	41.5	1162	0	1203	30	1244	17.3	1285	46.5	1326	28	1367	22.3	1408	15
1122	42.2	1163	0	1204	29.6	1245	18.4	1286	46.5	1327	28	1368	20.4	1409	13.8
1123	43	1164	0	1205	29.6	1246	21.5	1287	46.5	1328	28.4	1369	18.8	1410	10.8
1124	43.8	1165	0.4	1206	28.8	1247	24.6	1288	46.1	1329	29.6	1370	17.7	1411	8.4
1125	43.8	1166	4.2	1207	26.1	1248	27.3	1289	46.1	1330	30	1371	16.1	1412	6.1
1126	43.4	1167	9.2	1208	22.3	1249	30	1290	46.1	1331	30.3	1372	14.6	1413	4.2
1127	43	1168	11.9	1209	19.2	1250	31.5	1291	46.8	1332	29.2	1373	12.7	1414	3.5
1128	42.2	1169	14.2	1210	16.5	1251	31.9	1292	47.6	1333	26.5	1374	11.1	1415	3.5
1129	41.9	1170	15.7	1211	12.7	1252	32.6	1293	48	1334	25.3	1375	9.2	1416	1.5
1130	41.5	1171	15	1212	9.6	1253	33.4	1294	48.4	1335	25	1376	8.8	1417	0
1131	41.9	1172	14.2	1213	6.9	1254	34.9	1295	48	1336	24.6	1377	7.3	1418	0
1132	41.9	1173	13.4	1214	4.2	1255	36.5	1296	48	1337	24.6	1378	6.1	1419	0
1133	41.9	1174	13.8	1215	2.3	1256	37.6	1297	47.2	1338	25.3	1379	5	1420	0
1134	42.2	1175	14.6	1216	0.8	1257	39.2	1298	46.5	1339	26.1	1380	4.2	1421	0
1135	42.6	1176	14.6	1217	0	1258	40.3	1299	46.8	1340	27.3	1381	3.5	1422	0
1136	42.6	1177	14.2	1218	0	1259	40.7	1300	47.2	1341	28.4	1382	2.7	1423	0
1137	42.6	1178	16.1	1219	0	1260	41.1	1301	48.4	1342	29.2	1383	2.3	1424	0
1138	42.6	1179	15.7	1220	0	1261	40.7	1302	48.4	1343	29.2	1384	1.5	1425	0
1139	42.6	1180	15.7	1221	0	1262	40.7	1303	48.8	1344	29.6	1385	1.2	1426	0
1140	42.6	1181	14.6	1222	0	1263	40.7	1304	48.4	1345	30	1386	0	1427	0
1141	42.6	1182	13.1	1223	0	1264	41.5	1305	47.6	1346	31.1	1387	1.2	1428	0
1142	42.2	1183	10	1224	0	1265	42.6	1306	46.5	1347	32.6	1388	4.2	1429	0
1143	43	1184	7.3	1225	0	1266	43	1307	44.2	1348	33.8	1389	7.3	1430	0
1144	43.4	1185	3.5	1226	0	1267	44.5	1308	42.2	1349	34.6	1390	8.8	1431	0
1145	43	1186	0.8	1227	0	1268	45.3	1309	41.5	1350	34.9	1391	10.8	1432	0
1146	42.6	1187	0	1228	0	1269	45.3	1310	41.1	1351	34.6	1392	12.3	1433	0
1147	41.9	1188	0	1229	0	1270	44.9	1311	40.7	1352	34.9	1393	13.1	1434	0
1148	40.7	1189	0	1230	0	1271	43.4	1312	40.3	1353	34.6	1394	12.3	1435	0
1149	36.9	1190	0	1231	0	1272	40.3	1313	39.6	1354	34.9	1395	12.3		
1150	32.6	1191	0.4	1232	0	1273	38	1314	39.2	1355	34.9	1396	11.5		
1151	28	1192	2.7	1233	0	1274	36.1	1315	38.8	1356	34.9	1397	11.5		
1152	23.4	1193	7.3	1234	0	1275	36.5	1316	38	1357	34.2	1398	11.1		
1153	18.4	1194	11.5	1235	0	1276	38	1317	37.6	1358	33.8	1399	11.1		

ATTACHMENT A-4

California Environmental Protection Agency
AIR RESOURCES BOARD

CALIFORNIA NON-METHANE ORGANIC GAS TEST PROCEDURES

Adopted:	July 12, 1991
Amended:	September 22, 1993
Amended:	June 24, 1996
Amended:	August 5, 1999
Amended:	July 30, 2002
Amended:	March 22, 2012

Monitoring and Laboratory Division, Southern Laboratory Branch
Mobile Source Division
9528 Telstar Avenue
El Monte, California 91731

NOTE: Mention of any trade name or commercial product does not constitute endorsement or recommendation of this product by the Air Resources Board. Note: The proposed amendments to this document are shown in underline to indicate additions and strikeout to indicate deletions compared to the test procedures as last amended September 27, 2010. [No change] indicates proposed federal provisions that are also proposed for incorporation herein without change. Existing intervening text that is not amended in this rulemaking is indicated by "* * * *".

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APPENDICES

Part A

GENERAL APPLICABILITY AND REQUIREMENTS

1. These test procedures shall apply to all 1993 and subsequent model-year transitional low-emission vehicles (TLEV), low-emission vehicles (LEV), ultra-low-emission vehicles (ULEV), and super-ultra-low-emission vehicles (SULEV) certifying to non-methane organic gas (NMOG) emission standards.

2. This document sets forth the analysis and calculation procedures that shall be performed to determine NMOG mass emissions. The document consists of the following parts:

   A. General Applicability and Requirements
   B. Determination of Non-Methane Hydrocarbon Mass Emissions by Flame Ionization Detection
   C. Determination of Alcohols in Automotive Source Samples by Gas Chromatography (Method No. 1001)
   D. Determination of C_2 to C_5 Hydrocarbons in Automotive Source Samples by Gas Chromatography (Method No. 1002)
   E. Determination of C_6 to C_{12} Hydrocarbons in Automotive Source Samples by Gas Chromatography (Method No. 1003)
   F. Determination of Aldehyde and Ketone Compounds in Automotive Source Samples by High Performance Liquid Chromatography (Method No. 1004).
   G. Determination of NMOG Mass Emissions

Appendix 1 List of Light-End and Mid-Range Hydrocarbons
Appendix 2 Definitions and Commonly Used Abbreviations
Appendix 3 References

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.

3. The analyses specified in the table below shall be performed to determine mass emission rates of NMOG in grams per mile (g/mi) or milligrams per mile (mg/mi) for vehicles operated on the listed fuel:

Fuel	**NMHC by FID**	**NMHC by GC**	**Alcohols**	**Carbonyls**
Alcohol	X		X	X
CNG		X		X
Diesel	X			X
Gasoline	X			X
LPG	X			X

The specified analyses shall be performed in accordance with the following parts of this document:

NMHC by FID--	Part B.	Determination of Non-Methane Hydrocarbon Mass Emissions by Flame Ionization Detection
NMHC by GC--	Part D.	Determination of C_2 to C_5 Hydrocarbons in Automotive Source Samples by Gas Chromatography (Method No. 1002); and
	Part E.	Determination of C_6 to C_{12} Hydrocarbons in Automotive Source Samples by Gas Chromatography (Method No. 1003)
CARBONYLS--	Part F.	Determination of Aldehyde and Ketone Compounds in Automotive Source Samples by High Performance Liquid Chromatography (Method No. 1004)
ALCOHOLS --	Part C.	Determination of Alcohols in Automotive Source Samples by Gas Chromatography (Method No. 1001)

4. For those manufacturers that choose to develop reactivity adjustment factors unique to a specific engine family, exhaust NMOG emissions shall be fully speciated. NMHC emissions shall be analyzed in accordance with parts D and E (Method Nos. 1002 and 1003). In addition, aldehydes and ketones, alcohols, and ethers shall be analyzed according to parts F, C, and E (Method Nos. 1004, 1001, and 1003). Analysis for alcohols shall be required only for vehicles that are operated on fuels containing alcohols.

5. For natural gas-fueled vehicles, the methane concentration in the exhaust sample shall be measured with a methane analyzer. A GC combined with a FID is used for direct measurement of methane concentrations. SAE Recommended Practice J1151 is a reference on generally accepted GC principles and analytical techniques for this application. A density of 18.89 g/ft^3 shall be used to determine the methane mass emissions. The methane mass emissions shall be multiplied by the appropriate methane reactivity adjustment factor and then added to the reactivity-adjusted NMOG emissions as specified in the “California Exhaust Emission Standards and Test Procedures for 1988-2000 Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles” and in the “California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles.”

6. The mass of NMOG emissions shall be calculated in accordance with part G, “Determination of NMOG Mass Emissions”. The mass of NMOG emissions in g/mile or mg/mile shall be calculated by summing the mass of NMHC determined by the FID, the mass of aldehydes and ketones, and the mass of alcohols.

PART B

DETERMINATION OF NON-METHANE HYDROCARBON MASS EMISSIONS BY FLAME IONIZATION DETECTION

1. INTRODUCTION

1.1 This procedure describes a method for determining NMHC exhaust mass emissions from motor vehicles. Other applicable forms of instrumentation and analytical techniques which prove to yield equivalent results to those specified in this procedure may be used subject to the approval of the Executive Officer of the Air Resources Board.

1.2 All definitions and abbreviations are contained in Appendix 2 of these test procedures.

2. TOTAL HYDROCARBON MEASUREMENT

2.1 A FID is used to measure total hydrocarbon concentration in vehicle exhaust in accordance with the Code of Federal Regulations [Ref.1]. SAE Recommended Practices J254 [Ref. 2] and J1094a [Ref. 3] are references on generally accepted gas analysis and constant volume sampling techniques. For Beckman 400 FIDs only, implementation of the recommendations outlined in SAE paper 770141[Ref. 4] shall be required. Other FID analyzer models shall be checked and adjusted, if necessary, to minimize any non-uniformity of relative response to different hydrocarbons.

3. METHANE MEASUREMENT

3.1 A GC combined with a FID constitute a methane analyzer and shall be used for direct measurement of methane concentrations. The SAE Recommended Practice J1151[Ref. 5] is a reference on generally accepted GC principles and analytical techniques for this specific application.

4. TOTAL HC FID RESPONSE TO METHANE

4.1 The FID is calibrated to propane and therefore tends to over respond to the methane portion of the vehicle exhaust sample during hydrocarbon analysis. In order to calculate the NMHC concentration, a methane response factor must be applied to the methane concentration (as measured by the methane analyzer) before it can be deducted from the total hydrocarbon concentration. To determine the total hydrocarbon FID response to methane, known methane in air concentrations traceable to NIST shall be analyzed by the FID. Several methane concentrations shall be analyzed by the FID in the range of the exhaust sample concentration. The total hydrocarbon FID response to methane is calculated as follows:

$$r_{CH_4} = FID_{ppm}/SAM_{ppm}$$

where:

r_{CH_4}	=	FID methane response factor.
FID_{ppm}	=	FID reading in ppmC.
SAM_{ppm}	=	the known methane concentration in ppmC.

The FID response to methane shall be checked at each calibration interval.

5. NMHC MASS EMISSION PER TEST PHASE

5.1 The following calculations shall be used to determine the NMHC mass emissions for each phase of the Federal Test Procedure~~.~~ [Ref. 1].

5.2 **~~Non-Alcohol Fueled~~ All Vehicles**

5.2.1 $NMHC_e = FID\ THC_e - (r_{CH_4} * CH_{4e})$
NOTE: If $NMHC_e$ is calculated to be less than zero, then $NMHC_e = 0$.

5.2.2 $NMHC_d = FID\ THC_d - (r_{CH_4} * CH_{4d})$
NOTE: If $NMHC_d$ is calculated to be less than zero, then $NMHC_d = 0$.

5.2.3 $CO_e = (1 - (0.01 + 0.005 * HCR) * CO_{2e} - 0.000323 * R_a) * CO_{em}$
NOTE: If a CO instrument which meets the criteria specified in CFR 40, 86.111 is used and the conditioning column has been deleted, CO_{em} must be substituted directly for CO_e.

a) For gasoline, $CH_{1.85}$, where HCR = 1.85:
$CO_e = (1 - 0.01925 * CO_{2e} - 0.000323 * R_a) * CO_{em}$

b) For Phase 2 gasoline, $CH_{1.94}$, where HCR = 1.94:
$CO_e = (1 - 0.01970 * CO_{2e} - 0.000323 * R_a) * CO_{em}$

c) For LPG, $CH_{2.64}$, where HCR = 2.64:
$CO_e = (1 - 0.02320 * CO_{2e} - 0.000323 * R_a) * CO_{em}$

d) For CNG, $CH_{3.78}$, where HCR = 3.78:
$CO_e = (1 - 0.02890 * CO_{2e} - 0.000323 * R_a) * CO_{em}$

5.2.4 $$DF = \frac{100 * \left(\frac{x}{x + y/2 + 3.76 * (x + y/4 - z/2)}\right)}{CO_{2e} + (NMHC_e + CH_{4e} + CO_e) * 10^{-4}}$$

(where fuel composition is $C_xH_yO_z$ as measured for the fuel used~~.~~; this expression is generally normalized so that x = 1)

a) For gasoline, $CH_{1.85}$, where x = 1, y = 1.85, and z = 0:
$DF = 13.47 / [CO_{2e} + (NMHC_e + CH_{4e} + CO_e) * 10^{-4}]$

b) For Phase 2 gasoline, $CH_{1.94}$, x = 1, y = 1.94 and z = 0.017:
$DF = 13.29 / [CO_{2e} + (NMHC_e + CH_{4e} + CO_e) * 10^{-4}]$

c) For LPG, $CH_{2.64}$, where x = 1, y = 2.64, and z = 0:
$DF = 11.68 / [CO_{2e} + (NMHC_e + CH_{4e} + CO_e) * 10^{-4}]$

d) For CNG, $CH_{3.78}$, where x = 1, y = 3.78, and z = 0.016:
$DF = 9.83 / [CO_{2e} + (NMHC_e + CH_{4e} + CO_e) * 10^{-4}]$

e) For E85, $CH_{2.7841}O_{0.3835}$, Where x = 1, y = 2.7841, and z = 0.3835:
$DF = 12.4253 / [CO_{2e} + (NMHC_e + CH_{4e} + CO_e) * 10^{-4}]$

5.2.5 The density of the NMHC is determined using the carbon:hydrogen ratio of the fuel, $C_xH_yO_z$, according to the following equation:

$$NMHC_{dens} = (x * 12.01115 + y * 1.00797)(g/mole) * \left(\frac{28.316847\ liter/ft3}{24.055\ liter/mole}\right)$$

where: 12.01115 = atomic weight of carbon
1.00797 = atomic weight of hydrogen

~~5.3 **Vehicles Operating on Fuels Containing Methanol**~~

~~5.3.1 $NMHC_e = FID\ THC_e - (r_{CH_4} * CH_{4e}) - (r_{CH_3OH} * CH_3OH_e)$~~
~~NOTE: If $NMHC_e$ is calculated to be less than zero, then $NMHC_e = 0$.~~

~~5.3.2 $NMHC_d = FID\ THC_d - (r_{CH_4} * CH_{4d}) - (r_{CH_3OH} * CH_3OH_d)$~~
~~NOTE: If $NMHC_d$ is calculated to be less than zero, then $NMHC_d = 0$.~~

~~5.3.3 $CO_e = (1 - (0.01 + 0.005 * HCR) * CO_{2e} - 0.000323 * R_a) * CO_{em}$~~
~~NOTE: If a CO instrument which meets the criteria specified in CFR 40 86.111 is used and the conditioning column has been deleted, CO_{em} must be substituted directly for CO_e.~~

~~a) For M100 (100% methanol), CH_3OH, where HCR = 4:~~
~~$CO_e = (1 - 0.03000 * CO_{2e} - 0.000323 * R_a) * CO_{em}$~~

~~b) For M85 (85% methanol, 15% indolene), $CH_{3.41}O_{0.72}$, where HCR = 3.41:~~
~~$CO_e = (1 - 0.02705 * CO_{2e} - 0.000323 * R_a) * CO_{em}$~~

~~5.3.4~~ $$\cancel{DF = \frac{100 * \left(\frac{x}{x + y/2 + 3.76 * (x + y/4 - z/2)}\right)}{CO_{2e} + (NMHC_e + CH_{4e} + CO_e + CH_3OH_e + HCHO_e) * 10^{-4}}}$$

~~(where fuel composition is $C_xH_yO_z$ as measured for the fuel used.)~~

a) ~~For M100 (100% methanol), CH_3OH, where x = 1, y = 4, and z = 1:~~
~~$DF = 11.57 / [CO_{2e} + (NMHC_e + CH_{4e} + CO_e + CH_3OH_e + HCHO_e) * 10^{-4}]$~~

b) ~~For M85 (85% methanol, 15% Indolene), $CH_{3.41}O_{0.72}$, where x = 1, y = 3.41, and z = 0.72:~~
~~$DF = 12.02 / [CO_{2e} + (NMHC_e + CH_{4e} + CO_e + CH_3OH_e + HCHO_e) * 10^{-4}]$~~

~~5.4 **Vehicles Operating on Fuels Containing Ethanol**~~

~~5.4.1 $NMHC_e = FID\ THC_e - (r_{CH_4} * CH_{4e}) - (r_{C_2H_5OH} * C_2H_5OH_e)$~~
~~NOTE: If $NMHC_e$ is calculated to be less than zero, then $NMHC_e = 0$~~

~~5.4.2 $NMHC_d = FID\ THC_d - (r_{CH_4} * CH_{4d}) - (r_{C_2H_5OH} * C_2H_5OH_d)$~~
~~NOTE: If $NMHC_d$ is calculated to be less than zero, then $NMHC_d = 0$~~

~~5.4.3 $CO_e = (1 - (0.01 + 0.005 * HCR) * CO_{2e} - 0.000323 * R_a) * CO_{em}$~~
~~NOTE: If a CO instrument which meets the criteria specified in CFR 40, 86.111 is used and the conditioning column has been deleted, CO_{em} must be substituted directly for CO_e.~~

a) ~~For E100 (100% ethanol), C_2H_5OH, where HCR = 3:~~
~~$CO_e = (1 - 0.02500 * CO_{2e} - 0.000323 * R_a) * CO_{em}$~~

~~5.4.4~~
$$\cancel{DF = \frac{100 * \left(\frac{x}{x + y/2 + 3.76 * (x + y/4 - z/2)}\right)}{CO_{2e} + (NMHC_e + CH_{4e} + CO_e + C_2H_5OH_e + HCHO_e) * 10^{-4}}}$$

~~(where fuel composition is $C_xH_yO_z$ as measured for the fuel used.)~~

a) ~~For E100 (100% ethanol), C_2H_5OH, where x = 1, y = 3, and z = 0.5:~~
~~$DF = 12.29 / [CO_{2e} + (NMHC_e + CH_{4e} + CO_e + C_2H_5OH_e + HCHO_e) * 10^{-4}]$~~

~~5.5 **All Vehicles**~~

5.2.6~~5.1~~ $NMHC_{conc} = NMHC_e - NMHC_d * [1 - (1 / DF)]$
NOTE: If $NMHC_{conc}$ is calculated to be less than zero, then $NMHC_{conc} = 0$

5.2.7~~5.2~~ $NMHC_{mass_n} = NMHC_{conc} * NMHC_{dens} * VMIX * 10^{-6}$

6. TOTAL WEIGHTED NMHC MASS EMISSIONS

6.1 All Vehicles

6.1.1
$$NMHC_{wm} = 0.43 * \left(\frac{NMHC_{mass1} + NMHC_{mass2}}{D_{phase1} + D_{phase2}}\right) + 0.57 * \left(\frac{NMHC_{mass3} + NMHC_{mass2}}{D_{phase3} + D_{phase2}}\right)$$

7. SAMPLE CALCULATIONS

7.1 Given the following data for a gasoline vehicle operated on phase 2 certification fuel, $CH_{1.964}O_{0.0182}$, calculate the weighted NMHC mass emission.

Test Phase	FID THC_e (ppmC)	FID THC_d (ppmC)	CH_{4e} (ppmC)	CH_{4d} (ppmC)	CO_{em} (ppm)	CO_{2e} (%)	VMIX (ft^3)	$D_{phase\ n}$ (mile)	~~R_a (%)~~
1	21.928 ~~141.8~~	3.557 ~~8.6~~	3.667 ~~7.53~~	2.545 ~~5.27~~	94.758 ~~147.2~~	0.9581 ~~1.19~~	2745 ~~2846~~	3.610 ~~3.583~~	~~38~~
2	3.826 ~~13.0~~	3.533 ~~8.4~~	2.694 ~~5.68~~	2.490 ~~5.10~~	16.516 ~~20.8~~	0.5925 ~~0.80~~	4700 ~~4856~~	3.876 ~~3.848~~	~~38~~
3	4.242 ~~15.4~~	3.386 ~~8.9~~	2.769 ~~6.16~~	2.414 ~~5.20~~	11.524 ~~36.7~~	0.8225 ~~1.04~~	2738 ~~2839~~	3.611 ~~3.586~~	~~38~~

For Phase 1:

$NMHC_e$ = FID THC_e - (r_{CH_4} * CH_{4e})
= 21.928 ~~41.8~~ ppmC - (1.15 ~~1.04~~ * 3.667 ~~7.53~~ ppmC)
= 17.711 ~~33.97~~ ppmC

$NMHC_d$ = FID THC_d - (r_{CH_4} * CH_{4d})
= 3.557 ~~8.6~~ ppmC - (1.15 ~~1.04~~ * 2.545 ~~5.27~~ ppmC)
= 0.630 ~~3.12~~ ppmC

~~CO_e = (1 - 0.01925 * CO_{2e} – 0.000323 * R_a) * CO_{em}~~
~~NOTE: If a CO instrument which meets the criteria specified in CFR 40, 86.111 is used and the conditioning column has been deleted, CO_{em} must be substituted directly for CO_e .~~

~~= (1 - 0.01925 * 1.19% - 0.000323 * 38%) * 147.18 ppm~~
~~= 142.0 ppm~~

The numerator of the DF
= 100 * (x / (x + y/2 + 3.76 * (x + y/4 – z/2))
= 100 * (1 / 1 + 1.964 / 2 + 3.76 * (1 + 1.964 / 4 – 0.0182 / 2)
= 13.2381

DF = 13.2381 ~~13.47~~ ÷ [CO_{2e} + ($NMHC_e$ + CH_{4e} + CO_e) * 10^{-4}]

$$DF = \frac{13.2381}{0.9581 + (17.711\ ppmC + 3.667\ ppmC + 94.758\ ppmC) * 10^{-4}}$$

$$\cancel{DF = \frac{13.47}{1.19\% + (33.97\ ppmC + 7.53\ ppmC + 142.0\ ppmC) * 10^{-4}}}$$

= ~~11.15~~ 13.653

$NMHC_{conc}$ = $NMHC_e$ - $NMHC_d$ * [1 - (1 ÷ DF)]

~~= 33.97 ppmC - 3.12 ppmC * [1- (1÷11.15)]~~
= 17.711 ppmC – 0.630 ppmC * [1 - (1 ÷ 13.653)]
= 17.127 ~~31.13~~ ppmC

$$NMHC_{dens} = (x * 12.01115 + y * 1.00797)(g / mole) * \left(\frac{28.316847 \text{liter/ft3}}{24.0547 \text{liter/mole}}\right)$$

$NMHC_{dens}$ = (1 * 12.01115 + 1.964 *1.00797)* (28.316847/24.055)
= 16.470 g/ft^3

$NMHC_{mass\ n}$ = $NMHC_{conc}$ * $NMHC_{dens}$ * VMIX * 10^{-6}
= 17.127 ~~31.13~~ ppmC * 16.47~~33~~ g/ft^3 * 2745 ~~2846~~ ft^3 * 10^{-6}

$NMHC_{mass\ 1}$ = 0.7743 ~~1.45~~ g

Similarly, for Phase 2: $NMHC_{mass\ 2}$ = 0.0068 ~~0.33~~ g
and for Phase 3: $NMHC_{mass\ 3}$ = 0.0219 ~~0.27~~ g

Therefore,

$$NMHC_{wm} = 0.43 * \left(\frac{NMHC_{mass1} + NMHC_{mass2}}{D_{phase1} + D_{phase2}}\right) + 0.57 * \left(\frac{NMHC_{mass3} + NMHC_{mass2}}{D_{phase3} + D_{phase2}}\right)$$

$$\cancel{NMHC_{wm} = 0.43 * \left(\frac{1.45\,g + 0.33\,g}{3.583 \text{ miles} + 3.848 \text{ miles}}\right) + 0.57 * \left(\frac{0.27\,g + 0.33\,g}{3.586 \text{ miles} + 3.848 \text{ miles}}\right)}$$

$$NMHC_{wm} = 0.43 * \left(\frac{0.768\,g + 0.0068\,g}{3.610 \text{ miles} + 3.876 \text{ miles}}\right) + 0.57 * \left(\frac{0.0217\,g + 0.0068\,g}{3.611 \text{ miles} + 3.876 \text{ miles}}\right)$$

$NMHC_{wm}$ = 0.047 ~~0.15~~ g/mile

7.2 Given the following data for a vehicle operating on 10~~85~~% ~~m~~ethanol and 90~~15~~% gasoline (E10 ~~M-85~~) $CH_{2.7841}O_{0.3835}$, calculate the weighted NMHC mass emission.

~~Test Phase~~	~~FID THC_e (ppmC)~~	~~FID THC_d (ppmC)~~	~~CH_{4e} (ppmC)~~	~~CH_{4d} (ppmc)~~	~~CH_3OH_e (ppm)~~	~~CO_{em} (ppm)~~	~~CO_{2e} (%)~~	~~VMIX (ft^3)~~	~~$D_{phase\ n}$ (mile)~~	~~R_a (%)~~	~~$HCHO_e$ (ppm)~~
~~1~~	~~88.5~~	~~5.5~~	~~17.76~~	~~2.82~~	~~72.9~~	~~303.2~~	~~1.28~~	~~2832~~	~~3.570~~	~~32~~	~~0.96~~
~~2~~	~~14.5~~	~~7.0~~	~~8.01~~	~~2.82~~	~~5.1~~	~~9.7~~	~~0.83~~	~~4827~~	~~3.850~~	~~32~~	~~0.10~~
~~3~~	~~21.8~~	~~7.7~~	~~10.13~~	~~2.93~~	~~7.4~~	~~18.2~~	~~1.13~~	~~2825~~	~~3.586~~	~~32~~	~~0.12~~

Test Phase	FID THC_e (ppmC)	FID THC_d (ppmC)	CH_{4e} (ppmC)	CH_{4d} (ppmC)	CO_{em} (ppm)	CO_{2e} (%)	VMIX (ft^3)	$D_{phase\ n}$ (mile)
1	14.398	2.971	3.639	2.125	97.83	0.9203	3508	3.590
2	2.882	2.830	2.176	2.010	12.25	0.5935	6010	3.858
3	3.976	2.642	2.621	2.058	19.86	0.7624	3502	3.581

~~[For this example, CH_3OH_d was assumed to be 0.0 ppmC for all three background bag samples.]~~

For Phase 1:

$$NMHC_e = \text{FID } THC_e - (r_{CH_4} * CH_{4e}) \cancel{- (r_{CH_3OH} * CH_3OH_e)}$$
$$= \underline{14.398}\ \cancel{88.5}\ \text{ppmC} - (\underline{1.15}\ \cancel{1.04} * \underline{2.215}\ \cancel{17.76}\ \text{ppmC}) \cancel{- (0.66*72.9\ \text{ppmC})}$$
$$= \underline{10.213}\ \cancel{21.92}\ \text{ppmC}$$

$$NMHC_d = \text{FID } THC_d - (r_{CH_4} * CH_{4d}) \cancel{- (r_{CH_3OH} * CH_3OH_d)}$$
$$= \underline{2.971}\ \cancel{5.5}\ \text{ppmC} - (\underline{1.15}\ \cancel{1.04} * \underline{2.125}\ \cancel{2.82}\ \text{ppmC}) \cancel{- (0.66*0.0\ \text{ppmC})}$$
$$= \underline{0.527}\ \cancel{2.57}\ \text{ppmC}$$

$$\cancel{CO_e = (1 - 0.02705 * CO_{2e} - 0.000323 * R_a) * CO_{em}}$$

~~NOTE: If a CO instrument which meets the criteria specified in CFR 40, 86.111 is used and the conditioning column has been deleted, CO_{em} must be substituted directly for CO_e.~~

$$\cancel{= (1 - 0.02705 * 1.28\% - 0.000323 * 32\%) * 303.2\ \text{ppm}}$$
$$\cancel{= 289.6\ \text{ppm}}$$

$$DF = \underline{13.511}\ \cancel{12.02} \div [CO_{2e} + (NMHC_e + CH_{4e} + CO_e \cancel{+ CH_3OH_e + HCHO_e}) * 10^{-4}]$$

$$\cancel{= \frac{12.02}{1.28\% + (21.92\ \text{ppmC} + 17.76\ \text{ppmC} + 289.6\ \text{ppmC} + 72.9\text{ppmC} + 0.96\text{ppmC}) * 10^{-4}}}$$

$$= \frac{13.511}{0.9203 + (10.213\ \text{ppmC} + 3.639\ \text{ppmC} + 97.83\ \text{ppmC}) * 10^{-4}}$$

$$= \underline{14.505}\ \cancel{9.10}$$

$$NMHC_{conc} = NMHC_e - NMHC_d * [1 - (1 / DF)]$$
$$= \underline{10.213}\ \cancel{21.92}\ \text{ppmC} \underline{- 0.527}\ \cancel{2.57}\ \text{ppmC} * [1 - (1 / \underline{14.505}\ \cancel{9.10})]$$
$$= \underline{9.722}\ \cancel{19.63}\ \text{ppmC}$$

$$NMHC_{mass\ n} = NMHC_{conc} * NMHC_{dens} * VMIX * 10^{-6}$$

$$NMHC_{mass\ 1} = \underline{0.558}\ \cancel{0.91}\ \text{g}$$

Similarly, Phase 2: $NMHC_{mass\ 2}$ = 0.0 g
and for Phase 3: $NMHC_{mass\ 3}$ = ~~0.10~~ 0.040 g

Therefore,

$$NMHC_{wm} = 0.43 * \left(\frac{NMHC_{mass1} + NMHC_{mass2}}{D_{phase1} + D_{phase2}} \right) + 0.57 * \left(\frac{NMHC_{mass3} + NMHC_{mass2}}{D_{phase3} + D_{phase2}} \right)$$

$$\cancel{NMHC_{wm} = 0.43 * \left(\frac{0.91\,g + 0.00\,g}{3.570\text{ miles} + 3.850\text{ miles}} \right) + 0.57 * \left(\frac{0.10\,g + 0.00\,g}{3.586\text{ miles} + 3.850\text{ miles}} \right)}$$

$$\underline{NMHC_{wm} = 0.43 * \left(\frac{0.558\,g + 0.00\,g}{3.590\text{ miles} + 3.858\text{ miles}} \right) + 0.57 * \left(\frac{0.040\,g + 0.00\,g}{3.581\text{ miles} + 3.858\text{ miles}} \right)}$$

~~$NMHC_{wm}$ = 0.06 g/mile~~

$NMHC_{wm}$ = 0.035 g/mile

Part C

DETERMINATION OF ALCOHOLS IN AUTOMOTIVE SOURCE SAMPLES BY GAS CHROMATOGRAPHY

METHOD NO. 1001

1. INTRODUCTION

1.1 This document describes a method of sampling and analyzing automotive source samples ~~exhaust~~ for alcohols ~~in the range of 1 to 1200 µg per 15 mL of solution~~. ~~The "target" alcohols that shall be analyzed and reported by this method are methanol and ethanol. These alcohols, when measured in concentrations above the LOD, shall be reported~~.

1.2 This procedure is based on a method developed by the U. S. Environmental Protection Agency, (U.S. EPA) [Ref -6] which involves flowing diluted engine exhaust through deionized or purified water contained in glass impingers and analyzing this solution by gas chromatography~~-~~.

1.3 The "target" alcohols (compounds of interest) that shall be measured by this method are methanol and ethanol in the range of 1 to 1200 µg per 15 mL of impinger solution. These alcohols, when measured in concentrations above the LOD, shall be reported.

1.3.1 For the purpose of calculating NMOG for vehicles tested on exhaust emission test fuel containing ethanol (see Part G, Determination of NMOG Mass Emissions):

1.3.1.1 The only alcohol that needs to be reported from this method is ethanol.

1.3.1.2 The analysis of methanol is also within the scope of this analytical method and its measurement may provide meaningful information to the laboratory. However, its measurement is not required.

1.4 Other applicable forms of instrumentation and analytical techniques may be used if shown to yield results equivalent to those specified in this procedure and if approved in advance by the Executive Officer of the Air Resources Board.

1.5 All definitions and abbreviations are contained in Appendix 2 of these test procedures.

2. METHOD SUMMARY

2.1 The samples are received by the laboratory in impingers. Compound separation and analysis are performed using a GC. The sample is injected into the GC by means of a liquid autosampler. Separation of the sample mixture into its components is performed by a temperature-programmed capillary column. A FID is used for alcohol detection and quantification.

2.2 The computerized GC data system identifies the alcohol associated with each peak. The alcohol concentrations are determined by integrating the peak areas and using response factors determined from external standards.

3. INTERFERENCES AND LIMITATIONS

3.1 An ~~interferent~~ interfering compound is any component present in the sample with a retention time similar to that of any -target alcohol described in this method. To reduce interference error, proof of chemical identity may require periodic confirmations using an alternate method and/or instrumentation, e.g., GC/MS.

3.2 The concentration of the alcohols in the range of interest is stable for up to six days as long as the samples are sealed and refrigerated at a temperature below 40^oF.

3.3 To avoid sample loss and/or contamination, samples should be analyzed or transferred from the impingers to tightly sealed storage bottles as soon as possible after collection.

4. INSTRUMENTATION AND APPARATUS

4.1 For each mode of the CVS test, two sampling impingers, each containing a known amount of deionized or purified water (e.g. 15 mL for this procedure), are used to contain the sample.

4.1.1 A temperature-programmable GC, equipped with a DB-Wax type ~~Megabore~~ column ~~(~~[typically 30 m, 0.53 mm ID (Megabore), 1.0 μ film thickness]~~)~~ and FID, is used. Other columns may be used, provided the alternate(s) can be demonstrated to the ARB to be equivalent or better with respect to precision, accuracy and resolution of all the target alcohols.

4.1.2 A liquid injection autosampler is required.

4.1.3 A PC-controlled data acquisition system for quantifying peak areas is required.

5. REAGENTS AND MATERIALS

5.1 Methanol shall have a purity of 99.9 percent, or be high performance liquid chromatography grade, EM Science or equivalent.

5.2 Ethanol shall be absolute, ACS reagent grade.

5.3 ASTM Type I purified or Type II deionized water shall be used.

5.4 Stock solutions are prepared gravimetrically or volumetrically by diluting methanol and ethanol with deionized or purified water, e.g., for this method a typical stock solution contains approximately 10 mg/mL of each target alcohol. Stock solutions must be replaced at least every six months.

5.4.1 A **calibration standard** within the expected concentration range of the samples is prepared by successive dilutions of the stock solution with deionized or purified water. ~~; 3 to 50 µg/mL is typical, depending on fuel type. Calibration standards must be replaced at least every week.~~

5.4.1.1 Typical calibration standards range from 3 to 100 µg/mL for exhaust emission testing, depending on fuel type.

5.4.1.2 Evaporative emission testing may require calibration standards as high as 1000 µg/mL due to higher sample concentration.

5.4.1.3 Calibration standards must be replaced frequently to avoid degradation of the standard. Standards with concentrations of 100 µg/mL or less should be replaced weekly.

5.4.2 A **control standard** containing all target alcohols is prepared by successive dilutions of a stock solution different from that ~~of~~ used in Section 5.4.1. This standard, at an approximate concentration of the samples, is used to monitor the precision of the analysis of each target alcohol. Control standards must be replaced at least every week.

5.4.3 Standards used for linearity and LOD determinations (Section 8) are also prepared by successive dilutions of an appropriate level stock solution.

5.4.4 Standards may also be purchased (e.g., NIST).

5.4.5 All standards should be refrigerated at a temperature below 40^{o}F during storage.

5.5 Gas requirements.

5.5.1 Air shall be “Zero” grade (<1 ppmC total hydrocarbon contamination) or better.

5.5.2 Nitrogen shall have a minimum purity of 99.998 percent.

5.5.3 Helium shall have a minimum purity of 99.995 percent.

5.5.4 Hydrogen shall have a minimum purity of 99.995 percent.

6. PROCEDURE

6.1 Each of the graduated sampling impingers is filled with 15 mL of deionized or purified water.

6.2 The impingers are placed in an ice bath during the sample collection.

6.3 After sampling, the solution contained in each impinger is transferred to a vial and sealed.

6.3.1 Samples shall be refrigerated at a temperature below 40^{o}F if immediate analysis is not feasible, or if reanalysis at a later date may be required.

6.4 One microliter aliquots of unmodified samples are injected via autosampler into a GC. ~~Suggested~~ Typical standard operating conditions for the GC are:

Column:	DB-Wax, 30 m, 0.53 mm ID, 1.0μ film thickness
Carrier gas flow:	Helium at 5 mL/min
Make-up gas flow:	Nitrogen at 25 mL/min
Detector:	FID, hydrogen at 30 mL/min and air at 300 mL/min
Injector:	Packed column injector with Megabore adapter insert; on-column injection
Column temperature:	50^{o}C (1 min)~~,~~ 50^{o}C to 70^{o}C (5^{o}C/min)~~,~~ 70^{o}C to 110^{o}C (15^{o}C/min)~~,~~ 110^{o}C (4 min)
Data system:	PC-based data acquisition system

6.5 Samples containing compounds having concentrations above the documented range of instrument linearity must be diluted and reanalyzed.

6.6 The peak integrations are corrected as necessary in the data system. Any misplaced baseline segments are corrected in the reconstructed chromatogram.

6.7 The peak identifications provided by the computer are checked and corrected if necessary.

7. CALCULATIONS

7.1 The concentration of each target alcohol, in µg/mL, is determined by the following calculation that ~~compares~~ relates the sample peak area to ~~with~~ that of an external standard:

$$\text{Concentration } (\mu g/mL)_{sample} = \text{Peak Area}_{sample} \times \text{Response Factor}$$

where the response factor (RF) is calculated during the calibration by:

$$RF = \frac{\text{Concentration}_{\text{standard}\,(\mu g/mL)}}{\text{Peak Area}_{\text{standard}}}$$

7.2 Sample batches that span a broad concentration range (several orders of magnitude) should use more than one calibration level.

7.2.1 Each sample concentration would then be calculated by using a standard of similar concentration to calculate the response factor, as in Section 7.1.

7.2.2 A multipoint calibration curve calculated by the GC software (e.g., Varian Star 6.0) may be used instead of the one-point calibration described in Section 7.1.

7.3 This concentration is then used to calculate the total amount of alcohol in each impinger:

$$\text{Mass } (\mu g) = \text{Concentration } (\mu g/mL) \times \text{Impinger volume } (mL)$$

7.4 An internal standard method may also be used.

8. QUALITY CONTROL

8.1 Blank Run - A deionized or purified water blank is run each analysis day. All target alcohol concentrations from the blank analysis must be below the LOD before the analysis may proceed.

8.1.1 If the blank shows a peak greater than the limit of detection (LOD) in the region of interest, the source of the contamination must be investigated and remedied.

8.2 Calibration Run - The calibration standard is analyzed each analysis day to generate the response factor used to quantify the sample concentrations.

8.3 Control Standard Run - The quality control standard is analyzed at least once each analysis day. Measurements of all target alcohols in the control standard must fall within the control limits to ensure the validity of the sample analyses that day. To meet this requirement, it may be necessary to inspect and repair the GC, and rerun the calibration and/or control standards.

8.4 Control Charts - A quality control chart is maintained for each analyte in the control standard. The control charts, used on a daily basis, establish that the method is “in-control”. The following describes how to construct a typical control chart:

1. Obtain at least 20 daily control standard results;
2. Calculate the control standard mean concentration and standard deviation for the target analyte; and
3. Create a control chart for the target analyte by placing the concentration on the Y-axis and the date on the X-axis. Establish upper and lower warning limits at either two standard deviations (2s) or 5 percent, whichever is greater, above and below the average concentration. Establish ~~an~~ upper and lower control limits at either three standard deviations (3s) or 5 percent, whichever is greater, above and below the average concentration.
4. A control standard measurement is considered to be out-of-control when the analyzed value exceeds the control limit or two successive control standard measurements of the same analyte exceed the warning limit.
5. If 20 control standard results are not yet available to create a control chart (e.g., the control standard was expended and replaced with a different concentration standard prior to obtaining 20 points with the new standard), measurements must be within 10% of the theoretical concentration.

The measured concentrations of all target analytes contained in the control standard must be within the control limits (“in-control”) for the sample results to be considered acceptable.

8.5 Duplicates - A duplicate analysis of one sample is performed at least once per analysis day. The relative percent difference (RPD) is calculated for each duplicate run:

$$\mathrm{RPD}(\%) = \frac{\left|\text{Difference between duplicate and original measurements}\right|}{\text{Average of duplicate and original measurements}} * 100$$

For each compound, the allowable RPD depends on the average concentration level for the duplicate runs, as shown in the following table:

Average Measurement for Duplicate Runs		Allowable RPD (%)
1 to 10	times LOD	100
10 to 20	“ “	30
20 to 50	“ “	20
Greater than 50	“ “	15

If the results of the duplicate analyses do not meet these criteria for all target alcohols, the sample may be reanalyzed. If reanalysis is not feasible or if the criteria are still not met on reanalysis, all sample results for that analysis day are invalid.

8.6 Linearity - A multipoint calibration to confirm instrument linearity is performed for all target alcohols for new instruments, after making instrument modifications that can affect linearity, and at least once every year. The multipoint calibration consists of at least five concentration or mass loading levels, each above the LOD, distributed over the range of expected sample concentration. Each concentration level is measured at least twice. A linear regression analysis is performed using concentration and area counts to determine the regression correlation coefficient (r). The r must be greater than 0.995 to be considered sufficiently linear for one point calibrations.

8.7 Limit of Detection - The LOD for the target alcohols must be determined for new instruments, after making instrument modifications that can affect the LOD and at least once every year. To make the calculations, it is necessary to perform a multipoint calibration consisting of at least four “low” concentration levels, each above the expected LOD, with at least five replicate determinations of the lowest concentration standard. A linear regression is performed and the standard deviation (in area counts) of the lowest concentration standard determined. The standard deviation is converted to concentration units using the slope of the linear regression:

$$s = s_a \div m$$

where m is the slope of the linear regression, s is the standard deviation (in concentration units) of the lowest concentration standard and s_a is the standard deviation (in area counts) of the lowest concentration standard.

The LOD must be calculated using the following equation [Ref. 12]:

$$LOD = t * s$$

where s is the standard deviation (in concentration units) of at least five replicate determinations of the lowest concentration standard and t is the t-factor for 99 percent confidence for a one-sided normal (Gaussian) distribution. The number of degrees of freedom is equal to the number of replicates, minus one. An abbreviated t–table is:

Degrees of Freedom	t-value
4	3.7
5	3.4
6	3.1
7	3.0

The lowest standard must be of a concentration of one to five times the estimated LOD.

8.7.1 The maximum allowable LOD for each alcohol is 0.10 µg/mL. The calculated laboratory LOD must be equal to or lower than the maximum allowable LOD. All peaks identified as target compounds that are equal to or exceed the maximum allowable LOD must be reported. If the calculated laboratory LOD is less than the maximum allowable LOD, the laboratory may choose to set its reporting limit at the maximum allowable LOD, the calculated laboratory LOD, or any level in between.

8.7.2 For the purpose of calculating the total mass of all species, the concentrations of the compounds below the LOD are considered to be zero.

Part D

DETERMINATION OF C_2 TO C_5 HYDROCARBONS IN AUTOMOTIVE SOURCE SAMPLES BY GAS CHROMATOGRAPHY

METHOD NO. 1002

1. **INTRODUCTION**

1.1 This document describes a gas chromatographic method of ~~analyzing~~ measuring C_2 to C_5 hydrocarbons (light-end hydrocarbons) in the ppbC range from automotive source samples. This method does not include sample collection procedures [Ref. 8]. The "target" hydrocarbons (compounds of interest) that shall be analyzed and reported by this method and Method 1003 are listed in Appendix 1. All compounds on this list, when measured in concentrations above the LOD, shall be measured and reported ("targeted") by either Method 1002 or Method 1003. Each laboratory should divide the list into light-end (Method 1002) and mid-range (Method 1003) hydrocarbons in the manner that best suits the laboratory instrumentation. All compounds on the list not targeted by Method 1002 must be targeted by Method 1003.

1.2 Other applicable forms of instrumentation and analytical techniques may be used if shown to yield results equivalent to those specified in this procedure and if approved in advance by the Executive Officer of the Air Resources Board.

1.3 All definitions and abbreviations are contained in Appendix 2 of these test procedures.

2. **METHOD SUMMARY**

2.1 This is a method intended for routine analysis.

2.2 The samples are received by the laboratory in ~~Tedlar~~ Kynar® bags, which are sub-sampled into a GC for separation and analysis.

2.3 The gas chromatographic analysis is performed on an Alumina (Al_20_3) PLOT column temperature programmed from 0^oC to 200^oC. An FID is used for detection and quantification.

2.4 The sample is injected into the GC by means of gas sampling valves. Separation of the sample hydrocarbon mixture into its components takes place in the chromatographic column. The chromatographic column and the corresponding operating parameters described in this method normally provide complete resolution of most target compounds.

2.5 The computerized GC data acquisition system identifies the hydrocarbons associated with each peak. The hydrocarbon concentrations are determined by integrating the peak areas and using response factors determined from NIST-traceable standards.

3. INTERFERENCES AND LIMITATIONS

3.1 An ~~interferent~~ <u>interfering compound</u> is any component present in the sample with a retention time very similar to that of any target hydrocarbon described in this method. To reduce interference error, proof of chemical identity may require periodic confirmations using an alternate method and/or instrumentation, e.g., GC/MS, PID, different column, etc.

3.2 To maximize sample integrity, sample bags should not leak or be exposed to bright light or excessive heat. Sampling bags must be shielded from direct sunlight to avoid photochemically induced reactions of any reactive hydrocarbons. The compound 1,3-butadiene, resulting mostly during cold-start testing<u>,</u> is unstable. Therefore all cold-start samples must be analyzed within 8 hours; all other samples must be analyzed within 24 hours, although analysis within 8 hours is recommended.

4. INSTRUMENTS AND APPARATUS

4.1 ~~Tedlar~~ <u>Kynar® (polyvinylidene fluoride)</u> bags, ~~2~~ <u>4</u> mil in thickness, nominally 5 to 10 liters in capacity and equipped with quick-connect fittings, are <u>typically</u> used to contain the samples. <u>Other sample collection containers, such as bags made of Tedlar® (polyvinyl fluoride) film or nickel-coated stainless steel canisters, may be used, provided they are made of non-reactive material and do not cause sample loss or contamination.</u>

4.2 For manual sub-sampling into a GC, a ground glass syringe is used to transfer gaseous samples from Tedlar bags to the GC sample inlet. For automated systems, a sample loop is used to transfer gaseous samples from the Tedlar bag to the sample inlet of the GC. Sample aliquot size is chosen based on considerations of instrument sensitivity and/or linearity.

4.3 A temperature-programmable GC equipped with a gas sampling valve system, a FID, and accessories is required.

4.4 An Alumina PLOT column (<u>typically</u> 50 m x 0.32 mm) is used. A wax precolumn is recommended to prevent water damage to the PLOT column. Other columns may be used, provided the alternate(s) can be demonstrated <u>to the ARB</u> to be equivalent or better with respect to precision, accuracy and resolution of all the target hydrocarbons.

4.5 A sample trap capable of being cryogenically cooled may be used.

4.6 Data acquisition software is used to integrate peak areas to determine hydrocarbon concentrations.

5. REAGENTS AND MATERIALS

5.1 Helium shall have a minimum purity of 99.995 percent. Higher purity helium may be required to achieve the LOD required by Section 8.7.1.

5.2 Hydrogen shall have a minimum purity of 99.995 percent.

5.3 Air shall be "Zero" grade (<1 ppmC total hydrocarbon contamination) or better.

5.4 Nitrogen shall have a minimum purity of 99.998 percent.

5.5 Calibration Standard - The quantitative calibration standard for all target hydrocarbons shall be propane at a concentration level between 0.25 and 1 ppm-mole and within the calculated linearity of the method. (See Section 8.6.) This propane standard must be a NIST-certified SRM or secondary NIST-traceable standard. A secondary standard is obtained by a comparison between a SRM and a candidate standard.

5.6 Control Standard - A quality control standard, containing at least ethene, propane, n-butane, and 2-methylpropene with concentrations between 0.2 and 3 ppmC based on a propane standard, is used for the following purposes:

1. Daily update of control charts, and
2. Daily determination of marker retention time windows.

5.7 A high concentration standard (higher than the calibration standard), containing the target hydrocarbons listed in Section 5.6, is used for linearity determinations. The high concentration standard must have concentrations verified against a NIST-traceable propane standard. (See Section 5.5 for the definition of NIST-traceable.) This verification can be performed at the laboratory performing the analysis.

5.8 A low concentration standard (one to five times the estimated LOD), containing the target hydrocarbons listed in Section 5.6, is used for LOD determinations. The low concentration standard must have concentrations verified against a NIST-traceable propane standard. (See Section 5.5 for the definition of NIST-traceable.) This verification can be performed at the laboratory performing the analysis.

5.8.1 In lieu of a low concentration standard, a higher concentration standard may be diluted.

5.9 Liquid nitrogen may be required to cool the cryogenic sample trap and column oven where applicable.

6. PROCEDURE

6.1 The gaseous sample is analyzed for the target hydrocarbons C_2 through C_5.

6.2 ~~Suggested~~ Typical standard operating conditions for the automated gas chromatograph are:

Helium carrier gas flow ~~velocity~~:	~~30 cm/sec~~ 2.2 mL/min at 200^{0}C
Detector (0.010" FID)	
Temperature:	250^{0}C or higher
Nitrogen make-up gas flow:	sufficient such that the total flow of helium plus nitrogen is ~~30~~ 25 mL/min
Hydrogen gas flow:	~~30~~ 25 mL/min
Air flow:	300 mL/min
Range 12, attenuation 8 (or another suitable value)	
Sample loop/valve temperature:	150^{0}C (PLOT column)
Cryotrap temperature:	-180^{0}C (hold to trap hydrocarbons) 200^{0}C (heat to release) hydrocarbons)
Precolumn oven temperature:	50^{0}C
Analytical column valve oven temperature:	150^{0}C
Column Temperature Program:	0^{0}C (hold ~~3~~7 min)~~,~~ ~~10^{0}C/min to 200^{0}C (hold 15 min)~~ 5^{0}C/min to 200^{0}C 200^{0}C (hold 35 min)
~~Detector temperature~~:	~~250^{0}C~~
~~Injector temperature:~~	~~150^{0}C~~

6.3 For automated systems, connect the samples to the GC and begin the analytical process.

6.3.1 Samples may be injected manually by injecting an aliquot with a ground glass syringe.

6.4 Introduce the sample into the carrier gas stream through the injection valve.

6.5 Each separated component exits from the column into the FID where a response is generated.

6.6 Concentrations of hydrocarbons are calculated using data acquisition/ processing software that uses calibration data from the NIST-traceable propane calibration standard.

6.7 For compounds having concentrations above the documented range of instrument linearity, a smaller aliquot must be taken (for manual systems, a smaller syringe or smaller loop; for automated systems, a smaller loop) or the sample must be diluted.

6.8 The peak integrations are corrected as necessary in the data system. Any misplaced baseline segments are corrected in the reconstructed chromatogram.

6.9 The peak identifications provided by the computer are checked and corrected if necessary.

6.10 Target compounds that coelute are reported as the major component, as determined by the analysis of several samples by GC/MS or other methods. An exception to this is m- and p-xylene, where GC/MS data and fuel profiles are used to determine the relative contribution of each component to the peak. This method was used to determine the m- and p-xylene MIR value given in Appendix 1.

6.11 The Alumina PLOT column is programmed to 200°C to assure all compounds are eluted before the next run.

7. CALCULATIONS

7.1 The target hydrocarbon concentrations, in ppbC, are calculated by the data system using propane as an external standard.

$$\text{Concentration}_{\text{sample}}\ (\text{ppbC}) = \text{Peak Area}_{\text{sample}} \times \text{Response Factor}$$

where the response factor (RF) is calculated during daily calibration by:

$$RF = \frac{\text{Concentration of NIST-traceable propane standard, ppbC}}{\text{Area of propane peak}}$$

8. QUALITY CONTROL

8.1 Blank Run - A blank (pure nitrogen or helium) is run each analysis day. All target hydrocarbon concentrations from the blank analysis must be below the LOD before the analysis may proceed. As an alternative to a daily blank run, a daily partial blank check in tandem with a weekly blank run may be used. A partial blank check is defined as a check of the calibration standard run for contamination over all but the propane region of the chromatograph. The calibration standard must consist of only propane and make-up gas, with the concentration of all organic compounds except methane and propane below 2 percent of the propane standard concentration. The weekly blank run will provide a check on contamination in the propane region of the chromatograph.

8.1.1 If the blank shows a peak greater than the limit of detection (LOD) in the region of interest, the source of contamination must be investigated and remedied.

8.2 Calibration Run - The calibration standard is analyzed each analysis day to generate the response factor used to quantify the sample concentrations.

8.3 Control Standard Run - The quality control standard is analyzed at least once each analysis day. Measurements of all compounds specified in Section 5.6 must fall within the control limits to ensure the validity of the sample analyses that day. To meet this requirement, it may be necessary to inspect and repair the GC, and rerun the calibration and/or control standards.

8.4 Control Charts - A quality control chart is maintained for each component of the control standard listed in Section 5.6. The control charts, used on a daily basis, establish that the method is "in- control." The following describes how to construct a typical control chart:

1. Obtain at least 20 daily control standard results;
2. Calculate the control standard mean concentration and standard deviation for the target hydrocarbon; and
3. Create a control chart for the target hydrocarbon by placing the concentration on the Y-axis and the date on the X-axis. Establish upper and lower warning limits at either two standard deviations (2s) or 5 percent, whichever is greater, above and below the average concentration. Establish upper and lower control limits at either three standard deviations (3s) or 5 percent, whichever is greater, above and below the average concentration.
4. A control standard measurement is considered to be out-of-control when the analyzed value exceeds the control limit or two successive control standard measurements of the same analyte exceed the warning limit.
5. If 20 control standard measurements are not yet available to create a control chart (e.g., the control standard was expended and replaced prior to obtaining 20 points with the new standard), measurements must be within 10% of the certified concentration. If the control standard is not a NIST standard, the cylinder should be certified by the laboratory against a NIST standard.

The measured concentrations of all target hydrocarbons contained in the control standard must be within the control limits (in-control) for the sample results to be considered acceptable.

8.5 Duplicates - A duplicate analysis of one sample is performed at least once per analysis day. The relative percent difference (RPD) is calculated for each duplicate run:

$$\text{RPD (\%)} = \frac{|\text{Difference between duplicate and original measurements}|}{\text{Average of duplicate and original measurements}} \times 100$$

For each compound specified in Section 5.6, the allowable RPD depends on the average concentration level for the duplicate runs, as shown in the following table:

Average Measurement for the Duplicate Runs			Allowable RPD (%)
1 to 10	times	LOD	100
10 to 20	"	"	30
20 to 50	"	"	20
Greater than 50	"	"	15

If the results of the duplicate analyses do not meet these criteria for all compounds specified in Section 5.6, the sample may be reanalyzed. If reanalysis is not feasible or if the criteria are still not met on reanalysis, all sample results for that analysis day are invalid.

8.6 Linearity - A multipoint calibration to confirm instrument linearity is performed for the target hydrocarbons in the control standard for new instruments, after making instrument modifications that can affect linearity, and at least once every year unless a daily check of the instrument response indicates that the linearity has not changed. To monitor the instrument response, a quality control chart is constructed, as specified in Section 8.4, except using calibration standard area counts rather than control standard concentrations. When the standard area counts are out-of-control, corrective action(s) must be taken before analysis may proceed. The multipoint calibration consists of at least five concentration or mass loading levels (using smaller or larger volume sample sizes of existing standards is acceptable), each above the LOD, distributed over the range of expected sample concentration. Each concentration level is measured at least twice. A linear regression analysis is performed using concentration and average area counts to determine the regression correlation coefficient (r). The r must be greater than 0.995 to be considered sufficiently linear for one-point calibrations.

8.7 Limit of Detection – The LOD for the target hydrocarbons in the control standard must be determined ~~must be determined~~ for new instruments and after making instrument modifications that can affect linearity and/or sensitivity and at least once every year unless a daily check of the instrument response indicates that the LOD has not changed. To monitor the instrument response, a quality control chart is constructed, as specified in Section 8.4, except using calibration standard area counts rather than control standard concentrations. When the calibration standard area counts are out-of-control, investigation and/or corrective action(s) must be taken. To make the calculations, it is necessary to perform a multipoint calibration consisting of at least four "low" concentration levels, each above the LOD, with at least five replicate determinations of the lowest concentration standard. A linear regression is performed and the standard deviation is converted to concentration units using the slope of the linear regression:

$$s = s_a \div m$$

where m is the slope of the linear regression, s is the standard deviation (in concentration units) of the lowest concentration standard and s_a is the standard deviation (in area counts) of the lowest concentration standard.

The LOD must be calculated using the following equation [Ref. 12]:

$$LOD = t * s$$

where s is the standard deviation (in concentration units) of at least five replicate determinations of the lowest concentration standard and t is the t-factor for 99 percent confidence for a one-sided normal (Gaussian) distribution. The number of degrees of freedom is equal to the number of replicates, minus one. An abbreviated t-table is:

Degrees of Freedom	t-value
4	3.7
5	3.4
6	3.1
7	3.0

The lowest standard must be of a concentration of one to five times the estimated LOD.

8.7.1 The maximum allowable LOD for each compound is 5 ppbC. The calculated laboratory LOD must be equal to or lower than the maximum allowable LOD. All peaks identified as target compounds that are equal to or exceed the maximum allowable LOD must be reported. If the calculated laboratory LOD is less than the maximum allowable LOD, the laboratory may choose to set its reporting limit at the maximum allowable LOD, the calculated laboratory LOD, or any level in between.

8.7.2 For the purpose of calculating the total mass of all species, the concentrations of all compounds below the LOD are considered to be zero.

8.8 Method No. 1002/Method No. 1003 Crossover Check - For each sample, a compound shall be measured by both Method No. 1002 and Method No. 1003. The crossover compound shall be a compound that can reasonably be expected to be found and measured by both methods in the laboratory performing the analysis. The results obtained by the two methods should be compared and an acceptance criteria set for the relative percent difference.

Part E

DETERMINATION OF C_6 TO C_{12} HYDROCARBONS IN AUTOMOTIVE SOURCE SAMPLES BY GAS CHROMATOGRAPHY

METHOD NO. 1003

1. INTRODUCTION

1.1 This document describes a gas chromatographic method of ~~analyzing~~ measuring C_6 to C_{12} hydrocarbons (mid-range hydrocarbons) in the ppbC range from automotive source samples. This method does not include sample collection procedures [Ref. 7]. The target hydrocarbons (compounds of interest) that shall be analyzed and reported by this method and Method 1002 are listed in Appendix 1. All compounds on this list, when measured in concentrations above the LOD, shall be measured and reported ("targeted") by either Method 1002 or Method 1003. Each laboratory should divide the list into light-end (Method 1002) and mid-range (Method 1003) hydrocarbons in the manner that best suits the laboratory instrumentation. All compounds on the list not targeted by Method 1003 must be targeted by Method 1002.

1.2 Other applicable forms of instrumentation and analytical techniques may be used if shown to yield results equivalent to those specified in this procedure and if approved in advance by the Executive Officer of the Air Resources Board.

1.3 All definitions and abbreviations are contained in Appendix 2 of these test procedures.

2. METHOD SUMMARY

2.1 This is a method intended for routine analysis.

2.2 The samples are received by the laboratory in ~~Tedlar~~ Kynar® bags, which are sub-sampled into a GC for separation and analysis.

2.3 The gas chromatographic analysis is performed through a temperature-programmed capillary column. A FID is used for detection.

2.4 The sample is injected into the GC by means of gas sampling valves. Separation of the sample hydrocarbon mixture into its components takes place in the chromatographic column. The chromatographic column and the corresponding operating parameters described in this method normally provide complete resolution of most target hydrocarbons.

2.5 The computerized GC data acquisition system identifies the hydrocarbons associated with each peak. The hydrocarbon concentrations are determined by integrating the peak areas and using a response factor determined from NIST-traceable standards.

3. INTERFERENCES AND LIMITATIONS

3.1 An ~~interferent~~ interfering compound is any component present in the sample with a retention time similar to that of any target hydrocarbon described in this method. To reduce interference error, proof of chemical identity may require periodic confirmations using an alternate method and/or instrumentation, e.g., GC/MS, PID, different column, etc.

3.2 The concentration of hydrocarbons in the range of interest is stable for at least 24 hours in the Tedlar sampling bags, provided the sample bags do not leak and are not exposed to bright light or excessive heat. Sampling bags must be shielded from direct sunlight to avoid photochemically induced reactions of any reactive hydrocarbons. Samples must be analyzed within 24 hours.

4. INSTRUMENTATION AND APPARATUS

4.1 ~~Tedlar~~ Kynar® (polyvinylidene fluoride) bags, ~~2~~ 4 mil in thickness, nominally 5 to 10 liters in capacity and equipped with quick-connect fittings, are typically used to contain the samples. Other sample collection containers, such as bags made of Tedlar® (polyvinyl fluoride) film or nickel-coated stainless steel canisters, may be used, provided they are made of non-reactive material and do not cause sample loss or contamination.

4.2 For manual sub-sampling into a GC, a ground glass syringe is used to transfer gaseous samples from Tedlar bags to the GC sample inlet. For automated systems, a sample loop is used to transfer gaseous samples from the Tedlar bag to the sample inlet of the GC. Sample aliquot size is chosen based on considerations of instrument sensitivity and/or linearity.

4.3 The GC is equipped with a FID, and a gas sampling valve system.

4.4 A non-polar capillary column [e.g., ~~J&W~~ Varian DB-1 (methylsiloxane), typically 60 m x 0.32 mm ID, film thickness 1.0 μ] is used. Other columns may be used, provided the alternate(s) can be demonstrated to the ARB to be equivalent or better with respect to precision, accuracy and resolution of all the target hydrocarbons.

4.5 A sample trap capable of being cryogenically cooled may be used.

4.6 A computer-controlled data acquisition system is required for quantifying peak areas.

5. REAGENTS AND MATERIALS

5.1 Helium shall have a minimum purity of 99.995 percent. Higher purity helium may be required to achieve the LOD required by Section 8.7.1.

5.2 Hydrogen shall have a minimum purity of 99.995 percent.

5.3 Air shall be "Zero" grade (<1 ppmC total hydrocarbon contamination) or better.

5.4 Nitrogen shall have a minimum purity of 99.998 percent.

5.5 Calibration Standard - The quantitative calibration standard for all target hydrocarbons shall be propane at a concentration level between 0.25 and 1 ppm-mole and within the calculated linearity of the method. (See Section 8.6.) This propane standard must be a NIST-certified SRM or secondary NIST-traceable standard. A secondary standard is obtained by a comparison between a SRM and a candidate standard.

5.6 Control Standard - A quality control standard, containing at least n-hexane, n-octane, n-decane, benzene, toluene, and m- or p-xylene with concentrations between 0.2 and 1 ppmC based on a propane standard, is used for the following purposes:

1. Daily update of control charts, and
2. Daily determination of marker retention time windows.

5.7 A high concentration standard (higher than the calibration standard), containing the target hydrocarbons listed in Section 5.6, is used for linearity determinations. The high concentration standard must have concentrations verified against a NIST-traceable propane standard. (See Section 5.5 for the definition of NIST-traceable.) This verification can be performed at the laboratory performing the analysis.

5.8 A low concentration standard (one to five times the estimated LOD), containing the target hydrocarbons listed in Section 5.6, is used for LOD determinations. The low concentration standard must have concentrations verified against a NIST-traceable propane standard. (See Section 5.5 for the definition of NIST-traceable.) This verification can be performed at the laboratory performing the analysis.

5.8.1 In lieu of a low concentration standard, a higher concentration standard may be diluted.

5.9 Liquid nitrogen may be required to cool the cryogenic trap and column oven where applicable.

6. **PROCEDURE**

6.1 The gaseous sample is analyzed for the target hydrocarbons C_5 through C_{12}.

~~6.1 Typical operating conditions.~~

~~6.1.1 Suggested operating conditions for the manual GC are:~~

~~Helium carrier gas velocity:~~	~~30 cm/sec at 200°C~~
~~Nitrogen make-up gas flow:~~	~~sufficient such that the total flow of helium plus nitrogen is 30 mL/min~~
~~Hydrogen gas flow (for FID):~~	~~30 mL/min~~
~~"Zero" air gas flow (for FID):~~	~~300 mL/min~~
~~Autozero FID at:~~	~~0.0 min~~
~~Range 11, Attenuation 8 (or another suitable value)~~	
~~Sample valve temperature:~~	~~150°C~~
~~Injector temperature:~~	~~150°C~~
~~Column entrance port temperature:~~	~~95°C~~
~~Detector temperature:~~	~~250°C~~
~~Column temperature:~~	~~Initial temperature 0°C;~~ ~~10°C/min to 200°C~~

6.2~~.1.2~~ ~~Suggested~~ Typical operating conditions for the automated GC are:

Helium carrier gas flow flow ~~velocity~~:	~~30 cm/sec~~ 2.2 mL/min at 200°C
Detector (0.010" FID)	
Temperature:	275°C or higher
Nitrogen make-up gas flow:	sufficient such that the total flow of helium plus nitrogen is ~~30~~ 25 mL/min
Hydrogen gas flow (for FID):	~~30~~ 25 mL/min
"Zero" air gas flow (for FID):	300 mL/min
Range 12, attenuation 8 (or another suitable value)	
~~Sample~~ Autosampler valve temperature:	150°C
~~Detector temperature:~~	~~300°C~~
~~Injector temperature:~~	~~150°C~~
Cryotrap temperature:	-180 °C (hold to trap hydrocabons) 200 °C (heat to release hydrocarbons)
Analytical column valve oven temperature:	150°C
Column temperature program:	-40°C (hold 2.5 min) 3.6°C/min to 210°C 210°C (hold 5 min) ~~Initial temperature -50°C (5 min),~~ ~~5°C/min to 50°C,~~ ~~10°C/min to 200°C~~

6.2.1 Samples may be injected manually by injecting an aliquot with a ground glass syringe.

6.3~~2~~ Data Reduction

6.3~~2~~.1 The results are calculated from the FID responses.

6.3~~2~~.2 The results are examined to see that the peaks are correctly integrated.

6.3~~2~~.3 After running a particularly “dirty” sample, the analyst should run a blank before proceeding to the next sample as there may be sample carryover, or flush the sampling system with air.

6.3~~2~~.4 The peak identifications provided by the computer are reviewed and, if necessary, corrected using the following procedure and criteria:

1. The relative retention indices from GC/MS analyses are used to help confirm peak identifications.
2. The primary peak identification is done by the computer using the relative retention times based on reference calibration runs.
3. Confirm that the relative peak heights of the sample run (“fingerprint”) match the typical fingerprint seen in past sample runs.
4. Compare the relative retention times of the sample peaks with those of reference runs.
5. Any peak with a reasonable doubt is labeled 'Unidentified'.

6.3~~2~~.5 For compounds having concentrations above the documented range of instrument linearity, a smaller aliquot must be taken (for manual systems, a smaller syringe or smaller loop; for automated systems, a smaller loop) or the sample must be diluted.

6.3~~2~~.6 The concentrations of the hydrocarbons are calculated using data acquisition/ processing software which uses calibration data from a NIST-traceable propane calibration standard.

6.3~~2~~.7 Target compounds that coelute are reported as the major component, as determined by the analysis of several samples by GC/MS or other methods. An exception to this is m- and p-xylene, where GC/MS data and fuel profiles are used to determine the relative contribution of each component to the peak. This method was used to determine the m- and p-xylene MIR value given in Appendix 1.

7. CALCULATIONS

7.1 The target hydrocarbon concentrations, in ppbC, are calculated by the data system using propane as an external standard.

$$\text{Concentration}_{\text{sample}} \text{ (ppbC)} = \text{Peak Area}_{\text{sample}} * \text{ Response Factor}$$

where the Response Factor (RF) is calculated during daily calibration by:

$$RF = \frac{\text{Concentration of NIST} - \text{traceable propane standard, ppbC}}{\text{Area of propane peak}}$$

8. QUALITY CONTROL

8.1 Blank Run - A blank (pure nitrogen or helium) is run each analysis day. All target hydrocarbon concentrations from the blank analysis must be below the LOD before the analysis may proceed. As an alternative to a daily blank run, a daily partial blank check in tandem with a weekly blank run may be used. A partial blank check is defined as a check of the calibration standard run for contamination over all but the propane region of the chromatograph. The calibration standard must consist of only propane and make-up gas, with the concentration of all organic compounds except methane and propane below 2 percent of the propane standard concentration. The weekly blank run will provide a check on contamination in the propane region of the chromatograph.

8.1.1 If the blank shows a peak greater than the limit of detection (LOD) in the region of interest, the source of the contamination must be investigated and remedied.

8.2 Calibration Run - The calibration standard is analyzed each analysis day to generate the response factor used to quantify the sample concentrations.

8.3 Control Standard Run - The quality control standard is analyzed at least once each analysis day. Measurements of all compounds specified in Section 5.6 must fall within the control limits to ensure the validity of the sample analyses that day. To meet this requirement, it may be necessary to inspect and repair the GC, and rerun the calibration and/or control standards.

8.4 Control Charts - A quality control chart is maintained for each component of the control standard listed in Section 5.6. The control charts, used on a daily basis, establish that the method is “in-control”. The following describes how to construct a typical control chart:

1. Obtain at least 20 daily control standard results,
2. Calculate the control standard mean concentration and standard deviation for the target hydrocarbon, and

3. Create a control chart for the target hydrocarbon by placing the concentration on the Y-axis and the date on the X-axis. Establish upper and lower warning limits at either two standard deviations (2s) or 5 percent, whichever is greater, above and below the average concentration. Establish upper and lower control limits at either three standard deviations (3s) or 5 percent, whichever is greater, above and below the average concentration.
4. A control standard measurement is considered to be out-of-control when the analyzed value exceeds the control limit or two successive control standard measurements of the same analyte exceed the warning limit.
5. If 20 control standard measurements are not yet available to create a control chart (e.g., the control standard was expended and replaced prior to obtaining 20 points with the new standard), measurements must be within 10% of the certified concentration. If the control standard is not a NIST standard, the cylinder should be certified by the laboratory against a NIST standard.

The measured concentrations of all target hydrocarbons contained in the control standard must be within the control limits (in-control) for the sample results to be considered acceptable.

8.5 Duplicates - A duplicate analysis of one sample is performed at least once per analysis day. The relative percent difference (RPD) is calculated for each duplicate run:

$$\text{RPD}(\%) = \frac{|\text{ Difference between duplicate and original measurements }|}{\text{Average of duplicate and original measurements}} * 100$$

For each compound specified in Section 5.6, the allowable RPD depends on the average concentration level for the duplicate runs, as shown in the following table:

Average Measurement for Duplicate Runs			Allowable RPD (%)
1 to 10	times	LOD	100
10 to 20	“	“	30
20 to 50	“	“	20
Greater than 50	“	“	15

If the results of the duplicate analyses do not meet these criteria for all compounds specified in Section 5.6, the sample may be reanalyzed. If reanalysis is not feasible or if the criteria are still not met on reanalysis, all sample results for that analysis day are invalid.

8.6 Linearity - A multipoint calibration to confirm instrument linearity is performed for all target hydrocarbons in the control standard for new instruments, after making instrument modifications that can affect linearity, and at least once every year unless a daily check of the instrument response indicates that the linearity has not changed. To monitor the instrument response, a quality control chart is constructed, as specified in Section 8.4, except using calibration standard area counts rather than control standard concentrations. When the standard area counts are out-of-control, corrective action(s) must be taken before analysis may proceed. The multipoint calibration consists of at least five concentration or mass loading levels (using smaller or larger volume sample sizes of existing standards is acceptable), each above the LOD, distributed over the range of expected sample concentration. Each concentration level is measured at least twice. A linear regression analysis is performed using concentration and average area counts to determine the regression correlation coefficient (r). The r must be greater than 0.995 to be considered sufficiently linear for one point calibrations.

8.7 Limit of Detection - The LOD for the target hydrocarbons in the control standard must be determined for new instruments and after making instrument modifications that can affect linearity and/or sensitivity and at least once every year unless a daily check of the instrument response indicates that the LOD has not changed. To monitor the instrument response, a quality control chart is constructed, as specified in Section 8.4, except using calibration standard area counts rather than control standard concentrations. When the calibration standard area counts are out-of-control, investigation and/or corrective action(s) must be taken. To make the calculations, it is necessary to perform a multipoint calibration consisting of at least four "low" concentration levels, each above the LOD, with at least five replicate determinations of the lowest concentration standard. A linear regression is performed and the standard deviation (in area counts) of the lowest concentration standard determined. The standard deviation is converted to concentration units using the slope of the linear regression:

$$s = s_a \div m$$

where m is the slope of the linear regression, s is the standard deviation (in concentration units) of the lowest concentration standard and s_a is the standard deviation (in area counts) of the lowest concentration standard.

The LOD must be calculated using the following equation [Ref. 12]:

$$LOD = t * s$$

where s is the standard deviation (in concentration units) of at least five replicate determinations of the lowest concentration standard and t is the t-factor for 99 percent confidence for a one-sided normal (Gaussian) distribution. The number of degrees of freedom is equal to the number of replicates, minus one. An abbreviated t-table is:

Degrees of Freedom	t-value
4	3.7
5	3.4
6	3.1
7	3.0

The lowest standard must be of a concentration of one to five times the estimated LOD.

8.7.1 The maximum allowable LOD for each compound is 5 ppbC. The calculated laboratory LOD must be equal to or lower than the maximum allowable LOD. All peaks identified as target compounds that are equal to or exceed the maximum LOD must be reported. If the calculated laboratory LOD is less than the maximum allowable LOD, the laboratory may choose to set its reporting limit at the maximum allowable LOD, the calculated laboratory LOD, or any level in between.

8.7.2. For the purpose of calculating the total mass of all species, the concentrations of all compounds below the LOD are considered to be zero.

8.8 Method No. 1002/Method No. 1003 Crossover Check - For each sample a compound shall be measured by both Method No. 1002 and Method No. 1003. The crossover compound shall be a compound that can reasonably be expected to be found and measured by both methods in the laboratory performing the analysis. The results of the two analyses should be compared and an acceptance criteria set for the relative percent difference.

Part F

DETERMINATION OF ALDEHYDE AND KETONE COMPOUNDS IN AUTOMOTIVE SOURCE SAMPLES BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY

METHOD NO. 1004

1. INTRODUCTION

1.1 This document describes a method of analyzing automotive source samples ~~engine exhaust~~ for aldehyde and ketone compounds (carbonyls) using impingers, containing acidified 2,4-dinitrophenylhydrazine (DNPH)-absorbing solution, or DNPH-impregnated cartridges. Carbonyl masses ranging between 0.02 to 200 µg are measured by this method. The “target” carbonyls (compounds of interest) that shall be ~~analyzed~~ measured and reported by this method are listed in Appendix 1. All of these carbonyl compounds, when measured in concentrations above the LOD, shall be reported.

1.1.1 For the purpose of calculating NMOG for vehicles tested on exhaust emission test fuel containing ethanol (see Part G, Determination of NMOG Mass Emissions):

1.1.1.1 The only carbonyl compounds that need to be reported from this method are formaldehyde and acetaldehyde.

1.1.1.2 The additional carbonyls listed in Appendix 1 are within the scope of this analytical method and their measurement may provide meaningful information to the laboratory. However, their measurement is not required.

1.2 This procedure is derived from a method used by Hull [Ref. 10].

1.3 Other applicable forms of instrumentation and analytical techniques may be used if shown to yield results equivalent to those specified in this procedure and if approved in advance by the Executive Officer of the Air Resources Board.

1.4 All definitions and abbreviations are contained in Appendix 2 of these test procedures.

2. METHOD SUMMARY

2.1 The samples are received by the laboratory in sample collection cartridges or impingers. (See Section 4.2.) The DNPH reagent ~~absorbing solution (2,4-DNPH)~~

complexes the carbonyl compounds into their diphenylhydrazone derivatives. The cartridges are then extracted ~~eluted~~ with ~~5 mL~~ acetonitrile.

2.2 Separation and analysis are performed using a HPLC with an ultraviolet detector.

3. INTERFERENCES AND LIMITATIONS

3.1 An ~~interferent~~ interfering compound is any detectable compound present in the sample with a retention time very similar to that of any target carbonyl described in this method. To reduce interference error, proof of chemical identity may require periodic confirmations using an alternate method and/or instrumentation, e.g., alternative HPLC columns or mobile phase compositions.

3.2 If samples are not analyzed the same day as received, they must be refrigerated at a temperature below 40^{o}F.

3.2.1 Impinger solutions must first be transferred to glass bottles and sealed. ~~Refrigerated samples are stable for up to 30 days.~~

3.2.2 If cartridges are not immediately extracted they must be refrigerated.

3.2.3 Acrolein and crotonaldehyde have been shown to degrade in acidified DNPH cartridges; hence, it is recommended to extract the cartridges as soon as possible. The extract must be refrigerated.

3.2.4 Refrigerated cartridge sample extracts and impinger solutions are stable for up to 30 days.

~~3.3~~ ~~When using the DuPont Zorbax or Supelco's Supelcosil columns described in Section 4.1.5, methyl ethyl ketone (MEK) and butyraldehyde tend to coelute.~~

~~3.4~~ ~~When using the Delta Bond column described in Section 4.1.5, formaldehyde tends to coelute with an unknown, non-carbonyl compound, and the tolualdehyde isomers tend to coelute. The guard column for the Delta Bond column must also be changed frequently in order to prevent the coelution of butyraldehyde and methacrolein and to prolong the life of the column.~~

3.3 The presence of NOx in exhaust samples depletes DNPH in the cartridges. Laboratories should develop criteria to validate test results by ensuring that enough DNPH is left to trap the carbonyl compounds.

4. INSTRUMENT AND APPARATUS

4.1 The HPLC analytical system consists of the following:

4.1.1 Dual high pressure pumps.

4.1.2 Automated gradient controller or pump module controller.

4.1.3 Temperature controller module for the column oven.

4.1.4 A liquid autosampler.

4.1.5 The ~~primary~~ system incorporates two ~~DuPont Zorbax ODS or~~ ~~Supelco's Supelcosil~~ LC-18 columns (e.g., Supelco's Supelcosil, typically 25cm x 4.6mm, 5µ silica gel particles) in tandem and a guard column (e.g., Supelco's Pelliguard, 2 cm long packed with LC18 5 µm pellicular beads). ~~The secondary system incorporates a Delta Bond AK (4.6 mm ID x 200 mm) packed column with a guard column 2 cm long packed with LC18 5 µm pellicular beads or equivalent).~~ Other columns may be used, provided the alternate(s) can be demonstrated to the ARB to be equivalent or better with respect to precision, accuracy and resolution of all target carbonyls.

4.1.6 An ultraviolet/visible (UV/VIS) detector.

4.1.7 Data system for peak integration.

4.2 Samples are collected ~~collection containers~~ ~~are~~ in glass impingers or DNPH-impregnated cartridges.

5. REAGENTS AND MATERIALS

5.1 Acetonitrile, HPLC grade~~,~~ (Burdick and Jackson or equivalent).

5.2 Water, HPLC grade~~,~~ (Burdick and Jackson or equivalent).

5.3 Methanol, HPLC grade (Burdick and Jackson or equivalent).

5.4 Acidified DNPH-Silica cartridges (Waters Corp. or equivalent).

5.5~~3~~ ~~2,4-~~DNPH, purified, Radian Corporation or equivalent. Unpurified DNPH must be recrystallized twice from acetonitrile. The recrystallized DNPH is checked for contaminants by injecting a dilute solution of DNPH in contaminant-free acetonitrile into the HPLC.

5.6~~4~~ Sulfuric acid, or perchloric acid, analytical reagent grade~~,~~ (Baker Analyzed or equivalent).

5. 7~~5~~ The carbonyl/~~2,4-dinitrophenylhydrazone (~~DNPH~~)~~ complexes [Ref. 11] listed in Table F1 may be purchased (e.g., Radian Corporation, in 1.2 mL ampules) or prepared in the laboratory. In-house standards must be recrystallized at least three times from 95 percent ethanol.

TABLE F-1
PROPERTIES OF CARBONYL/~~2,4-~~DNPH COMPLEXES

Complex	Molecular Weight (g/mole)	Melting Point °C
formaldehyde	210.15	165-166
acetaldehyde	224.18	152-153
acrolein	236.19	165[1]
acetone	238.20	125-127
propionaldehyde	238.20	144-145
butyraldehyde	252.23	119-120
hexanaldehyde	280.28	106-107
benzaldehyde	286.25	240-242
methyl ethyl ketone	252.53	117-118
methacrolein	250.21	200-201
crotonaldehyde	250.21	185-188
valeraldehyde	266.26	107-108
m-tolualdehyde	300.27	212

5.8~~6~~ Stock Calibration Standard - A stock calibration standard is prepared by diluting the target carbonyl/~~2,4-~~DNPH complexes with acetonitrile. A typical stock calibration standard contains 3.0 µg/mL of each target carbonyl compound. Stock calibration standards of other concentrations may also be used.

5.9~~7~~ Working Standard - A working standard is prepared when required by diluting the stock calibration solution, making sure that the highest concentration of the standard is above the expected test level. Typically, the 3.0 µg/mL stock is diluted five times with acetonitrile in a volumetric flask to yield a 0.6 µg/mL solution.

5.10~~8~~ Control Standard - A quality control standard, containing all target carbonyls/~~2,4-~~DNPH complexes within the typical concentration range of real samples, is analyzed to monitor the precision of the analysis of each target carbonyl. The control standard may be purchased, prepared in the laboratory from a stock solution different from the calibration standard, or prepared by batch mixing old samples, spiking it with a stock solution of target compounds, and stirring for a minimum of 2 hours. If necessary, the solution is filtered using filter paper to remove precipitation. All target compounds except acrolein have been found to be stable in the control standard.

5.11~~9~~ Standards used for linearity and LOD determinations (Section 8) may be purchased or prepared by dilutions of an appropriate level stock solution.

[1]This compound has been ~~known~~ shown to decompose.

6. **PROCEDURE**

6.1 For systems collecting the samples via impingers, an absorbing solution is prepared by dissolving 0.11 - 0.13 grams of recrystallized DNPH in 1 L of HPLC grade acetonitrile. The absorbing solution should be prepared at least every two weeks. Each batch of acetonitrile used in this procedure is checked for oxygenated impurities by adding it to a contaminant-free dilute solution of DNPH and analyzing by HPLC.

6.1.1 In the laboratory, pipette 15 mL of the DNPH absorbing solution into each of the 30 mL impingers for each emission test. Add 0.1 mL of 2.85 N sulfuric acid or 0.15 mL of 3.8 M perchloric acid to each impinger.

6.2 For systems collecting the samples via cartridges, DNPH-impregnated cartridges shall be sealed and refrigerated, at a temperature less than $40^{o}F$, upon receipt from manufacturer, until ready for use.

6.2.1 At the exhaust volumes being sampled (1 L/min), a back-up cartridge may be required for CVS phase 1 or other high-concentration sample but no back-up cartridge is needed for CVS phases 2 and 3 or other low-concentration samples.

6.3 After sampling uncap and place all impingers in preheated water at $70\text{-}80^{o}C$ for 30 minutes (min) to complete derivatization. Heating is not required when using perchloric acid.

6.3.1 For cartridges, remove the caps and extract with 5 mL acetonitrile, running the extract into glass storage bottles.

6.4 Remove the impingers from the water bath and cool to room temperature. Replace any lost solvent by adding acetonitrile to the 15-mL mark.

6.4.1 Replacing lost solvent is not required when using an internal standard method (Section 7.4).

6.5 Transfer the solution from each impinger/cartridge to glass vials and seal with new septum screw caps.

6.6 Place the vials containing blank, working standard, control standard, and samples into the autosampler for subsequent injection into an HPLC. Suggested standard operating conditions for the HPLC are:

~~Primary~~ Typical System:

Columns: ~~4.6 mm ID x 250 mm x 1/4 inches OD Dupont Zorbax ODS or~~ Supelco Supelcosil (LC-18, 25cm x 4.6mm, 5µm silica gel particles), ~~–~~two columns in series, and a Supelco

	Pelliguard ~~G~~guard column— (2 cm long packed with C18 5 µm pellicular beads)
Column temperature:	40^{o}C
Detector:	UV/VIS at 360 nm
Sample volume:	10 µL
Solvent A:	acetonitrile
Solvent B:	~~10 percent (volume/volume)~~ methanol ~~in water~~
Solvent C:	water
Flow:	1.2 mL/min

Program:

50 percent A, 5~~0~~ percent B, 45 percent C	0 (initial time)
65 percent A, 3.5 percent B, 31.5 percent C	0 to 30 ~~2~~ min (linear ramp)
100 percent A, 0 percent B, 0 percent C	~~2~~ 30 to 40 ~~22~~ min (linear ramp)
100 percent A, 0 percent B, 0 percent C	40 to 42 min (hold)
50 percent A, 5~~0~~ percent B, 45 percent C	~~22~~ 42 to 45 ~~37~~ min (linear ramp)

~~Under the above configuration, methyl ethyl ketone and butyraldehyde tend to coelute. In order to report these compounds, it is necessary to analyze the samples using a secondary system. The tolualdehyde isomers (m-, p-, and o-) are separated using this configuration. The reporting of tolualdehyde is addressed in Section 7.4.~~

~~Secondary System:~~

~~Columns:~~	~~Delta Bond AK C18 (4.6 mm ID x 200 mm x 1/4 in OD) packed column, Guard column - 2 cm long packed with C18 5 µm pellicular~~	
~~Column temperature:~~	~~40^{o}C~~	
~~Detector:~~	~~UV/VIS at 360 nm~~	
~~Sample volume:~~	~~10 µL~~	
~~Solvent A:~~	~~acetonitrile~~	
~~Solvent B:~~	~~acetonitrile in water, 35 percent (v/v)~~	
~~Flow:~~	~~1.5 mL/min~~	
~~Program:~~	~~0 percent A, 100 percent B~~	~~0 (initial time)~~
	~~23 percent A, 77 percent B~~	~~0 - 5.5 min~~
	~~46 percent A, 54 percent B~~	~~5.5 - 13 min~~
	~~0 percent A, 100 percent B~~	~~13 to 30 min~~

~~This secondary system is not used to report all compounds because formaldehyde tends to coelute with a non-carbonyl compound. If this coelution is resolved, the secondary system may be used alone to analyze all carbonyl compounds. The tolualdehyde isomers, however, are not separated with this configuration. The reporting of tolualdehyde is addressed in Section 7.4.~~

Data System: The outputs from the UV/VIS detector are sent to a PC-controlled data acquisition system.

6.7 If all target compounds are not separated using this configuration, a second HPLC with a different configuration must be used, in addition to the primary system, to separate the coeluting compounds.

6.8~~7~~ The peak integrations are corrected as necessary in the data system. Any misplaced baseline segments are corrected in the reconstructed chromatogram.

6.9~~8~~ Samples containing compounds having concentrations above the documented range of instrument linearity must be diluted and reanalyzed.

7. CALCULATIONS

7.1 For each target carbonyl, the carbonyl mass is calculated from its carbonyl/~~2,4-~~DNPH mass.

7.2 The mass of each carbonyl compound, per impinger or cartridge, is determined by the following calculation:

$$\text{Mass}_{\text{sample}} = \text{Peak Area}_{\text{sample}} * \text{Response Factor} * \text{Impinger}\left(\text{or Cartridge}\right) \text{volume}\left(\text{mL}\right) * \text{B}$$

where B is the ratio of the molecular weight of the carbonyl compound to its 2,4-dinitrophenylhydrazone derivative and where the response factor (RF) for each carbonyl is calculated during the calibration by:

$$\text{RF} = \frac{\text{Concentration}_{\text{standard}}\ (\mu\text{g } \cancel{2,4\text{-}}\text{DNPH species/mL})}{\text{Peak Area}_{\text{standard}}}$$

7.3 For tolualdehyde, the sum of all isomers present is reported as m-tolualdehyde.

~~7.3.1 Under the conditions of the primary system in Section 6.6, the isomers are separated. The m-tolualdehyde response factor is applied to each peak and the sum reported as m-tolualdehyde.~~

~~7.3.2~~ Under the conditions of the ~~secondary~~ system described in Section 6.6, the isomers coelute. The m-tolualdehyde response factor is applied to the single tolualdehyde peak. This concentration is reported as m-tolualdehyde.

7.4 An internal standard method may also be used.

8. QUALITY CONTROL

8.1 Blank Runs

8.1.1 Reagent Blanks - The solvents used are of the highest HPLC grade and are tested for impurities when a new lot number is used. If this lot number is found to be acceptable, (no carbonyls present at concentrations at or above the LOD), daily blank analysis is not performed.

8.1.2 Carbonyl/~~2,4~~-DNPH Purity - The carbonyl/~~2,4~~-DNPHs are checked for purity by their melting points and their chromatograms (See Table F-1). Analysis of the solution of carbonyl/~~2,4~~-DNPH must yield only the peak of interest. No contaminant peaks above the LOD should be observed.

8.1.3 Field Blanks – One cartridge is analyzed as a field blank for each emission test. If the field blank shows a peak greater than the limit of detection (LOD) in the region of interest, the source of the contamination must be investigated and remedied.

8.1.4 Cartridge Blanks - At least one cartridge per batch is analyzed as a batch blank. If the cartridge blank shows a peak greater than the limit of detection (LOD) in the region of interest, the source of the contamination must be investigated and remedied.

8.2 Calibration Run - The calibration standard is analyzed each analysis day to generate the response factors used to quantify the sample concentrations.

8.3 Control Standard Run - The quality control standard is analyzed at least once each analysis day. Measurements of all target compounds in the control standard, except acrolein, must fall within the control limits to ensure the validity of the sample analyses that day. To meet this requirement, it may be necessary to rerun the calibration and control standards, and inspect and repair the HPLC.

8.4 Control Charts - A quality control chart is maintained for each component of the control standard. The control charts, used on a daily basis, establish that the method is “in- control.” The following describes how to construct a typical control chart:

1. Obtain at least 20 daily control standard results,
2. Calculate the control standard mean concentration, and standard deviation(s) for the target analyte, and
3. Create a control chart for the target analyte by placing the concentration on the Y-axis and the date on the X-axis. Establish an upper warning limit and a lower warning limit at two standard deviations (2s) above and below the average concentration. Establish an upper control limit and a lower control limit at three standard deviations (3s) above and below the average concentration.
4. Due to the low variability of the carbonyl control standard measurements, a control standard measurement is considered to be out-of-control when the analyzed value exceeds either the 3s limit, or the range of ± 10% of the mean control measurement, whichever is greater, or if two successive control standard measurements of the same analyte exceed the 2s limit.

5. If 20 control standard measurements are not yet available to create a control chart (e.g., the control standard was expended and replaced prior to obtaining 20 points with the new standard), measurements must be within 10% of the assay (purchased) or theoretical (prepared in-house) concentration.

The measured concentrations of all target analytes contained in the control standard must be within the control limits (in-control) for the sample results to be considered acceptable. No control requirements have been established for acrolein, since it has been shown to degrade over time.

8.5 Duplicates - A duplicate analysis of one sample is performed at least once per analysis day. The relative percent difference (RPD) is calculated for each duplicate run:

$$\mathrm{RPD}(\%) = \frac{|\text{ Difference between duplicate and original measurements }|}{\text{Average of duplicate and original measurements}} * 100$$

For each compound, the allowable RPD depends on the average concentration level for the duplicate runs, as shown in the following table:

Average Measurement for Duplicate Runs		Allowable RPD (%)
1 to 10	times LOD	100
10 to 20	“ “	30
20 to 50	“ “	20
Greater than 50	“ “	15

If the results of the duplicate analyses do not meet these criteria for all target carbonyls, the sample may be reanalyzed. If reanalysis is not feasible or if the criteria are still not met on reanalysis, all sample results for that analysis day are invalid.

8.6 Linearity - A multipoint calibration to confirm instrument linearity is performed for all target analytes for new instruments, after making instrument modifications that can affect linearity, and at least once every year. The multipoint calibration consists of at least five concentration or mass loading levels (using smaller or larger volume sample sizes of existing standards is acceptable), each above the LOD, distributed over the range of expected sample concentration. Each concentration level is measured at least twice. A linear regression analysis is performed using concentration and average area counts to determine regression correlation coefficient (r). The r must be greater than 0.995 to be considered linear for one point calibrations.

8.7 Limit of Detection - The LOD for the target analytes must be determined for new instruments, after making instrument modifications which can affect the LOD and at least once per year. To make the calculations, it is necessary to perform a multipoint calibration consisting of at least four “low” concentration levels, each above the LOD, with at least five replicate determinations of the lowest concentration standard. A linear regression is performed and the standard deviation (in area counts) of the lowest concentration standard determined. The standard deviation is converted to concentration units using the slope of the linear regression:

$$s = s_a \div m$$

where m is the slope of the linear regression, s is the standard deviation (in concentration units) of the lowest concentration standard and s_a is the standard deviation (in area counts) of the lowest concentration standard.

The LOD must be calculated using the following equation [Ref. 12]:

$$LOD = t * s$$

where s is the standard deviation (in concentration units) of at least five replicate determinations of the lowest concentration standard and t is the t-factor for 99 percent confidence for a one-sided normal (Gaussian) distribution. The number of degrees of freedom is equal to the number of replicates, minus one. An abbreviated t-table is:

Degrees of Freedom	t-value
4	3.7
5	3.4
6	3.1
7	3.0

The lowest standard must be of a concentration of one to five times the estimated LOD.

8.7.1 The maximum allowable LOD is 0.0075 µg/mL. The calculated laboratory LOD must be equal to or lower than the maximum allowable LOD. All peaks identified as target compounds that are equal to or exceed the maximum allowable LOD must be reported. If the calculated laboratory LOD is less than the maximum allowable LOD, the laboratory may choose to set its reporting limit at the maximum allowable LOD, the calculated laboratory LOD, or any level in between.

8.7.2 For the purpose of calculating the total mass of all species, the concentrations of the compounds below the LOD are considered to be zero.

Part G
DETERMINATION OF NMOG MASS EMISSIONS

1. INTRODUCTION

1.1 NMOG mass emissions consist of non-methane hydrocarbons and oxygenated hydrocarbons.

1.2 All definitions and abbreviations are set forth in Appendix 2 of these test procedures.

2. NMOG WEIGHTED MASS EMISSIONS

2.1 ~~NMOG weighted mass (wm) emissions shall be calculated as follows:~~

$$\cancel{NMOG_{wm} = \sum NMHC_{wm} + \sum ROH_{wm} + \sum RHO_{wm}}$$

Non-methane hydrocarbon weighted mass emissions ($NMHC_{wm}$) can be determined by either ~~(~~FID or GC. If the FID method is used to calculate $NMHC_{wm}$, refer to Part B of these test procedures entitled, “Determination of Non-Methane Hydrocarbon Mass Emissions by Flame Ionization Detection.” If the GC method is used to calculate $NMHC_{wm}$, refer to section 4~~3~~, “Speciated Hydrocarbon Mass Emissions Calculation~~,~~” contained herein. Carbonyl weighted mass emissions (RHO_{wm}) are to be calculated according to section 6~~5~~, “Carbonyl Mass Emissions Calculation~~,~~” contained herein. For alcohol fueled vehicles, alcohol weighted mass emissions (ROH_{wm}) are to be calculated according to section 5~~4~~, “Alcohol Mass Emissions Calculation~~,~~” contained herein. Dilution factors and mass emission are determined according to section 3, “Dilution Factors and Mass Emission Calculation,” contained herein.

If the FID method is used to determine the non-methane hydrocarbon weighted mass emissions, the NMHC sample measurement includes contributions from any oxygenated hydrocarbons that may be present in the sample. Therefore, the FID NMHC measurement must be corrected for the presence of alcohols and carbonyl compounds, to give a resultant value called non-oxygenated non-methane hydrocarbons (NONMHC). This correction may take place at the concentration level, for each sample and ambient background, or at the mass level, after $NMHC_{mass}$ and $NMHC_{wm}$ have been calculated. (The two operations are mathematically equivalent.) For the calculations presented in this document, the oxygenate correction is presumed to take place after $NMHC_{mass}$ and $NMHC_{wm}$ have been calculated.

2.2 NMOG weighted mass (wm) emissions, using the FID method, shall be calculated as follows:

$$\left(NMOG_{wm}\right)_{FID} = \sum NONMHC_{wm} + \sum ROH_{wm} + \sum RHO_{wm}$$

$NONMHC_{wm}$ is calculated according to the following equations:

$$NONMHC_{wm} = 0.43 * \left(\frac{NONMHC_{mass1} + NONMHC_{mass2}}{D_{phase1} + D_{phase2}}\right) + 0.57 * \left(\frac{NONMHC_{mass3} + NONMHC_{mass2}}{D_{phase3} + D_{phase2}}\right)$$

and

$$NONMHC_{mass\,n} = NMHC_{mass\,n} - NMHC_{dens} * \sum\left(\frac{ROH_{mass\,n}}{ROH_{dens}}\right) * r_{ROH} - NMHC_{dens} * \sum\left(\frac{RHO_{mass\,n}}{RHO_{dens}}\right) * r_{RHO}$$

where:

$NMHC_{mass\,n} = NMHC_{conc} * NMHC_{dens}$

2.3 NMOG weighted mass (wm) emissions, using the GC method, shall be calculated as follows:

$$\left(NMOG_{wm}\right)_{GC} = \sum HC_{wm} + \sum ROH_{wm} + \sum RHO_{wm}$$

In the GC method, the hydrocarbons are each measured individually and, therefore, the sum of species (∑HC) does not include methane or oxygenated compounds. Thus, this method does not need the corrections that the FID method requires.

3. DILUTION FACTOR AND NMHC MASS EMISSION CALCULATION

3.1 As shown in Part B, the dilution factor is determined using only the major constituents of the emission sample. The dilution factor is determined using the following equation:

$$DF = \frac{100 * \left(\dfrac{x}{x + y/2 + 3.76 * (x + y/4 - z/2)}\right)}{CO_{2e} + \left(NMHC_e + CH_{4e} + CO_e\right) * 10^{-4}}$$

(where fuel composition is $C_xH_yO_z$ as measured for the fuel used; this expression is generally normalized so that x = 1)

3.2 The density of the NMHC is determined using the carbon:hydrogen ratio of the fuel, $C_xH_yO_z$, according to the following equation:

$$NMHC_{dens} = (x * 12.01115 + y * 1.00797)(g/mole) * \left(\frac{28.316847 liter/ft3}{24.0547 liter/mole}\right)$$

where: 12.01115 = atomic weight of carbon
1.00797 = atomic weight of hydrogen

a) For gasoline, $CH_{1.85}$, where x = 1, y = 1.85, and z = 0:
DF = $13.47 / [CO_{2e} + (NMHC_e + CH_{4e} + CO_e) * 10^{-4}]$
$NMHC_{dens}$ = 16.33

b) For Phase 2 gasoline, $CH_{1.94}O_{0.017}$, where x = 1, y = 1.94 and z = 0.017,
DF = $13.295 / [CO_{2e} + (NMHC_e + CH_{4e} + CO_e) * 10^{-4}]$
$NMHC_{dens}$ = 16.44

c) For LPG, $CH_{2.64}$, where x = 1, y = 2.64, z = 0:
DF = $11.68 / [CO_{2e} + (NMHC_e + CH_{4e} + CO_e) * 10^{-4}]$
$NMHC_{dens}$ = 17.27

d) For CNG, $CH_{3.78}O_{0.016}$, where x = 1, y = 3.78, and z = 0.016:
DF = $9.83 / [[CO_{2e} + (NMHC_e + CH_{4e} + CO_e) * 10^{-4}]$
$NMHC_{dens}$ = 18.63

e) For E85, $CH_{2.7841}O_{0.3835}$, Where x = 1, y = 2.7841, and z = 0.3835:
DF = $12.4253 / [CO_{2e} + (NMHC_e + CH_{4e} + CO_e) * 10^{-4}]$
$NMHC_{dens}$ = 17.44

3.3 Sample Calculation

A flex-fuel vehicle using E85 fuel $CH_{2.7841}O_{0.3835}$, where x = 1, y = 2.7841, and z = 0.3835:

Test Phase	FID THC_e (ppmC)	CH_{4e} (ppmC)	CO_{2e} (%)	CO_e (ppm)	FID THC_d (ppmC)	CH_{4d} (ppmC)	CO_{2d} (%)	CO_d (ppm)	VMIX (ft^3)	$D_{phase\ n}$ (mile)
1	27.230	6.918	0.8564	117.801	3.532	2.261	0.0438	0.5224	3495	3.591
2	3.5459	2.357	0.5595	10.8229	3.476	2.247	0.4446	0.3322	5799	3.846
3	3.8510	2.590	0.7163	5.1538	3.396	2.188	0.4507	0.6752	3484	3.591

FID response factor of methane is experimentally determined for each individual FID. The value of 1.15 used here is for example only.

For phase 1:

$NMHC_e$ = FID $THC_e - r_{CH_4} * CH_{4e}$

$= 27.230 - 1.15 * 6.918$
$= 19.274$ ppmC

$DF = 12.4253 / [CO_{2e} + (NMHC_e + CH_{4e} + CO_e) * 10^{-4}]$
$= 12.4253 / [0.8564 + (19.274 + 6.918 + 117.801) * 10^{-4}]$
$= 14.2688$ ppmC

$NMHC_d = FID\ THC_d - r_{CH_4} * CH_{4d}$
$= 3.532 - 1.15 * 2.261$
$= 0.9319$ ppmC

$NMHC_{conc} = NMHC_e - NMHC_{d} * (1 - 1/DF)$
$= 19.274 - 0.9319 * (1 - 1 / 14.2688)$
$= 18.407$ ppmC

$NMHC_{mass1} = NMHC_{conc} * NMHC_{dens} * VMIX_1 * 10^{-6}$

$= 18.407 * 17.44 * 3495 * 10^{-6}$
$= 1.1220$ g

Similarly, for Phase 2, DF = 22.152 and $NMHC_{mass2} = 0$

Similarly, for Phase 3, DF = 17.332 and $NMHC_{mass2} = 0.0026$ g

~~3~~4. SPECIATED HYDROCARBON MASS EMISSIONS CALCULATION

~~3~~4.1 INTRODUCTION

Vehicular exhaust emissions are measured according to the FTP [Ref. 1]. For each of the three phases of the FTP, a ~~tedlar~~ sample collection bag~~, of 0.5 ft³~~ nominally 5 to 10 liters in capacity, is used to collect a dilute exhaust sample. Sample collection bags may be made of Tedlar® (polyvinylfloride, or PVF), 2 mil in thickness, or of Kynar® or Solef® (polyvinylidenefloride, or PVDF), each 4 mil in thickness. A fourth ~~0.5 ft³~~ ~~tedlar~~ bag is used to collect a composite dilution air (background) sample from all three phases of the FTP. Since PVF and PVDF films contain plasticizer or volatile organic components, all of the films are conditioned in a vented oven at 250°F for 16 hours before made into sample bags. All bag samples are analyzed according to Method No. 1002 (Part D of these test procedures) and Method No. 1003 (Part E of these test procedures) to determine the dilute exhaust and dilution air concentrations of individual hydrocarbon compounds. The measured hydrocarbon compound concentrations are used in the following equations to calculate the weighted mass emissions of each hydrocarbon compound.

~~3~~4.2 HC MASS EMISSIONS CALCULATION PER TEST PHASE

~~3~~4.2.1 $HC_{mass\ n} = (HC_{conc} * HC_{dens} * VMIX * 10^{-6}) / (\text{Carbon No.})$

~~3~~4.2.2 $HC_{conc} = HC_e - (HC_d * (1 - (1 / DF)))$
NOTE: If HC_{conc} is calculated to be less than zero, then $HC_{conc} = 0$.

~~3~~4.3. WEIGHTED HC MASS EMISSIONS CALCULATION

~~3~~4.3.1 $$HC_{wm} = 0.43 * \left(\frac{HC_{mass1} + HC_{mass2}}{D_{phase1} + D_{phase2}} \right) + 0.57 * \left(\frac{HC_{mass3} + HC_{mass2}}{D_{phase3} + D_{phase2}} \right)$$

~~3~~4.4. SAMPLE CALCULATION

~~3~~4.4.1 Exhaust emissions from a gasoline vehicle are collected in three dilute exhaust sample bags and one dilution air (background) sample bag during the FTP. Gas chromatography is used to determine the benzene concentration of each bag sample. Calculate the weighted benzene mass emissions based on the following data:

Test Phase	HC_e (ppbC)	HC_d (ppbC)	FID THC_e (ppmC)	CH_{4e} (ppmC)	CO_{2e} (%)	CO_{em} (ppm)	R_a (%)	VMIX (ft^3)	$D_{phase\ n}$ (mile)
1	500	25	98	6	1.20	280	28	2846	3.584
2	100	25	22	4	0.95	87	25	4854	3.842
3	120	25	29	5	1.07	101	24	2840	3.586

For Phase 1:

DF = $13.47 / [CO_{2e} + (NMHC_e + CH_{4e} + CO_e) * 10^{-4}]$
(see section 3~~6~~, DF Calc.)

$NMHC_e$ = FID $THC_e - (r_{CH_4} * CH_{4e})$
= 98 ppmC - (1.04 * 6 ppmC)
= 92 ppmC

CO = $(1 - (0.01 + 0.005 * HCR) * CO_{2e} - 0.000323 * R_a) * CO_{em}$
NOTE: If a CO instrument which meets the criteria specified in CFR 40, 86.111 is used and the conditioning column has been deleted, CO_{em} must be substituted directly for CO_e .
= (1 - (0.01925) * 1.2% - 0.000323 * 28%) * 280 ppm
= 271 ppm

DF = $13.47 / [1.2\% + (92 \text{ ppmC} + 6 \text{ ppmC} + 271 \text{ ppm}) * 10^{-4}]$
= 10.89

HC_{conc} = HC_e - (HC_d * (1 - (1 / DF)))
= 500 ppbC - (25 ppbC * (1 - (1 / 10.89)))
= 477 ppbC

Mol. Wt. of C_6H_6 = (6 * 12.01115) + (6 * 1.00797)
= 78.11472 g/mole

HC_{dens} = (Mol. Wt. * conversion of liter to ft^3) / (Mol. Vol.)
= (78.11472 g/mole * 28.316 liter/ft^3) / 24.055 liter/mole
= 91.952 g/ft^3

$HC_{mass\ n}$ = (HC_{conc} * HC_{dens} * VMIX * 10^{-6}) / (Carbon No.)

$HC_{mass\ 1}$ = (477 ppbC * 91.952 g/ft^3 * 2846 ft^3 * 10^{-6}) / 6
= 20.8 mg

Similarly, for Phase 2: Hc_{mass} = 5.7 mg

and for Phase 3: Hc_{mass} = 4.2 mg

Therefore,

$$HC_{wm} = 0.43 * \left(\frac{HC_{mass1} + HC_{mass2}}{D_{phase1} + D_{phase2}} \right) + 0.57 * \left(\frac{HC_{mass3} + HC_{mass2}}{D_{phase3} + D_{phase2}} \right)$$

$$HC_{wm} = 0.43 * \left(\frac{20.8\,\text{mg} + 5.7\,\text{mg}}{3.584 \text{ miles} + 3.842 \text{ miles}} \right) + 0.57 * \left(\frac{4.2\,\text{mg} + 5.7\,\text{mg}}{3.586 \text{ miles} + 3.842 \text{ miles}} \right)$$

HC_{wm} = 2.3 mg/mile (benzene weighted mass emissions)

~~4~~5. ALCOHOL MASS EMISSIONS CALCULATION

~~4~~5.1. INTRODUCTION

Vehicular emissions are measured according to the (FTP [Ref. 1]. For each of the three phases of the FTP, a set of two impingers is used to collect alcohol emissions in the dilute exhaust. A fourth set of two impingers is used to collect a composite dilution air (background) alcohol sample from all three phases of the FTP. All impingers are analyzed according to Method No. 1001 to determine the alcohol concentration in each impinger. The measured alcohol concentrations are used in the following equations to calculate the weighted mass emissions of alcohol compounds.

~~4~~5.2. ALCOHOL MASS EMISSIONS CALCULATION PER TEST PHASE

~~4~~5.2.1 $ROH_{mass\ n} = (ROH_{conc} * ROH_{dens} * VMIX * 10^{-6})$ ~~/ (Carbon No.)~~

~~4~~5.2.2 $ROH_{conc} = ROH_{e} - (ROH_{d} * (1 - (1 / DF)))$
NOTE: If ROH_{conc} is calculated to be less than zero, then $ROH_{conc} = 0$.

~~4~~5.2.3 $ROH_{e} = (Imass_{e} / Ivol_{e}) * (\text{Mol. Vol.} / \text{Mol. Wt.})$

~~4~~5.2.4 $Imass_{e} = (Iconc_{e1} + Iconc_{e2})$ ~~$* Dens_{ROH}$~~ $* Ivol_{r}$

~~4~~5.2.5 $Ivol_{e} = Ivol_{em} * (293.16^{o}K / Itemp_{e}) * (P_{B} / 760\text{ mm Hg})$

~~4~~5.2.6 $ROH_{d} = (Imass_{d} / Ivol_{d}) * (\text{Mol. Vol.} / \text{Mol. Wt.})$

~~4~~5.2.7 $Imass_{d} = (Iconc_{d1} + Iconc_{d2})$ ~~$* Dens_{ROH}$~~ $* Ivol_{r}$

~~4~~5.2.8 $Ivol_{d} = Ivol_{dm} * (293.16^{o}K / Itemp_{d}) * (P_{B} / 760\text{ mm Hg})$

~~4~~5.3. WEIGHTED ALCOHOL MASS EMISSIONS CALCULATION

$$ROH_{wm} = 0.43 * \left(\frac{ROH_{mass1} + ROH_{mass2}}{D_{phase1} + D_{phase2}} \right) + 0.57 * \left(\frac{ROH_{mass3} + ROH_{mass2}}{D_{phase3} + D_{phase2}} \right)$$

~~4~~5.4 SAMPLE CALCULATION

~~4~~5.4.1 Alcohol emissions from an ~~M85~~ E85 fueled vehicle are collected in three sets of dilute exhaust impingers and one set of dilution air impingers during the FTP. Gas chromatography is used to determine the ~~methanol~~ alcohol concentration in each impinger. This is the same vehicle test as the example in section 3.3. Calculate the weighted ~~m~~ethanol mass emissions based on the following data, along with the data presented in section 3.3:

Test Phase	$Ivol_r$ (mL)	$Iconc_{e1}$ (µg/mL)	$Iconc_{e2}$ (µg/mL)	$Ivol_{em}$ (liter)	$Iconc_{d1}$ (µg/mL)	$Iconc_{d2}$ (µg/mL)	$Ivol_{dm}$ (liter)	$Itemp_e$ (°K)	$Itemp_d$ (°K)
1	15	4.984 ~~2.24~~	0.106 ~~0.05~~	8.18 ~~3.90~~	0 ~~0.07~~	0 ~~0.01~~	31.16 ~~13.50~~	294.26 ~~295~~	294.26 ~~294~~
2	15	0 ~~0.29~~	0 ~~0.06~~	14.65 ~~6.50~~	0 ~~0.07~~	0 ~~0.01~~	31.16 ~~13.50~~	294.26 ~~297~~	294.26 ~~294~~
3	15	0 0~~.32~~	0 ~~0.02~~	8.67 ~~4.00~~	0 ~~0.07~~	0 ~~0.01~~	31.16 ~~13.50~~	294.26 ~~298~~	294.26 ~~294~~

Test Phase	$D_{phase\ n}$ (mile)	DF	P_B (mm HG)	VMIX (ft3)
1	3.591	14.27	760	3495
2	3.846	22.15	760	5799
3	3.591	17.33	760	3484

~~Test Phase~~	~~FID THC_e (ppmC)~~	~~CH_{4e} (ppmC)~~	~~CO_{2e} (%)~~	~~CO_{em} (ppm)~~	~~R_a (%)~~	~~VMIX (ft^3)~~	~~$D_{phase\ n}$ (mile)~~	~~P_B (mmHg)~~	~~$HCHO_e$ (ppm)~~
~~1~~	~~82~~	~~9~~	~~1.5~~	~~250~~	~~30~~	~~2834~~	~~3.581~~	~~760~~	~~0.81~~
~~2~~	~~19~~	~~5~~	~~0.7~~	~~20~~	~~32~~	~~4862~~	~~3.845~~	~~760~~	~~0.09~~
~~3~~	~~22~~	~~6~~	~~0.8~~	~~32~~	~~29~~	~~2835~~	~~3.583~~	~~760~~	~~0.10~~

Ethanol

For Phase 1:

$Imass_e = (Iconc_{e1} + Iconc_{e2}) \cancel{* Dens_{ROH}} * Ivol_r$

$= (4.984\ \mu g/mL + 0.106\ \mu g/mL) * 15\ mL$

$= 76.35\ \mu g$

~~$= (2.24\ \mu g/mL + 0.05\ \mu g/mL) * 0.7914\ g/mL * 15\ mL * 10^6\ \mu g/g$~~

~~$= 27.2\ \mu g$~~

Mol. Wt. of C_2H_5OH = $(2 * 12.01115) + (6 * 1.00797) + (1 * 15.9994)$

$= 46.06952$ g/mole

~~Mol. Wt. of CH_3OH = $(1 * 12.01115) + (4 * 1.00797) + (1 * 15.9994)$~~

~~$= 32.0428$ g/mole~~

$Ivol_e = Ivol_{em} * (293/16^o\ K / Itemp_e) * (P_B / 760\ mm\ Hg)$

$= 8.18\ liter * (293.16^o K / 294.26^o K) * (760\ mm\ Hg / 760\ mm\ Hg)$

$= 8.15$ liters

~~$= 3.90\ liter * (293.16^o K / 295^o K) * (760\ mm\ Hg / 760\ mm\ Hg)$~~

~~$= 3.88$ liter~~

$ROH_e = (Imass_e / Ivol_e) * (Mol.\ Vol. / Mol.\ Wt.)$

$= \quad (76.35\ \mu g / 8.15\ liter) * (24.055\ liter/mole / 46.06952\ g/mole)$
$= \quad 4.89\ ppm$

~~= (27.2*10^-6 g / 3.88 liter) * (24.055 liter/mole / 46.06952 g/mole)~~
~~= 5.27 ppmC~~

$Imass_d = (Iconc_{d1} + Iconc_{d2})$ ~~* Dens_ROH~~ $* Ivol_r$
$= \quad (0\ \mu g/mL + 0 \mu g/mL) * 15\ mL$
$= \quad 0\ \mu g$

~~= (0.07 µg/mL + 0.01 µg/mL) * 0.7914 g/ml * 15 ml * 10^6 µg/g~~
~~= 0.95 µg~~

$Ivol_d = Ivol_{dm} * (293.16^o\ K / Itemp_d) * (P_B / 760\ mm\ Hg)$
$= \quad 31.16\ liter * (293.16^o K / 294.26^o K) * (760\ mm\ Hg / 760\ mm\ Hg)$
$= \quad 31.04\ liters$

~~= 13.50 liter * (293.16°K / 294°K) * (760 mm Hg / 760 mm Hg)~~
~~= 13.46 liter~~

$ROH_d = (Imass_d / Ivol_d) * (Mol.\ Vol. / Mol.\ Wt.)$
$= \quad (0\ \mu g / 31.46\ liter) * (24.055\ liter/mole / 46.06952\ g/mole)$
$= \quad 0\ ppm$

~~= (0.95*10^-6 g/ 13.46 liter) * (24.055 liter/mole / 32.0428 g/mole)~~
~~= 0.05 ppmC~~

$DF = 14.2688$ (as calculated in section 3.3)

$$\cancel{DF = \frac{12.02}{CO_{2e} + (NMHC_e + CH_{4e} + CO_e + ROH_e + HCHO_e) * 10^{-4}}}$$
~~(see section 6, DF Calc.)~~

$$\cancel{NMHC_e = FID\ THC_e - (r_{CH_4} * CH_{4e}) - (r_{CH_3OH} * ROH_e)}$$
$$\cancel{= 82\ ppmC - (1.04 * 9\ ppmC) - (0.66 * 5.27\ ppmC)}$$
$$\cancel{= 69\ ppmC}$$

$$\cancel{CO_e = (1 - (0.01 + 0.005 * HCR) * CO_{2e} - 0.000323 * R_a) * CO_{em}}$$
~~NOTE: If a CO instrument which meets the criteria specified in CFR 40, 86.111 is used and the conditioning column has been deleted, CO_em must be substituted directly for CO_e .~~

$$\cancel{= (1 - (0.02705) * 1.5\% - 0.000323 * 30\%) * 250\ ppm}$$
$$\cancel{= 237\ ppm}$$

$$\cancel{DF} = \frac{12.02}{1.5\% + (69\,\text{ppmC} + 9\,\text{ppmC} + 237\,\text{ppmC} + 5.27\,\text{ppmC} + 0.81\,\text{ppm}) * 10^{-4}}$$

ROH_{conc} = ROH_e - (ROH_d * (1 - (1 / DF)))
= 4.89 ppm - (0 ppmC * (1 - (1 / 14.27)))
= 4.89 ppm

~~= 5.27 ppmC - (0.05 ppmC * (1 - (1 / 7.84)))~~
~~= 5.23 ppmC~~

ROH_{dens} = (Mol. Wt. * conversion of liter to ft^3) / (Mol. Vol.)
= (46.06952 g/mole * 28.316 liter/ft^3) / 24.055 liter/mole
= 54.23007808 g/ft^3

~~= (32.0428 g/mole * 28.316 liter/ft) / 24.055 liter/mole~~
~~= 37.719 g/ft^3~~

VMIX = 3495 ft^3 (from section 3.3)

$ROH_{mass\ n}$ = (ROH_{conc} * ROH_{dens} * VMIX * 10^{-6}) ~~/ (Carbon No.)~~
$ROH_{mass\ 1}$ = (4.89 ppmC * 54.23 g/ft^3 * 3495 ft^3 * 10^{-6})
= 0.93 g

~~= (5.23 ppmC * 37.719 g/ft^3 * 2834 ft^3 * 10^{-6}) / 1~~
~~= 0.56 g~~

Similarly, for Phase 2: $ROH_{mass\ 2}$ = 0 ~~0.08~~ g
and for Phase 3: $ROH_{mass\ 3}$ = 0 ~~0.08~~ g

Therefore,

$$ROH_{wm} = 0.43 * \left(\frac{ROH_{mass1} + ROH_{mass2}}{D_{phase1} + D_{phase2}} \right) + 0.57 * \left(\frac{ROH_{mass3} + ROH_{mass2}}{D_{phase3} + D_{phase2}} \right)$$

$$ROH_{wm} = 0.43 * \left(\frac{0.93\,\text{g} + 0\,\text{g}}{3.591\,\text{miles} + 3.846\,\text{miles}} \right) + 0.57 * \left(\frac{0\,\text{g} + 0\,\text{g}}{3.591\,\text{miles} + 3.846\,\text{miles}} \right)$$

$$\cancel{ROH_{wm} = 0.43 * \left(\frac{0.56\,\text{mg} + 0.08\,\text{mg}}{3.581\,\text{miles} + 3.845\,\text{miles}} \right) + 0.57 * \left(\frac{0.08\,\text{mg} + 0.08\,\text{mg}}{3.583\,\text{miles} + 3.845\,\text{miles}} \right)}$$

ROH_{wm} = 0.045 g/mile (ethanol weighted mass emissions)

~~ROH_{wm} = 0.05 g (methanol weighted mass emissions)~~

~~5~~6. CARBONYL MASS EMISSIONS CALCULATIONS

~~5~~6.1. INTRODUCTION

Vehicular emissions are measured according to the FTP [Ref. 1]. For each of the three phases of the FTP, a set of two impingers (or cartridges) is used to collect carbonyl emissions in the dilute exhaust. A fourth set of two impingers (or cartridges) is used to collect a composite dilution air (background) carbonyl sample from all three phases of the FTP. All impingers (or cartridges) are analyzed according to Method No. 1004 to determine the mass of individual carbonyl compounds in each impinger (or cartridge). The measured carbonyl masses are used in the following equations to calculate the weighted mass emissions of each carbonyl compound.

~~5~~6.2. CARBONYL MASS EMISSIONS CALCULATION PER TEST PHASE

~~5~~6.2.1 $RHO_{mass\ n} = (RHO_{conc} * RHO_{dens} * VMIX * 10^{-6})$

~~5~~6.2.2 $RHO_{conc} = RHO_e - (RHO_d * (1 - (1 / DF)))$
NOTE: If RHO_{conc} is calculated to be less than zero, then RHO_{conc} = 0.

~~5~~6.2.3 $RHO_e = (Imass_e / Ivol_e) * (Mol.\ Vol. / Mol.\ Wt.)$

~~5~~6.2.4 $Imass_e = Iconc_{ce} * Ivol_c$

~~5~~6.2.5~~4~~ $Ivol_e = Ivol_{em} * (293.16^{o}K / Itemp_e) * (P_B / 760\ mm\ Hg)$

~~5~~6.2.6~~5~~ $RHO_d = (Imass_d / Ivol_d) * (Mol.\ Vol. / Mol.\ Wt.)$

~~5~~6.2.7 $Imass_d = Iconc_{cd} * Ivol_c$

~~5~~6.2.8~~6~~ $Ivol_d = Ivol_{dm} * (293.16^{o}K / Itemp_d) * (P_B / 760\ mm\ Hg)$

~~5~~6.3. WEIGHTED CARBONYL MASS EMISSIONS CALCULATION

$$RHO_{wm} = 0.43 * \left(\frac{RHO_{mass1} + RHO_{mass2}}{D_{phase1} + D_{phase2}} \right) + 0.57 * \left(\frac{RHO_{mass3} + RHO_{mass2}}{D_{phase3} + D_{phase2}} \right)$$

~~5~~6.4. SAMPLE CALCULATION

~~5~~6.4.1 Carbonyl emissions from ~~a CNG~~ an E85 vehicle are collected in three sets of dilute exhaust impingers and one set of dilution air impingers during the FTP. HPLC is used to determine the ~~formaldehyde~~ carbonyl mass in each impinger. This is the same vehicle test as the example in section 3.3. Calculate the weighted formaldehyde and acetaldehyde mass emissions based on the following data, along with the data presented in section 3.3:

Test Phase	$Ivol_c$ (ml)	Formaldehyde		$Ivol_{em}$ (liter)	Acetaldehyde		$Ivol_{dm}$ (liter)	$Itemp_e$ (°K)	$Itemp_d$ (°K)
		$Iconc_{ce}$ (µg/mL)	$Iconc_{cd}$ (µg/mL)		$Iconc_{ce}$ (µg/mL)	$Iconc_{cd}$ (µg/mL)			
1	4.4	0.387	0.006	8.47	4.114	0.006	8.23	294.26	294.26
2	4.4	0.048	0.016	15.35	0.013	0.009	13.88	294.26	294.26
3	4.4	0.016	0.006	9.01	0.012	0.005	8.16	294.26	294.26

~~Test Phase~~	~~$Ivol_r$ (mL)~~	~~$Imass_e$ (µg)~~	~~$Ivol_{em}$ (liter)~~	~~$Imass_d$ (µg)~~	~~$Ivol_{dm}$ (liter)~~	~~$Itemp_e$ (°K)~~	~~$Itemp_d$ (°K)~~
~~1~~	~~15~~	~~2.45~~	~~8.49~~	~~0.17~~	~~31.57~~	~~295~~	~~292~~
~~2~~	~~15~~	~~0.76~~	~~14.55~~	~~0.17~~	~~31.57~~	~~298~~	~~292~~
~~3~~	~~15~~	~~0.64~~	~~4.00~~	~~0.17~~	~~31.57~~	~~298~~	~~292~~

Test Phase	$D_{phase\ n}$ (mile)	DF	P_B (mm HG)	VMIX (ft3)
1	3.591	14.27	760	3495
2	3.846	22.15	760	5799
3	3.591	17.33	760	3484

~~Test Phase~~	~~FID THC_e (ppmC)~~	~~CH_{4e} (ppmC)~~	~~CO_{2e} (%)~~	~~CO_{em} (ppm)~~	~~R_a (%)~~	~~VMIX (ft^3)~~	~~$D_{phase\ n}$ (mile)~~	~~P_B (mmHg)~~
~~1~~	~~132~~	~~108~~	~~0.9~~	~~8~~	~~68~~	~~2866~~	~~3.581~~	~~760~~
~~2~~	~~4~~	~~3~~	~~0.1~~	~~4~~	~~67~~	~~4841~~	~~3.845~~	~~760~~
~~3~~	~~22~~	~~9~~	~~0.5~~	~~5~~	~~65~~	~~2837~~	~~3.583~~	~~760~~

Formaldehyde

For Phase 1:

$$Imass_e = Iconc_{ce} * Ivol_c$$
$$= 0.387\ \mu g/mL * 4.4\ mL$$
$$= 1.70\ \mu g$$

Mol. Wt. of HCHO = (1 * 12.01115) + (2 * 1.00797) + (1 * 15.9994)
= 30.0268 g/mole

$$Ivol_e = Ivol_{em} * (293/16^{o}\ K / Itemp_e) * (P_B / 760\ mm\ Hg)$$
$$= 8.47\ liter * (293.16^{o}K / 294.26^{o}K) * (760\ mm\ Hg / 760\ mm\ Hg)$$
$$= 8.44\ liter$$

~~= 8.49 liter * (293.16°K / 295°K) * (760 mm Hg / 760 mm Hg)~~
~~= 8.44 liter~~

RHO_e = ($Imass_e$ / $Ivol_e$) * (Mol. Vol. / Mol. Wt.)
= (1.70 µg / 8.44 liter) * (24.055 liter/mole / 30.0268 g/mole)
= 0.16 ppm

~~= (2.45*10^{-6} g / 8.44 liter) * (24.055 liter/mole / 30.0268 g/mole)~~
~~= 233 ppb~~

$Imass_d$ = $Iconc_{cd}$ * $Ivol_c$
= 0.006 µg/mL * 4.4 mL
= 0.026 µg

$Ivol_d$ = $Ivol_{dm}$ * (293.16°K / $Itemp_d$) * (P_B / 760 mm Hg)
= 8.23 liter * (293.16°K / 294.26°K) * (760 mm Hg / 760 mm Hg)
= 8.20 liter

~~= 31.57 liter * (293.16°K / 292°K) * (760 mm Hg / 760 mm Hg)~~
~~= 31.70 liter~~

RHO_d = ($Imass_d$ / $Ivol_d$) * (Mol. Vol. / Mol. Wt.)
= (0.026 µg / 8.20 liter) * (24.055 liter/mole / 30.0268 g/mole)
= 0.00258 ppm

~~= (0.17*10^{-6} g / 31.70 liter)*(24.055 liter/mole / 30.0268 g/mole)~~
~~= 4 ppb~~

DF = 14.2688

~~DF = 9.77 / [CO_{2e} + ($NMHC_e$ + CH_{4e} + CO^e) * 10^{-4}]~~
~~(see section 6, DF Calc.)~~

~~$NMHC_e$ = FID THC_e – (r_{CH_4} * CH_{4e})~~
~~= 132 ppmC - (1.04 * 108 ppmC)~~
~~= 20 ppmC~~

~~CO_e = (1 - (0.01 + 0.005 * HCR) * CO_{2e} – 0.000323 * R_a) * CO_{em}~~
~~NOTE: If a CO instrument which meets the criteria specified in CFR 40, 86.111 is used and the conditioning column has been deleted, CO_{em} must be substituted directly for CO_e.~~

~~= (1 - 0.02890 * 0.9% - 0.000323 * 68%) * 8 ppm~~
~~= 7.6 ppm~~

~~DF = 9.77 / [0.9% + (20 ppmC + 108 ppmC + 7.6 ppm) * 10^{-4}]~~
~~= 10.69~~

RHO_{conc} = RHO_e - (RHO_d * (1 - (1 / DF)))

= 0.162 ppm - (0.00258 ppm * (1 - (1 / 14.27)))
= 0.1596 ppm

~~= 233 ppb - (4 ppb * (1 - (1 / 10.69)))~~
~~= 229 ppb~~

RHO_{dens} = (Mol. Wt. * conversion of liter to ft^3) / (Mol. Vol.)
= (30.0268 g/mole * 28.316 liter/ft^3) / 24.055 liter/mole
= 35.35 g/ft^3

VMIX = 3495 ft^3

$RHO_{mass\ n}$ = (RHO_{conc} * RHO_{dens} * VMIX * 10^{-6})
$RHO_{mass\ 1}$ = (0.1596 ppm * 35.35 g/ft^3 * 3495 ft^3 * 10^{-6} * 1000 mg/g)
= 19.718 mg

~~= (229 ppb * 35.35 g/ft³ * 2866 ft³ * 10⁻⁶)~~
~~= 23.2 mg~~

Similarly, for Phase 2: $RHO_{mass\ 2}$ = 1.457 ~~6.6~~ mg
and for Phase 3: $RHO_{mass\ 3}$ = 0.472 ~~12.7~~ mg

Therefore,

$$RHO_{wm} = 0.43 * \left(\frac{RHO_{mass1} + RHO_{mass2}}{D_{phase1} + D_{phase2}} \right) + 0.57 * \left(\frac{RHO_{mass3} + RHO_{mass2}}{D_{phase3} + D_{phase2}} \right)$$

$$RHO_{wm} = 0.43 * \left(\frac{19.718\,mg + 1.457\,mg}{3.591\ miles + 3.846\ miles} \right) + 0.57 * \left(\frac{0.472\,mg + 1.457\,mg}{3.591\ miles + 3.846\ miles} \right)$$

$$\cancel{RHO_{wm} = 0.43 * \left(\frac{23.2\,mg + 6.6\,mg}{3.581\ miles + 3.845\ miles} \right) + 0.57 * \left(\frac{12.7\,mg + 6.6\,mg}{3.583\ miles + 3.845\ miles} \right)}$$

RHO_{wm} = 1.371 ~~3.2~~ mg/mi (formaldehyde weighted mass emissions)

Acetaldehyde

Similarly,

Phase 1: $RHO_{mass\ 1}$ = 212 mg
Phase 2: $RHO_{mass\ 2}$ = 0.165 mg
Phase 3: $RHO_{mass\ 3}$ = 0.329 mg

$$RHO_{wm} = 0.43 * \left(\frac{212\,mg + 0.165\,mg}{3.591\ miles + 3.846\ miles} \right) + 0.57 * \left(\frac{0.329\,mg + 0.165\,mg}{3.591\ miles + 3.846\ miles} \right)$$

RHO_{wm} = 0.0123 mg/mi (acetaldehyde weighted mass emissions)

~~5.4.2 Carbonyl emissions from a gasoline vehicle are collected in three sets of dilute exhaust cartridges and dilution air cartridges during the FTP. HPLC is used to determine the formaldehyde mass in each cartridge. Calculate the weighted formaldehyde mass emissions based on the following data:~~

~~Test Phase~~	~~Iconc$_{ce}$ (µg/mL)~~	~~Iconc$_{cd}$ (µg/mL)~~	~~Iconc$_{blk}$ (µg/mL)~~	~~Ivol$_{dm}$ (liter)~~	~~Ivol$_{em}$ (liter)~~	~~Itemp$_e$ (°K)~~	~~Itemp$_d$ (°K)~~
~~1~~	~~1.212~~	~~0.028~~	~~0.0~~	~~8.61~~	~~8.57~~	~~294.26~~	~~294.26~~
~~2~~	~~0.334~~	~~0.043~~	~~0.0~~	~~14.91~~	~~13.83~~	~~294.26~~	~~294.26~~
~~3~~	~~0.172~~	~~0.026~~	~~0.0~~	~~8.68~~	~~8.74~~	~~294.26~~	~~294.26~~

~~Test Phase~~	~~FID THC$_e$ (ppmC)~~	~~CH$_{4e}$ (ppmC)~~	~~CO$_{2e}$ (%)~~	~~CO$_{em}$ (ppm)~~	~~R$_a$ (%)~~	~~VMIX (ft^3)~~	~~D$_{phase\ n}$ (mile)~~	~~P$_B$ (mmHg)~~
~~1~~	~~132~~	~~108~~	~~0.9~~	~~8~~	~~68~~	~~2866~~	~~3.581~~	~~760~~
~~2~~	~~4~~	~~3~~	~~0.1~~	~~4~~	~~67~~	~~4841~~	~~3.845~~	~~760~~
~~3~~	~~22~~	~~9~~	~~0.5~~	~~5~~	~~65~~	~~2837~~	~~3.583~~	~~760~~

~~For all three phases Ivolc = 4.4 mL~~

~~For Phase 1:~~

~~Imass$_d$ = (Iconc$_{cd}$ – Iconc$_{blk}$)*Ivol$_e$~~

~~Imass$_d$ = (0.028 – 0.0) µg/mL * 4.4 mL = 0.1232 µg~~

~~Imass$_e$ = (Iconc$_{ce}$ – Iconc$_{blk}$)*Ivol$_e$~~

~~Imass$_e$ = (1.212 – 0.0) µg/mL * 4.4 mL = 5.33 µg~~

~~Mol. Wt. of HCHO = (1 * 12.01115) + (2 * 1.00797) + (1 * 15.9994)~~
~~= 30.0265 g/mole~~

~~Ivol$_e$ = Ivol$_{em}$ * (293/16° K / Itemp$_e$) * (P$_B$ / 760 mm Hg)~~

~~= 8.57 liter * (293.16^{o}K / 294.26^{o}K) * (760 mm Hg / 760 mm Hg)~~
~~= 8.54 liter~~

~~RHO_e = ($Imass_e$ / $Ivol_e$) * (Mol. Vol. / Mol. Wt.)~~
~~= ($5.33*10^{-6}$ g / 8.54 liter) * (24.055 liter/mole / 30.0265 g/mole)~~
~~= 500 ppb~~

~~$Ivol_d$ = $Ivol_{dm}$ * (293.16^{o}K / $Itemp_d$) * (P_B / 760 mm Hg)~~
~~= 8.61 liter * (293.16^{o}K / 294.26^{o}K) * (760 mm Hg / 760 mm Hg)~~
~~= 8.58 liter~~

~~RHO_d = ($Imass_d$ / $Ivol_d$) * (Mol. Vol. / Mol. Wt.)~~
~~= ($0.1232*10^{-6}$g / 8.58 liter)*(24.055 liter/mole / 30.0265 g/mole)~~
~~= 11.5 ppb~~

~~DF = 9.77 / [CO_{2e} + ($NMHC_e$ + CH_{4e} + CO_e) * 10^{-4}]~~
~~(see section 6, DF Calc.)~~

~~$NMHC_e$ = FID THC_e – (r_{CH_4} * CH_{4e})~~
~~= 132 ppmC - (1.04 * 108 ppmC)~~
~~= 20 ppmC~~

~~CO_e = (1 - (0.01 + 0.005 * HCR) * CO_{2e} – 0.000323 * R_a) * CO_{em}~~
~~NOTE: If a CO instrument which meets the criteria specified in CFR 40, 86.111 is used and the conditioning column has been deleted, CO_{em} must be substituted directly for CO_e.~~

~~= (1 – 0.02890 * 0.9% - 0.000323 * 68%) * 8 ppm~~
~~= 7.6 ppm~~

~~DF = 9.77 / [0.9% + (20 ppmC + 108 ppmC + 7.6 ppm) * 10^{-4}]~~
~~= 10.69~~

~~RHO_{conc} = RHO_e – (RHO_d * (1 – (1 / DF)))~~
~~= 500 ppb - (11.5 ppb * (1 – (1 / 10.69)))~~
~~= 489.6 ppb (formaldehyde)~~

~~RHO_{dens} = (Mol. Wt. * conversion of liter to ft^3) / (Mol. Vol.)~~
~~= (30.0265 g/mole * 28.316 liter/ft^3) / 24.055 liter/mole~~
~~= 35.35 g/ft^3~~

~~$RHO_{mass\ n}$ = (RHO_{conc} * RHO_{dens} * VMIX * 10^{-6})~~

~~$RHO_{mass\ 1}$ = (489.6 ppb * 35.35 g/ft^3 * 2866 ft^3 * 10^{-6})~~
~~= 49.6 mg (formaldehyde)~~

~~Similarly, for Phase 2: $RHO_{mass\ 2}$ = 12.9 mg~~

~~and similarly for Phase 3: RHO~~$_{mass\ 3}$~~= 5.6 mg~~

~~Therefore,~~

$$RHO_{wm} = 0.43 * \left(\frac{RHO_{mass\,1} + RHO_{mass\,2}}{D_{phase\,1} + D_{phase\,2}}\right) + 0.57 * \left(\frac{RHO_{mass\,3} + RHO_{mass\,2}}{D_{phase\,3} + D_{phase\,2}}\right)$$

$$RHO_{wm} = 0.43 * \left(\frac{49.6\text{ mg} + 12.9\text{ mg}}{3.581\text{miles} + 3.845\text{ miles}}\right) + 0.57 * \left(\frac{5.6\text{ mg} + 12.9\text{ mg}}{3.583\text{ miles} + 3.845\text{ miles}}\right)$$

~~RHO~~$_{wm}$ ~~= 5.04 mg/mi (formaldehyde weighted mass emissions)~~

~~6. DILUTION FACTOR CALCULATION~~

~~6.1. For Non-Alcohol Fueled Vehicles~~

~~6.1.1~~

$$DF = \frac{100 * \left(\frac{x}{x + y/2 + 3.76 * (x + y/4 - z/2)}\right)}{CO_{2e} + (NMHC_e + CH_{4e} + CO_e) * 10^{-4}}$$

~~(where fuel composition is~~ $C_xH_yO_z$ ~~as measured for the fuel used.)~~

~~6.1.2~~ $CO_e = (1 - (0.01 + 0.005 * HCR) * CO_{2e} - 0.000323 * R_a) * CO_{em}$

~~NOTE: If a CO instrument which meets the criteria specified in CFR 40, 86.111 is used and the conditioning column has been deleted,~~ CO_{em} ~~must be substituted directly for~~ CO_e~~.~~

~~a) For gasoline,~~ $CH_{1.85}$~~, where x = 1, y = 1.85, and z = 0:~~
$DF = 13.47 / [CO_{2e} + (NMHC_e + CH_{4e} + CO_e) * 10^{-4}$
$CO_e = (1 - 0.01925 * CO_{2e} - 0.000323 * R_a) * CO_{em}$

~~b) For Phase 2 gasoline,~~ $CH_{1.94}$~~, where x = 1, y = 1.94 and z = 0.017,~~
$DF = 13.29 / [CO_{2e} + (NMHC_e + CH_{4e} + CO_e) * 10^{-4}$
$CO_e = (1 - 0.01970 * CO_{2e} - 0.000323 * R_a) * CO_{em}$

~~c) For LPG,~~ $CH_{2.64}$~~, where x = 1, y = 2.64, z = 0:~~
$DF = 11.68 / [CO_{2e} + (NMHC_e + CH_{4e} + CO_e) * 10^{-4}$
$CO_e = (1 - 0.02320 * CO_{2e} - 0.000323 * R_a) * CO_{em}$

~~d) For CNG,~~ $CH_{3.78}$~~, where x = 1, y = 3.78, and z = 0.016:~~

~~$DF = 9.83 / [[CO_{2e} + (NMHC_e + CH_{4e} + CO_e) * 10^{-4}]$~~
~~$CO_e = (1 - 0.02890 * CO_{2e} - 0.000323 * R_a) * CO_{em}$~~

~~6.2. **For Alcohol Fueled Vehicles**:~~

~~6.2.1~~ $$\cancel{DF = \frac{100 * \left(\frac{x}{x + y/2 + 3.76 * (x + y/4 - z/2)}\right)}{CO_{2e} + (NMHC_e + CH_{4e} + CO_e + ROH_e + HCHO_e) * 10^{-4}}}$$

~~(where fuel composition is $C_xH_yO_z$ as measured for the fuel used.)~~

~~6.2.2 $CO_e = (1 - (0.01 + 0.005 * HCR) * CO_{2e} - 0.000323 * R_a) * CO_{em}$~~
~~NOTE: If a CO instrument which meets the criteria specified in CFR 40, 86.111 is used and the conditioning column has been deleted, CO_{em} must be substituted directly for CO_e.~~

~~a) For M100 (100% methanol), CH_3OH, where x = 1, y = 4, and z = 1:~~
~~$DF = 11.57 / [CO_{2e} + (NMHC_e + CH_{4e} + CO_e + ROH_e + HCHO_e) * 10^{-4}]$~~
~~$CO_e = (1 - 0.03000 * CO_{2e} - 0.000323 * R_a) * CO_{em}$~~

~~b) For M85 (85% methanol, 15% indolene), $CH_{3.41}O_{0.72}$, where x = 1, y = 3.41, and z = 0.72:~~
~~$DF = 12.02 / [CO_{2e} + (NMHC_e + CH_{4e} + CO_e + ROH_e + HCHO_e) * 10^{-4}]$~~
~~$CO_e = (1 - 0.02705 * CO_{2e} - 0.000323 * R_a) * CO_{em}$~~

~~c) For E100 (100% ethanol), C_2H_5OH, where x = 1, y = 3, and z = 0.5:~~
~~$DF = 12.29 / [CO_{2e} + (NMHC_e + CH_{4e} + CO_e + ROH_e + HCHO_e) * 10^{-4}]$~~
~~$CO_e = (1 - 0.02500 * CO_{2e} - 0.000323 * R_a) * CO_{em}$~~

7 NONMHC MASS EMISIONS CALCULATION

7.1 Non-oxygenated non-methane hydrocarbon is calculated from the FID NMHC measurement using the following equation:

$$NONMHC_{mass} = NMHC_{mass} - NMHC_{dens} * \sum\left(\frac{ROH_{mass}}{ROH_{dens}}\right) * r_{ROH} - NMHC_{dens} * \sum\left(\frac{RHO_{mass}}{RHO_{dens}}\right) * r_{RHO}$$

7.1.1 For the purpose of calculating NMOG for vehicles tested on exhaust emission test fuel containing ethanol:

7.1.1.1 The only alcohol included in the above calculation is ethanol.

7.1.1.2 The only carbonyl compounds included in the above calculation are formaldehyde and acetaldehyde.

7.2 FID Response Factors:

FID response factors are experimentally determined for each individual FID. The following values are used in the sample calculations and are presented for example only.

Oxygenated species	Response factor* (*RF*)
methanol	0.85
ethanol	0.756
formaldehyde	0
acetaldehyde	0.5

* Response factors are normalized to propane, i.e., propane has a response factor of 1.000.

7.3 Sample Calculation

Continuing from the same E85 test used in the alcohol and carbonyl calculations:

Test Phase	$NMHC_{mass\ n}$ (g)	$Ethanol_{mass\ n}$ (g)	$Formaldehyde_{massn}$ (g)	$Acetaldehyde_{mass\ n}$ (g)
1	1.1220	0.09271	0.0197	0.212
2	0	0	0.001457	0.000165
3	0.0026	0	0.000472	0.000329

and

$NMHC_{dens} = 17.44\ g/ft^3$

$$NONMHC_{mass1} = NMHC_{mass1} - NMHC_{dens} * \sum\left(\frac{ROH_{mass1}}{ROH_{dens}}\right) * r_{ROH} - NMHC_{dens} * \sum\left(\frac{RHO_{mass1}}{RHO_{dens}}\right) * r_{RHO}$$

$$\begin{aligned} NONMHC_{mass1} &= 1.1220 - 17.44\ g/ft^3 * (\ 0.9271\ g / 27.116\ (g/ft^3)) * 0.756 \\ &\quad - 17.44\ g/ft^3 * (\ 0.0197\ g / 35.350\ (g/ft^3)) * 0 \\ &\quad - 17.44\ g/ft^3 * (\ 0.212\ g / 25.929\ (g/ft^3)) * 0.5 \\ &= 1.1220 - 0.4508 - 0 - 0.0713 \\ &= 0.5999\ g \end{aligned}$$

$$\begin{aligned} NONMHC_{mass2} &= 0 - 17.44\ g/ft^3 * (\ 0\ g / 27.116\ (g/ft^3)) * 0.756 \\ &\quad - 17.44\ g/ft^3 * (\ 0.001457\ g / 35.350\ (g/ft^3)) * 0 \\ &\quad - 17.44\ g/ft^3 * (\ 0.000165\ g / 25.929\ (g/ft^3)) * 0.5 \\ &= 0 - 0 - 0 - 0.000055 \\ &= 0\ g \end{aligned}$$

Note: Results that are less than zero are reported as zero.

$$
\begin{aligned}
NONMHC_{mass3} &= 0.0026 - 17.44\ g/ft^3 * (\ 0\ g\ /\ 27.116\ (g/ft^3))*0.756 \\
&\quad - 17.44\ g/ft^3 * (\ 0.000472\ g\ /\ 35.350\ (g/ft^3))*0 \\
&\quad - 17.44\ g/ft^3 * (\ 0.000329\ g\ /\ 25.929\ (g/ft^3))*0.5 \\
&= 0.0026 - 0 - 0 - 0.000111 \\
&= 0.00249\ g
\end{aligned}
$$

8 WEIGHTED HYDROCARBON MASS EMISSIONS CALCULATION

8.1 Weighted NMOG is determined using the following equation:

$$NMOG_{wm} = \sum NONMHC_{wm} + \sum ROH_{wm} + \sum RHO_{wm}$$

where:

$$NONMHC_{wm} = 0.43 * \left(\frac{NONMHC_{mass1} + NONMHC_{mass2}}{D_{phase1} + D_{phase2}} \right) + 0.57 * \left(\frac{NONMHC_{mass3} + NONMHC_{mass2}}{D_{phase3} + D_{phase2}} \right)$$

$$ROH_{wm} = 0.43 * \left(\frac{ROH_{mass1} + ROH_{mass2}}{D_{phase1} + D_{phase2}} \right) + 0.57 * \left(\frac{ROH_{mass3} + ROH_{mass2}}{D_{phase3} + D_{phase2}} \right)$$

$$RHO_{wm} = 0.43 * \left(\frac{RHO_{mass1} + RHO_{mass2}}{D_{phase1} + D_{phase2}} \right) + 0.57 * \left(\frac{RHO_{mass3} + RHO_{mass2}}{D_{phase3} + D_{phase2}} \right)$$

8.1.1 For the purpose of calculating NMOG for vehicles tested on exhaust emission test fuel containing ethanol:

8.1.1.1 The only alcohol included in the weighted NMOG calculation is ethanol.

8.1.1.2 The only carbonyl compounds included in the weighted NMOG calculation are formaldehyde and acetaldehyde.

8.2 Sample calculation

Continuing from the previous example:

Test Phase	$NONMHC_{mass\ n}$ (g)	$Ethanol_{mass\ n}$ (g)	$Formaldehyde_{mass\ n}$ (g)	$Acetaldehyde_{mass\ n}$ (g)	Distance (mile)
1	0.5999	0.9271	0.019718	0.212	3.591
2	0	0	0.001457	0.000165	3.846

3	0.00249	0	0.000472	0.000329	3.591

$$\text{NONMHC}_{\text{wm}} = 0.43 * \left(\frac{0.5999\ \text{g} + 0\ \text{g}}{3.591\ \text{miles} + 3.846\ \text{miles}} \right) + 0.57 * \left(\frac{0.00249\ \text{g} + 0\ \text{g}}{3.591\ \text{miles} + 3.846\ \text{miles}} \right)$$

$\text{NONMHC}_{\text{wm}}$ = 0.03488 g/mile
Similarly, $\text{Ethanol}_{\text{wm}}$ = 0.05360 g/mile
Similarly, $\text{Formaldehyde}_{\text{wm}}$ = 0.00137 g/mile
Similarly, $\text{Acetaldehyde}_{\text{wm}}$ = 0.01231 g/mile

With all the above information, the weighted mass emissions of non-methane organic gas can be calculated:

$$\text{NMOG}_{\text{wm}} = \sum \text{NONMHC}_{\text{wm}} + \sum \text{ROH}_{\text{wm}} + \sum \text{RHO}_{\text{wm}}$$

NMOG_{wm} = 0.03488 g/mile + 0.05360 g/mile + 0.00137 g/mile + 0.01231 g/mile
= 0.102 g/mile

APPENDIX 1

LIST OF COMPOUNDS

CAS #	COMPOUND	MIR
	Alcohols	
00067-56-1	methanol	~~0.71~~ 0.67
00064-17-5	ethanol	~~1.69~~ 1.53
	Light End and Mid-Range Hydrocarbons (Listed in approximate elution order)	
00074-85-1	ethene	~~9.08~~ 9.00
00074-86-2	ethyne	~~1.25~~ 0.95
00074-84-0	ethane	~~0.31~~ 0.28
00115-07-1	propene	~~11.58~~ 11.66
00074-98-6	propane	~~0.56~~ 0.49
00463-49-0	1,2-propadiene	~~12.16~~ 8.45
00074-99-7	1-propyne	~~6.45~~ 6.72
00075-28-5	2-methylpropane	~~1.35~~ 1.23
00115-11-7	2-methylpropene	~~6.35~~ 6.29
00106-98-9	1-butene	~~10.29~~ 9.73
00106-99-0	1,3-butadiene	~~13.58~~ 12.61
00106-97-8	n-butane	~~1.33~~ 1.15
00624-64-6	trans-2-butene	~~13.91~~ 15.16
00463-82-1	2,2-dimethylpropane	~~1.68~~ 0.67
00107-00-6	1-butyne	~~6.20~~ 6.11
00590-18-1	cis-2-butene	~~13.22~~ 14.24
00563-45-1	3-methyl-1-butene	6.99
00078-78-4	2-methylbutane	~~1.68~~ 1.45
00503-17-3	2-butyne	~~16.33~~ 16.32
00109-67-1	1-pentene	~~7.79~~ 7.21
00563-46-2	2-methyl-1-butene	~~6.51~~ 6.40
00109-66-0	n-pentane	~~1.54~~ 1.31
00078-79-5	2-methyl-1,3-butadiene	~~10.69~~ 10.61
00646-04-8	trans-2-pentene	~~10.23~~ 10.56
00558-37-2	3,3-dimethyl-1-butene	~~6.06~~ 5.82
00627-20-3	cis-2-pentene	~~10.24~~ 10.38
00689-97-4	1-buten-3-yne	~~11.09~~ 10.48
00513-35-9	2-methyl-2-butene	~~14.45~~ 14.08
00542-92-7	1,3-cyclopentadiene	~~7.61~~ 6.98
00075-83-2	2,2-dimethylbutane	~~1.33~~ 1.17
00142-29-0	cyclopentene	~~7.38~~ 6.77
00691-37-2	4-methyl-1-pentene	~~6.26~~ 5.68

CAS #	COMPOUND	MIR
00760-20-3	3-methyl-1-pentene	~~6.22~~ 6.14
00287-92-3	cyclopentane	~~2.69~~ 2.39
00079-29-8	2,3-dimethylbutane	~~1.14~~ 0.97
01634-04-4	1-methyl-tert-butyl-ether	~~0.78~~ 0.73
00691-38-3	4-methyl-cis-2-pentene	~~8.44~~ 8.12
00107-83-5	2-methylpentane	~~1.80~~ 1.50
00674-76-0	4-methyl-trans-2-pentene	~~8.44~~ 8.12
00096-14-0	3-methylpentane	~~2.07~~ 1.80
00763-29-1	2-methyl-1-pentene	~~5.18~~ 5.26
00592-41-6	1-hexene	~~6.17~~ 5.49
00110-54-3	n-hexane	~~1.45~~ 1.24
13269-52-8	trans-3-hexene	~~8.16~~ 7.57
07642-09-3	cis-3-hexene	~~8.22~~ 7.61
04050-45-7	trans-2-hexene	~~8.44~~ 8.62
00616-12-6	3-methyl-trans-2-pentene	~~8.44~~ 13.17
00625-27-4	2-methyl-2-pentene	~~12.28~~ 11.00
01120-62-3	3-methylcyclopentene	~~8.65~~ 5.10
07688-21-3	cis-2-hexene	~~8.44~~ 8.31
00637-92-3	1-ethyl-tert-butyl-ether	~~2.11~~ 2.01
00922-62-3	3-methyl-cis-2-pentene	~~8.44~~ 12.49
00590-35-2	2,2-dimethylpentane	~~1.22~~ 1.12
00096-37-7	methylcyclopentane	~~2.42~~ 2.19
00108-08-7	2,4-dimethylpentane	~~1.65~~ 1.55
00464-06-2	2,2,3-trimethylbutane	~~1.32~~ 1.11
07385-78-6	3,4-dimethyl-1-pentene	~~4.56~~ 4.84
00693-89-0	1-methylcyclopentene	~~13.95~~ 12.49
00071-43-2	benzene	~~0.81~~ 0.72
03404-61-3	3-methyl-1-hexene	4.56 ~~4.41~~
00562-49-2	3,3-dimethylpentane	~~1.32~~ 1.20
00110-82-7	cyclohexane	~~1.46~~ 1.25
00591-76-4	2-methylhexane	~~1.37~~ 1.19
00565-59-3	2,3-dimethylpentane	~~1.55~~ 1.34
00110-83-8	cyclohexene	~~5.45~~ 5.00
00589-34-4	3-methylhexane	~~1.86~~ 1.61
01759-58-6	trans-1,3-dimethylcyclopentane	~~2.15~~ 1.94
02532-58-3	cis-1,3-dimethylcyclopentane	~~2.15~~ 1.94
00617-78-7	3-ethylpentane	~~1.63~~ 1.90
00822-50-4	trans-1,2-dimethylcyclopentane	1.99
00592-76-7	1-heptene	~~4.56~~ 4.43
00540-84-1	2,2,4-trimethylpentane	~~1.44~~ 1.26
14686-14-7	trans-3-heptene	~~6.96~~ 6.32
00142-82-5	n-heptane	~~1.28~~ 1.07
02738-19-4	2-methyl-2-hexene	~~6.96~~ 9.47
03899-36-3	3-methyl-trans-3-hexene	~~6.96~~ 9.72
14686-13-6	trans-2-heptene	~~7.33~~ 7.14

CAS #	COMPOUND	MIR
00816-79-5	3-ethyl-2-pentene	~~6.96~~ 9.75
00107-39-1	2,4,4-trimethyl-1-pentene	~~3.45~~ 3.34
10574-37-5	2,3-dimethyl-2-pentene	~~6.96~~ 9.74
06443-92-1	cis-2-heptene	~~6.96~~ 7.16
00108-87-2	methylcyclohexane	~~1.99~~ 1.70
00590-73-8	2,2-dimethylhexane	~~1.13~~ 1.02
00107-40-4	2,4,4-trimethyl-2-pentene	~~5.85~~ 6.29
01640-89-7	ethylcyclopentane	~~2.27~~ 2.01
00592-13-2	2,5-dimethylhexane	~~1.68~~ 1.46
00589-43-5	2,4-dimethylhexane	~~1.80~~ 1.73
02815-58-9	1,2,4-trimethylcyclopentane	~~1.75~~ 1.53
00563-16-6	3,3-dimethylhexane	~~1.57~~ 1.24
00565-75-3	2,3,4-trimethylpentane	~~1.23~~ 1.03
00560-21-4	2,3,3-trimethylpentane	~~1.57~~ 1.02
00108-88-3	toluene	~~3.97~~ 4.00
00584-94-1	2,3-dimethylhexane	~~1.34~~ 1.19
00592-27-8	2-methylheptane	~~1.20~~ 1.07
00589-53-7	4-methylheptane	~~1.48~~ 1.25
00589-81-1	3-methylheptane	~~1.35~~ 1.24
15890-40-1	(1a,2a,3b)-1,2,3-trimethylcyclopentane	~~1.75~~ 1.63
00638-04-0	cis-1,3-dimethylcyclohexane	~~1.72~~ 1.52
02207-04-7	trans-1,4-dimethylcyclohexane	~~1.75~~ 1.47
03522-94-9	2,2,5-trimethylhexane	~~1.33~~ 1.13
02613-65-2	trans-1-methyl-3-ethylcyclopentane	~~1.75~~ 1.64
16747-50-5	cis-1-methyl-3-ethylcyclopentane	~~1.75~~ 1.64
00111-66-0	1-octene	~~3.45~~ 3.25
14850-23-8	trans-4-octene	~~5.90~~ 4.81
00111-65-9	n-octane	~~1.11~~ 0.90
13389-42-9	trans-2-octene	~~5.90~~ 6.00
02207-03-6	trans-1,3-dimethylcyclohexane	~~1.72~~ 1.52
07642-04-8	cis-2-octene	~~5.90~~ 4.81
01069-53-0	2,3,5-trimethylhexane	~~1.33~~ 1.22
02213-23-2	2,4-dimethylheptane	~~1.48~~ 1.38
02207-01-4	cis-1,2-dimethylcyclohexane	~~1.75~~ 1.41
01072-05-5	2,6-dimethylheptane	~~1.25~~ 1.04
01678-91-7	ethylcyclohexane	~~1.75~~ 1.47
00926-82-9	3,5-dimethylheptane	~~1.63~~ 1.56
00100-41-4	ethylbenzene	~~2.79~~ 3.04
03074-71-3	2,3-dimethylheptane	~~1.25~~ 1.09
00108-38-3	m-&p-xylene	~~8.49~~ 8.45
02216-34-4	4-methyloctane	~~1.08~~ 0.95
03221-61-2	2-methyloctane	~~0.96~~ 0.83
02216-33-3	3-methyloctane	~~1.25~~ 0.99
00100-42-5	styrene (ethenylbenzene)	~~1.95~~ 1.73
00095-47-6	o-xylene	~~7.49~~ 7.64

CAS #	COMPOUND	MIR
00124-11-8	1-nonene	~~2.76~~ 2.60
00111-84-2	n-nonane	~~0.95~~ 0.78
00098-82-8	(1-methylethyl)benzene	~~2.32~~ 2.52
15869-87-1	2,2-dimethyloctane	~~1.09~~ 0.83
04032-94-4	2,4-dimethyloctane	~~1.09~~ 1.03
02051-30-1	2,6-dimethyloctane	~~1.27~~ 1.08
00103-65-1	n-propylbenzene	~~2.20~~ 2.03
00620-14-4	1-methyl-3-ethylbenzene	~~6.61~~ 7.39
00622-96-8	1-methyl-4-ethylbenzene	~~6.61~~ 4.44
00108-67-8	1,3,5-trimethylbenzene	~~11.22~~ 11.76
00611-14-3	1-methyl-2-ethylbenzene	~~6.61~~ 5.59
00095-63-6	1,2,4-trimethylbenzene	~~7.18~~ 8.87
00124-18-5	n-decane	~~0.83~~ 0.68
00538-93-2	(2-methylpropyl)benzene	~~1.97~~ 2.36
00135-98-8	(1-methylpropyl)benzene	~~1.97~~ 2.36
00535-77-3	1-methyl-3-(1-methylethyl)benzene	~~5.92~~ 7.10
00526-73-8	1,2,3-trimethylbenzene	~~11.26~~ 11.97
00099-87-6	1-methyl-4-(1-methylethyl)benzene	~~5.92~~ 4.44
00496-11-7	2,3-dihydroindene (indan)	~~3.17~~ 3.32
00527-84-4	1-methyl-2-(1-methylethyl)benzene	~~5.92~~ 5.49
00141-93-5	1,3-diethylbenzene	~~5.92~~ 7.10
00105-05-5	1,4-diethylbenzene	~~5.92~~ 4.43
01074-43-7	1-methyl-3-n-propylbenzene	~~5.92~~ 7.10
01074-55-1	1-methyl-4-n-propylbenzene	~~5.92~~ 4.43
00135-01-3	1,2-diethylbenzene	~~5.92~~ 5.49
01074-17-5	1-methyl-2-n-propylbenzene	~~5.92~~ 5.49
01758-88-9	1,4-dimethyl-2-ethylbenzene	~~8.86~~ 7.55
00874-41-9	1,3-dimethyl-4-ethylbenzene	~~8.86~~ 7.55
00934-80-5	1,2-dimethyl-4-ethylbenzene	~~8.86~~ 7.55
02870-04-4	1,3-dimethyl-2-ethylbenzene	~~8.86~~ 10.15
01120-21-4	n-undecane (hendecane)	~~0.74~~ 0.61
00933-98-2	1,2-dimethyl-3-ethylbenzene	~~8.86~~ 10.15
00095-93-2	1,2,4,5-tetramethylbenzene	~~8.86~~ 9.26
01595-11-5	1-methyl-2-n-butylbenzene	~~5.35~~ 4.73
00527-53-7	1,2,3,5-tetramethylbenzene	~~8.86~~ 9.26
01074-92-6	1-(1,1-dimethylethyl)-2-methylbenzene	~~5.35~~ 4.73
00488-23-3	1,2,3,4-tetramethylbenzene	~~8.86~~ 9.26
00538-68-1	n-pentylbenzene	~~1.78~~ 2.12
00098-19-1	1-(1,1-dimethylethyl)-3,5-DMbenzene	~~7.33~~ 8.02
00091-20-3	naphthalene	~~3.26~~ 3.34
00112-40-3	n-dodecane	~~0.66~~ 0.55

CAS #	COMPOUND	MIR
	Carbonyl Compounds	
00050-00-0	formaldehyde	~~8.97~~ 9.46
00075-07-0	acetaldehyde	~~6.84~~ 6.54
00107-02-8	acrolein	~~7.60~~ 7.45
00067-64-1	acetone	~~0.43~~ 0.36
00123-38-6	propionaldehyde	~~7.89~~ 7.08
00123-72-8	butyraldehyde	~~6.74~~ 5.97
00066-25-1	hexanaldehyde	~~4.98~~ 4.35
00100-52-7	benzaldehyde	0.00
00078-93-3	methyl ethyl ketone (2-butanone)	~~1.49~~ 1.48
00078-85-3	methacrolein	~~6.23~~ 6.01
04170-30-3	crotonaldehyde	~~10.07~~ 9.39
00110-62-3	valeraldehyde	~~5.76~~ 5.08
00620-23-5	m-tolualdehyde	0.00

As Amended: March 22, 2012
Board Hearing: January 26-27, 2012

List of Compounds
(Listed by CAS number)

00050-00-0	formaldehyde
00064-17-5	ethanol
00066-25-1	hexanaldehyde
00067-56-1	methanol
00067-64-1	acetone
00071-43-2	benzene
00074-84-0	ethane
00074-85-1	ethene
00074-86-2	ethyne
00074-98-6	propane
00074-99-7	1-propyne
00075-07-0	acetaldehyde
00075-28-5	2-methylpropane
00075-83-2	2,2-dimethylbutane
00078-78-4	2-methylbutane
00078-79-5	2-methyl-1,3-butadiene
00078-85-3	methacrolein
00078-93-3	methyl ethyl ketone (2-butanone)
00079-29-8	2,3-dimethylbutane
00091-20-3	naphthalene
00095-47-6	o-xylene
00095-63-6	1,2,4-trimethylbenzene
00095-93-2	1,2,4,5-tetramethylbenzene
00096-14-0	3-methylpentane
00096-37-7	methylcyclopentane
00098-19-1	1-(1,1-dimethylethyl)-3,5-dimethylbenzene
00098-82-8	(1-methylethyl)benzene
00099-87-6	1-methyl-4-(1-methylethyl)benzene
00100-41-4	ethylbenzene
00100-42-5	stryrene (ethenylbenzene)
00100-52-7	benzaldehyde
00103-65-1	n-propylbenzene
00105-05-5	1,4-diethylbenzene
00106-97-8	n-butane
00106-98-9	1-butene
00106-99-0	1,3-butadiene
00107-00-6	1-butyne
00107-02-8	acrolein
00107-39-1	2,4,4-trimethyl-1-pentene
00107-40-4	2,4,4-trimethyl-2-pentene
00107-83-5	2-methylpentane
00108-08-7	2,4-dimethylpentane

00108-38-3	m- & p-xylene
00108-67-8	1,3,5-trimethylbenzene
00108-87-2	methylcyclohexane
00108-88-3	toluene
00109-66-0	n-pentane
00109-67-1	1-pentene
00110-54-3	n-hexane
00110-62-3	valeraldehyde
00110-82-7	cyclohexane
00110-83-8	cyclohexene
00111-65-9	n-octane
00111-66-0	1-octene
00111-84-2	n-nonane
00112-40-3	n-dodecane
00115-07-1	propene
00115-11-7	2-methylpropene
00123-38-6	propionaldehyde
00123-72-8	butyraldehyde
00124-11-8	1-nonene
00124-18-5	n-decane
00135-01-3	1,2-diethylbenzene
00135-98-8	(1-methylpropyl)benzene
00141-93-5	1,3-diethylbenzene
00142-29-0	cyclopentene
00142-82-5	n-heptane
00287-92-3	cyclopentane
00463-49-0	1,2-propadiene
00463-82-1	2,2-dimethylpropane
00464-06-2	2,2,3-trimethylbutane
00488-23-3	1,2,3,4-tetramethylbenzene
00496-11-7	2,3-dihydroindene (indan)
00503-17-3	2-butyne
00513-35-9	2-methyl-2-butene
00526-73-8	1,2,3-trimethylbenzene
00527-53-7	1,2,3,5-tetramethylbenzene
00527-84-4	1-methyl-2-(1-methylethyl)benzene
00535-77-3	1-methyl-3-(1-methylethyl)benzene
00538-68-1	n-pentylbenzene
00538-93-2	(2-methylpropyl)benzene
00540-84-1	2,2,4-trimethylpentane
00542-92-7	1,3-cyclopentadiene
00558-37-2	3,3-dimethyl-1-butene
00560-21-4	2,3,3-trimethylpentane
00562-49-2	3,3-dimethylpentane
00563-16-6	3,3-dimethylhexane
00563-45-1	3-methyl-1-butene

00563-46-2	2-methyl-1-butene
00565-59-3	2,3-dimethylpentane
00565-75-3	2,3,4-trimethylpentane
00584-94-1	2,3-dimethylhexane
00589-34-4	3-methylhexane
00589-43-5	2,4-dimethylhexane
00589-53-7	4-methylheptane
00589-81-1	3-methylheptane
00590-18-1	cis-2-butene
00590-35-2	2,2-dimethylpentane
00590-73-8	2,2-dimethylhexane
00591-76-4	2-methylhexane
00592-13-2	2,5-dimethylhexane
00592-27-8	2-methylheptane
00592-41-6	1-hexene
00592-76-7	1-heptene
00611-14-3	1-methyl-2-ethylbenzene
00616-12-6	3-methyl-trans-2-pentene
00617-78-7	3-ethylpentane
00620-14-4	1-methyl-3-ethylbenzene
00620-23-5	m-tolualdehyde
00622-96-8	1-methyl-4-ethylbenzene
00624-64-6	trans-2-butene
00625-27-4	2-methyl-2-pentene
00627-20-3	cis-2-pentene
00637-92-3	1-ethyl-tert-butyl-ether
00638-04-0	cis-1,3-dimethylcyclohexane
00646-04-8	trans-2-pentene
00674-76-0	4-methyl-trans-2-pentene
00689-97-4	1-buten-3-yne
00691-37-2	4-methyl-1-pentene
00691-38-3	4-methyl-cis-2-pentene
00693-89-0	1-methylcyclopentene
00760-20-3	3-methyl-1-pentene
00763-29-1	2-methyl-1-pentene
00816-79-5	3-ethyl-2-pentene
00822-50-4	trans-1,2-dimethylcyclopentane
00874-41-9	1,3-dimethyl-4-ethylbenzene
00922-62-3	3-methyl-cis-2-pentene
00926-82-9	3,5-dimethylheptane
00933-98-2	1,2-dimethyl-3-ethylbenzene
00934-80-5	1,2-dimethyl-4-ethylbenzene
01069-53-0	2,3,5-trimethylhexane
01072-05-5	2,6-dimethylheptane
01074-17-5	1-methyl-2-n-propylbenzene
01074-43-7	1-methyl-3-n-propylbenzene

01074-55-1	1-methyl-4-n-propylbenzene
01074-92-6	1-(1,1-dimethylethyl)-2-methylbenzene
01120-21-4	n-undecane (hendecane)
01120-62-3	3-methylcyclopentene
01595-11-5	1-methyl-2-n-butylbenzene
01634-04-4	1-methyl-tert-butyl-ether
01640-89-7	ethylcyclopentane
01678-91-7	ethylcyclohexane
01758-88-9	1,4-dimethyl-2-ethylbenzene
01759-58-6	trans-1,3-dimethylcyclopentane
02051-30-1	2,6-dimethyloctane
02207-01-4	cis-1,2-dimethylcyclohexane
02207-03-6	trans-1,3-dimethylcyclohexane
02207-04-7	trans-1,4-dimethylcyclohexane
02213-23-2	2,4-dimethylheptane
02216-33-3	3-methyloctane
02216-34-4	4-methyloctane
02532-58-3	cis-1,3-dimethylcyclopentane
02613-65-2	trans-1-methyl-3-ethylcyclopentane
02738-19-4	2-methyl-2-hexene
02815-58-9	1,2,4-trimethylcyclopentane
02870-04-4	1,3-dimethyl-2-ethylbenzene
03074-71-3	2,3-dimethylheptane
03221-61-2	2-methyloctane
03404-61-3	3-methyl-1-hexene
03522-94-9	2,2,5-trimethylhexane
03899-36-3	3-methyl-trans-3-hexene
04032-94-4	2,4-dimethyloctane
04050-45-7	trans-2-hexene
04170-30-3	crotonaldehyde
06443-92-1	cis-2-heptene
07385-78-6	3,4-dimethyl-1-pentene
07642-04-8	cis-2-octene
07642-09-3	cis-3-hexene
07688-21-3	cis-2-hexene
10574-37-5	2,3-dimethyl-2-pentene
13269-52-8	trans-3-hexene
13389-42-9	trans-2-octene
14686-13-6	trans-2-heptene
14686-14-7	trans-3-heptene
14850-23-8	trans-4-octene
15869-87-1	2,2-dimethyloctane
15890-40-1	(1a,2a,3b)-1,2,3-trimethylcyclopentane
16747-50-5	cis-1-methyl-3-ethylcyclopentane

APPENDIX 2

DEFINITIONS AND COMMONLY USED ABBREVIATIONS

I. The abbreviations and definitions set forth in this section apply to Parts A through G of these test procedures:

ASTM	=	American Society for Testing and Materials
Carbon No.	=	number of carbon atoms in the hydrocarbon or organic compound being measured.
CCR	=	California Code of Regulations
CH_3OH_d	=	the methanol concentration in the dilution air as determined from the dilution air methanol sample using the procedure specified in Method No. 1001, ppmC.
CH_3OH_e	=	the methanol concentration in the dilute exhaust as determined from the dilute exhaust methanol sample using the procedure specified in Method No. 1001, ppmC.
CH_{4d}	=	the methane concentration in the dilution air, ppmC.
CH_{4e}	=	the methane concentration in the dilute exhaust, ppmC.
$C_2H_5OH_d$	=	the ethanol concentration in the dilution air as determined from the dilution air ethanol sample using the procedure specified in Method No. 1001, ppmC.
$C_2H_5OH_e$	=	the ethanol concentration in the dilute exhaust as determined from the dilute exhaust ethanol sample using the procedure specified in Method No. 1001, ppmC.
CNG	=	compressed natural gas
CO_e	=	the carbon monoxide concentration in the dilute exhaust corrected for carbon dioxide and water removal, ppm.
CO_{em}	=	the carbon monoxide concentration in the dilute exhaust uncorrected for carbon dioxide and water removal, ppm.
CO_{2e}	=	the carbon dioxide concentration in the dilute exhaust, %.
CVS	=	constant volume sampler

$D_{phase\ n}$	=	the distance driven by the test vehicle on a chassis dynamometer during test phase n (where n is either 1, 2, or 3), mile.
~~$Dens_{ROH}$~~	~~=~~	~~density of alcohol, g/mL.~~
DF	=	dilution factor (see Dilution Factor Calculation).
FID	=	flame ionization detector
FID THC_d	=	the total hydrocarbon concentration including methane and methanol (for methanol-fueled engines) or ethanol (for ethanol-fueled engines) in the dilution air as measured by the FID, ppmC.
FID THC_e	=	the total hydrocarbon concentration including methane and methanol (for methanol-dueled engines) or ethanol (for ethanol-fueled engines) in the dilution exhaust as measured by the FID, ppmC.
FTP	=	Federal Test Procedure
GC	=	gas chromatograph
GC/MS	=	gas chromatography/mass spectrometry
HC_{conc}	=	net concentration of an HC compound in the dilute exhaust corrected for background per test phase, ppbC.
HC_d	=	composite concentration of an HC compound in the dilution air (background) for all three test phases as determined from the composite dilution air sample using the procedure specified in Method No. 1002 and Method No. 1003, ppbC.
HC_{dens}	=	mass per unit volume of an HC compound corrected to standard conditions (293.16 K and 760 mm Hg) g/ft^3.
HC_e	=	concentration of an HC compound in the dilute exhaust per test phase as determined from the dilute exhaust sample using the procedure specific in Method No. 1002 and Method No. 1003, ppbC.
$HC_{mass\ n}$	=	mass emissions of an HC compound per test phase n (where n is either 1, 2, or 3), mg.

HC_{wm} = total weighted mass of an HC compound per mile, g/mile.

$HCHO_e$ = formaldehyde concentration in the dilute exhaust as determined from the dilute exhaust carbonyl sample using the procedure specified in Method No 1004, ppm.

HCR = the hydrogen-to-carbon ratio for the fuel used.

HPLC = high performance liquid chromatography

$Iconc_{blk}$ = concentration of the blank cartridge, µg/mL

$Iconc_{cd}$ = total concentration of carbonyl compound extracted from both cartridges for the dilution air, µg/mL

$Iconc_{ce}$ = total concentration of carbonyl compound extracted from both cartridges for the diluted exhaust, µg/mL

$Iconc_{d1}$ = dilution air (background) alcohol concentration in the primary impinger for all three test phases as determined by the procedure specified in Method No. 1001, µg/mL.

$Iconc_{d2}$ = dilution air (background) alcohol concentration in the secondary impinger for all three test phases as determined by the procedure specified in Method No. 1001, µg/mL.

$Iconc_{e1}$ = dilute exhaust alcohol concentration in the primary impinger per test phase as determined by the procedure specified in Method No. 1001, µg/mL.

$Iconc_{e2}$ = dilute exhaust alcohol concentration in the secondary impinger per test phase as determined by the procedure specified in Method No. 1001, µg/mL.

$Imass_d$ = total mass of an alcohol or carbonyl compound collected from the dilution air (background) in both primary and secondary impingers/cartridges for all three test phases as determined by the procedure specified in Method No. 1001 (alcohol) or Method No. 1004 (carbonyl), µg.

$Imass_e$ = total mass of an alcohol or carbonyl compound collected from the dilute exhaust in both primary and secondary impingers/cartridges per test phase as determined by the procedure specified in Method No. 1001 (alcohol) or Method No. 1004 (carbonyl), µg.

$Itemp_d$ = dilution air temperature at the flowmeter inlet for impinger/cartridge sampling, ^oK.

$Itemp_e$ = dilute exhaust temperature at the flowmeter inlet for impinger/cartridge sampling, ^oK.

$Ivol_c$ = elution volume of the cartridge, mL
(For example, ~~T~~the cartridge is extracted with 5 mL acetonitrile, but 0.6 mL is retained in the cartridge, so the elution volume is 4.4 mL.)

$Ivol_d$ = total volume of dilution air (background) drawn through the impingers/cartridges for all three test phases corrected to standard conditions (293.16^{o}K and 760 mm Hg), liter.

$Ivol_{dm}$ = total volume of dilution air (background) drawn through the impingers/cartridges for all three test phases as measured during testing, liter.

$Ivol_e$ = total volume of dilute exhaust drawn through the impingers/cartridges per test phase corrected to standard conditions (293.16^{o}K and 760 mm Hg), liter.

$Ivol_{em}$ = total volume of dilute exhaust drawn through the impingers/cartridges per test phase as measured during testing, liter.

$Ivol_r$ = volume of the reagent used in an impinger, mL.

LOD = limit of detection

LPG = liquified petroleum gas

Mol. Vol. = molecular volume which is 24.055 liter/mole at standard conditions (293.16^{o}K and 760 mm Hg).

Mol. Wt. = molecular weight of the compound being measured, g/mole.

NIST = National Institute of Standards and Technology

NMHC = non-methane hydrocarbons

$NMHC_{conc}$ = the non-methane hydrocarbon concentration in the dilute exhaust corrected for background, ppmC.

$NMHC_d$ = the non-methane hydrocarbon concentration in the dilution air corrected for methane and alcohol removal, ppmC.

$NMHC_{dens}$ = the mass per unit volume of non-methane hydrocarbon corrected to standard conditions (16.33 g/ft^3 at 293.16^{o}K and 760 mm Hg assuming a C:H ratio of 1:1.85 for gasoline; 16.78 g/ft^3 at 293.16^{o}K and 760 mm HG assuming a C:H ratio of 1:1.94 for Phase 2 reformulated gasoline; 19.52 g/ft^3 at 293.16^{o}K and 760 mm HG assuming a C:H ratio of 1:3.78 for natural gas; and 17.26 g/ft^3 for LPG at 293.16^{o}K and 760 mm Hg assuming a C:H ratio of 1:2.64), g/ft^3-.

$NMHC_e$ = non-methane hydrocarbon concentration in the dilute exhaust corrected for methane and alcohol removal, ppmC.

$NMHC_{mass\ n}$ = the mass emission of non-methane hydrocarbon per test phase n (where n is either 1, 2, or 3), g.

$NMHC_{wm}$ = the total weighted mass of non-methane hydrocarbon per mile for all three phases of the FTP, g/mile.

<u>$NONMHC_{mass\ n}$ = the mass emission of non-oxygenated non-methane hydrocarbon per test phase n (where n is either 1, 2, or 3), g.</u>

<u>$NONMHC_{wm}$ = the total weighted mass of non-oxygenated non-methane hydrocarbon per mile for all three phases of the FTP, g/mile.</u>

NMOG = non-methane organic gases

P_B = barometric pressure during testing, mm Hg.

PID = photoionization detector

PLOT = porous layer open tubular

R_a = the relative humidity of the ambient air, %.

r_{CH_3OH} = the FID response factor to methanol (see CFR 40, 86.121-90(c)).

r_{CH_4} = the FID response factor to methane (see Part B, “Determination of NMHC by FID”).

$r_{C_2H_5OH}$ = the FID response factor to ethanol (same procedure for methanol response factor, see CFR 40, 86.121-90(c)).

r_{ROH} = the FID response factor to an alcohol

r_{RHO} = the FID response factor to carbonyl compound

RHO = generic symbol representing a carbonyl compound such as formaldehyde, acetaldehyde, acetone, etc.

RHO_{conc} = net concentration of a carbonyl compound in the dilute exhaust corrected for background per test phase, ppm.

RHO_d = composite concentration of a carbonyl compound in the dilution air (background) for all three test phases, ppm.

RHO_{dens} = mass per unit volume of a carbonyl compound corrected to standard conditions (293.16°K and 760 mm Hg), g/ft^3.

RHO_e = concentration of a carbonyl compound in the dilute exhaust per test phase, ppm.

$RHO_{mass\ n}$ = mass emissions of a carbonyl compound per test phase n (where n is either 1, 2, or 3), g.

RHO_{wm} = total weighted mass emissions of a carbonyl compound per mile, g/mile.

ROH = generic symbol representing an alcohol compound such as methanol or ethanol.

ROH_{conc} = net concentration of an alcohol compound in the dilute exhaust corrected for background per test phase, ppm.

ROH_d = composite concentration of an alcohol compound in the dilution air (background) for all three test phases, ppm.

ROH_{dens} = mass per unit volume of an alcohol compound corrected to standard conditions (293.16°K and 760 mm Hg), g/ft^3.

ROH_e = concentration of an alcohol compound in the dilute exhaust per test phase, ppmC.

$ROH_{mass\ n}$ = mass emissions of an alcohol compound per test phase n (where n is either 1, 2, or 3), g.

ROH_{wm} = total weighted mass emissions of an alcohol compound per mile, g/mile.

SAE	=	Society of Automotive Engineers
SRM	=	Standard Reference Material
VMIX	=	the total dilute exhaust volume measured per test phase and corrected to standard conditions (293.16°K and 760 mm Hg), ft^3.

II. The following list is commonly used measurement abbreviations:

g	=	gram
μg	=	microgram
m	=	meter
cm	=	centimeter
μm	=	micrometer
μ	=	micron
L	=	liter
mL	=	milliliter
μL	=	microliter
ppb	=	parts per billion.
ppbC	=	parts per billion carbon equivalent.
ppm	=	parts per million.
ppmC	=	parts per million carbon equivalent.

APPENDIX 3

REFERENCES

[1] Code of Federal Regulations, Title 40, Part 86, Subpart B

[2] SAE J254, "Instrumentation and Techniques for Exhaust Gas Emissions Measurement"

[3] SAE J1094a, "Constant Volume Sampler System for Exhaust Emissions Measurement"

[4] SAE 770141, "Optimization of a Flame Ionization Detector for Determination of Hydrocarbons in Diluted Automotive Exhausts". G.D. Reschke, Vehicle Emissions Laboratory, General Motors Proving Ground

[5] SAE J1154, "Methane Measurement Using Gas Chromatography," (revised December 1991)

[6] U.S. Environmental Protection Agency, Characterization of Exhaust Emissions from Methanol and Gasoline Fueled Automobiles, EPA 460/3-82-004.

[7] U.S. Environmental Protection Agency, Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, (Method T03-15) EPA-600/4-89-017 Research Triangle Park, North Carolina, June, 1989.

[8] Standard Test Method for C_1 through C_6 Hydrocarbons in the Atmosphere by Gas Chromatography, American Standards for Testing Materials (ASTM) Standards on Chromatography (1981).

[9] U.S. Environmental Protection Agency, Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air, (Method T03-15) EPA-600/4-84-041 Research Triangle Park, North Carolina, April, 1989.

[10] Hull, L.A., Procedures for 2,4-Dinitrophenylhydrazone Aldehyde-Ketone Air Analysis, Internal Report at U.S. EPA.

[11] Shriner, R.L. and Fuson, R.C., Identification of Organic Compounds, 2nd. Ed., John Wiley and Sons, Inc., 1940, p. 143.

[12] Keith, L. H., Taylor, J.K., et al, "Principles of Environmental Analysis", Analytical Chemistry, Vol. 55, No. 14, December 1983.

ATTACHMENT A-5

State of California
AIR RESOURCES BOARD

CALIFORNIA EVAPORATIVE EMISSION STANDARDS AND TEST PROCEDURES FOR 2001 AND SUBSEQUENT MODEL MOTOR VEHICLES

Adopted: August 5, 1999
Amended: June 22, 2006
Amended: October 17, 2007
Amended: December 2, 2009
Amended: September 27, 2010
Amended: March 22, 2012

Note: Proposed amendments to this document are shown in underline to indicate additions and in ~~strikeout~~ to indicate deletions compared to the test procedures as last amended September 27, 2010.

NOTE: This document is incorporated by reference in section 1976(c), title 13, California Code of Regulations (CCR). Additional requirements necessary to complete an application for certification of motor vehicles are contained in other documents that are designed to be used in conjunction with this document. These other documents include:

1. “California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and ~~for 2001 and Subsequent~~ 2009 through 2016 Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles” (incorporated by reference in section 1961(d), title 13, CCR);

2. “California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles” (incorporated by reference in section 1961.2 (d), title 13, CCR);

~~2.~~ 3. “California Exhaust Emission Standards and Test Procedures for 2005 – 2008 Zero-Emission Vehicles, and 2001 – 2008 Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes” (incorporated by reference in section 1962(e), title 13, CCR);

~~3.~~ 4. “California Exhaust Emission Standards and Test Procedures for 2009 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes” (incorporated by reference in section 1962.1(h), title 13, CCR);

~~4.~~ 5. “California Refueling Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles” (incorporated by reference in section 1978(b), title 13, CCR);

~~5.~~ 6. "California Exhaust Emission Standards and Test Procedures for 1987 through 2003 Model Heavy-Duty Otto-Cycle Engines and Vehicles," as incorporated by reference in section 1956.8(d), title 13, CCR;

~~6.~~ 7. "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Otto-Cycle Engines," as incorporated by reference in section 1956.8(d), title 13, CCR.

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As Amended: March 22, 2012
Date of Hearing: January 26-27, 2012

CALIFORNIA EVAPORATIVE EMISSION STANDARDS AND TEST PROCEDURES FOR 2001 AND SUBSEQUENT MODEL MOTOR VEHICLES

The provisions of Title 40, Code of Federal Regulations (CFR), Part 86, Subparts A and B (as adopted or amended as of July 1, 1989); Subpart S (as adopted or amended on May 4, 1999); and, such sections of these Subparts as last amended on such other date set forth next to the 40 CFR Part 86 section title listed below, insofar as those subparts pertain to evaporative emission standards and test procedures, are hereby adopted as the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Years," with the following exceptions and additions:

PART I. GENERAL CERTIFICATION REQUIREMENTS FOR EVAPORATIVE EMISSIONS

A. 40 CFR §86.1801-01 Applicability.

1.1. These evaporative standards and test procedures are applicable to all new 2001 and subsequent model gasoline-, liquefied petroleum- and alcohol-fueled passenger cars, light-duty trucks, medium-duty vehicles, heavy-duty vehicles, hybrid electric vehicles (including fuel-flexible, dual fuel and bi-fuel vehicles, and 2012 and subsequent model-year off-vehicle charge capable hybrid electric vehicles), and motorcycles. These standards and test procedures do not apply to motor vehicles that are exempt from exhaust emission certification, dedicated petroleum-fueled diesel vehicles, dedicated compressed natural gas-fueled vehicles, or hybrid electric vehicles that have sealed fuel systems which can be demonstrated to have no evaporative emissions. A manufacturer may elect to certify 2009 through 2011 model-year off-vehicle charge capable hybrid electric vehicles using these provisions. In cases where a provision applies only to a certain vehicle group based on its model year, vehicle class, motor fuel, engine type, or other distinguishing characteristics, the limited applicability is cited in the appropriate section.

1.2. For general certification purposes, and except as otherwise noted in these test procedures, the requirements set forth in the "California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and ~~for 2001 and Subsequent~~ 2009 through 2016 Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles," the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles," the "California Exhaust Emission Standards and Test Procedures for 2005 – 2008 Model Zero-Emission Vehicles, and 2001 – 2008 Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes," the "California Exhaust Emission Standards and Test Procedures for

2009 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes," and the "California Refueling Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles," shall apply to light- and medium-duty vehicles; the "California Exhaust Emission Standards and Test Procedures for 1987 through 2003 Model Heavy-Duty Otto-Cycle Engines and Vehicles," and the "California Exhaust Emission Standards and Test Procedures for 2004 and Subsequent Model Heavy-Duty Otto-Cycle Engines," shall apply to heavy-duty vehicles; and, section 1958, title 13, CCR shall apply to motorcycles.

1.3. Approval of vehicles that are not exhaust emission tested using a chassis dynamometer pursuant to section 1961, title 13, CCR shall be based on an engineering evaluation of the system and data submitted by the applicant.

1.4. Reference to light-duty trucks in the federal CFR shall mean light-duty trucks and medium-duty vehicles. Regulations concerning methanol in the Title 40, CFR Part 86, shall mean methanol and ethanol, except as otherwise indicated in these test procedures.

1.5. The term "[no change]" means that these test procedures do not modify the applicable federal requirement.

1.6. In those instances where the testing conditions or parameters are not practical or feasible for vehicles operating on LPG fuel, the manufacturer shall provide a test plan that provides equal or greater confidence in comparison to these test procedures. The test plan must be approved in advance by the Executive Officer.

B. Definitions, Acronyms, Terminology

1. These test procedures incorporate by reference the definitions set forth in the "California <u>2001 through 2014 Model Criteria Pollutant</u> Exhaust Emission Standards and Test Procedures <u>and</u> ~~for 2001 and Subsequent~~ <u>2009 through 2016</u> Model <u>Greenhouse Gas Exhaust Emission Standards and Test Procedures for</u> Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles," <u>the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles,"</u> and~~,~~ the "California Exhaust Emission Standards and Test Procedures for 2009 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes," including the incorporated definitions from the Code of Federal Regulations. In addition, the following definitions apply:

1.1. "Non-integrated refueling canister-only system" means a subclass of a non-integrated refueling emission control system, where other non-refueling related evaporative emissions from the vehicle are stored in the fuel tank, instead of in a vapor storage unit(s).

1.2. "Sealed fuel system" means a non-liquid phase fuel system, on-board a vehicle, that stores, delivers, and meters the fuel under a very high pressure, and which inherently has no evaporative-related emissions, due to design specifications that eliminate the escape of any fuel vapors, under normal vehicle operations.

1.3. "2-gram breakthrough" means the point at which the cumulative quantity of hydrocarbons emitted from a stabilized canister vapor storage unit, during the loading process of the unit, is equal to 2 grams.

C. Useful Life

1. §86.1805-01. Delete. For vehicles certified to the emission standards in section I.E.1.(a), "useful life" shall have the same meaning as provided in section 2112, title 13, CCR. For vehicles certified to the emission standards in sections I.E.1.(c), ~~and~~ I.E.1.(d), and I.E.1.(e), the "useful life" shall be 15 years or 150,000 miles, whichever first occurs.

D. General Standards; increase in emissions; unsafe conditions; waivers

1. Light- and Medium-Duty Vehicles.

1.1. Amend §86.1810-01 (December 8, 2005) as follows:

(a) through (g). [The provisions of these paragraphs are contained in the "California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and ~~for 2001 and Subsequent~~ 2009 through 2016 Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles," and the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles."]

(h) For alcohol vehicles, hydrocarbon evaporative emissions shall be expressed as OMHCE.

(i) [No change.]

(j) Evaporative Emissions general provisions.

(1) The evaporative standards in section E. of this part apply equally to certification and in-use vehicles and trucks.

(2) For certification testing only, a manufacturer may conduct testing to quantify a level of stabilized non-fuel evaporative emissions for an individual certification test vehicle. Testing may be conducted on a representative vehicle to determine the non-fuel evaporative emission characteristics of the certification test vehicle. The demonstration must be submitted for advance approval by the Executive Officer and include a description of the sources of vehicle non-fuel evaporative emissions, the methodology for the quantification of the non-fuel emissions, an estimated non-fuel emission decay rate, and the stabilized non-fuel emission level. The demonstrated stabilized level of non-fuel evaporative emissions may be used in place of the test vehicle non-fuel evaporative emissions and be combined with the vehicle fuel evaporative emissions to determine compliance with the evaporative emission standard.

(3) [No change.]

(4) [No change.]

(k) through (n) [The provisions of these paragraphs are contained in the "California Refueling Emission Standards and Test Procedures for 2001 and Subsequent Model Year Motor Vehicles."]

(o) through (p). [The provisions of these paragraphs are contained in the "California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and ~~for 2001 and Subsequent~~ 2009 through 2016 Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles~~.~~" and the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles."]

2. Heavy-Duty Vehicles. Approval of heavy-duty vehicles over 14,000 lbs. GVWR and incomplete medium-duty vehicles shall be based on an engineering evaluation of the system and data submitted by the applicant. Such evaluation may include successful public usage on light-duty or medium-duty vehicles, adequate capacity of storage containers, routing of lines to prevent siphoning, and other emissions-related factors deemed appropriate by the Executive Officer. For LPG systems, this engineering evaluation shall include: emissions from pressure relief valves, carburetion systems and other sources of leakage; emissions due to fuel system wear and aging, and evaporative emission test data from light-duty or medium-duty vehicles with comparable systems.

E. Emission Standards

1. Evaporative Emission Standards for 2001 and Subsequent Model Year Vehicles Other Than Motorcycles.

(a) For the 2001 through 2005 model year vehicles identified below, tested in accordance with the test procedure sequence set forth in Part III, the maximum projected total hydrocarbon evaporative emissions are:

Class of Vehicle	Running Loss (grams per mile)	Three-Day Diurnal + Hot Soak (grams per test)	Two-Day Diurnal + Hot Soak (grams per test)
Passenger Cars, Light-Duty Trucks	0.05	2.0	2.5
Medium-Duty Vehicles (6,001 - 8,500 lbs. GVWR)			
with fuel tanks < 30 gallons	0.05	2.0	2.5
with fuel tanks ≥ 30 gallons	0.05	2.5	3.0
Medium-Duty Vehicles (8,501 - 14,000 lbs. GVWR)	0.05	3.0 (1)	3.5
	0.05	2.0 (2)	3.5
Heavy-Duty Vehicles (over 14,000 lbs. GVWR)	0.05	2.0	4.5
Hybrid Electric PCs, LDTs and MDVs	0.05	2.0	2.5

(1) The standards in this row apply to medium-duty vehicles certified according to the exhaust standards in section 1961, title 13, CCR.

(2) The standards in this row apply to incomplete medium-duty vehicles certifying to the exhaust standards in section 1956.8, title 13, CCR.

(b) Zero emission vehicles shall produce zero fuel evaporative emissions under any and all possible operational modes and conditions.

(c) For 2001 through 2014 model year vehicles, ~~T~~ the optional zero-fuel evaporative emission standards for the three-day and two-day diurnal-plus-hot-soak tests are 0.35 grams per test for passenger cars, 0.50 grams per test for light-duty trucks 6,000 lbs. GVWR and under, and 0.75 grams per test for light-duty trucks from 6,001 to 8,500 lbs. GVWR, to account for vehicle non-fuel evaporative emissions (resulting from paints, upholstery, tires, and other vehicle sources). Vehicles demonstrating compliance with these evaporative emission standards shall also have zero (0.0) grams of fuel evaporative emissions per test for the three-day and two-day diurnal-plus-hot-soak tests. The "useful life" shall be 15 years or 150,000 miles, whichever occurs first. In lieu of demonstrating compliance with the zero (0.0) grams of fuel evaporative emissions per test over the three-day and two-day diurnal-plus-hot-soak tests, the manufacturer may submit for advance Executive Officer approval a test plan to demonstrate that the vehicle has zero (0.0) grams of fuel evaporative emissions throughout its useful life.

Additionally, in the case of a SULEV vehicle for which a manufacturer is seeking a partial ZEV credit, the manufacturer may prior to certification elect to have measured fuel evaporative emissions reduced by a specified value in all certification and in-use testing of the vehicle as long as measured mass exhaust emissions of NMOG for the vehicle are increased in all certification and in-use testing. The measured fuel evaporative emissions shall be reduced in increments of 0.1 gram per test, and the measured mass exhaust emissions of NMOG from the vehicle shall be increased by a gram per mile factor, to be determined by the Executive Officer, for every 0.1 gram per test by which the measured fuel evaporative emissions are reduced. For the purpose of this calculation, the evaporative emissions shall be measured, in grams per test, to a minimum of three significant figures.

(d) For the 2004 ~~and subsequent~~ through 2014 model motor vehicles identified below, tested in accordance with the test procedure sequence set forth in Part III, the maximum projected total hydrocarbon evaporative emissions are:

Vehicle Type	Hydrocarbon Standards(1)(2)		
	Running Loss (grams per mile)	Three-Day Diurnal + Hot Soak (grams per test)	Two-Day Diurnal + Hot Soak (grams per test)
Passenger Cars	0.05	0.50	0.65
Light-Duty Trucks (under 8,501 lbs. GVWR)			
6,000 lbs. GVWR and under	0.05	0.65	0.85
6,001 - 8,500 lbs. GVWR	0.05	0.90	1.15
Medium-Duty Vehicles (8,501 - 14,000 lbs. GVWR)	0.05	1.00	1.25

Heavy-Duty Vehicles (over 14,000 lbs. GVWR)	0.05	1.00	1.25

(1) (a) These evaporative emission standards shall be phased-in beginning with the 2004 model year. Each manufacturer, except small volume manufacturers, shall certify at a minimum the specified percentage of its vehicle fleet to the evaporative emission standards in this table or the optional zero-evaporative emission standards in section I.E.1.(c) according to the schedule set forth below. For purposes of this paragraph (a), each manufacturer’s vehicle fleet consists of the total projected California sales of the manufacturer’s gasoline-fueled, liquefied petroleum-fueled and alcohol-fueled passenger cars, light-duty trucks, medium-duty vehicles, and heavy-duty vehicles.

Model Year	*Minimum Percentage of Vehicles Certified to the Standards in Sections I.E.1.(c) and I.E.1.(d)*
2004	40
2005	80
2006 and subsequent	100

A small volume manufacturer shall certify 100 percent of its 2006 and subsequent model vehicle fleet to the evaporative emission standards in the table or the optional zero-evaporative emission standards in section I.E.1.(c).

All 2004 through 2005 model-year motor vehicles which are not subject to these standards or the standards in section E.1.(c) pursuant to the phase-in schedule shall comply with the requirements of section I.E.1.(a).

(b) A manufacturer may use an "Alternative or Equivalent Phase-in Schedule" to comply with the phase-in requirements. An "Alternative Phase-in" is one that achieves at least equivalent emission reductions by the end of the last model year of the scheduled phase-in. Model-year emission reductions shall be calculated by multiplying the percent of vehicles (based on the manufacturer's projected California sales volume of the applicable vehicle fleet) meeting the new requirements per model year by the number of model years implemented prior to and including the last model year of the scheduled phase-in. The "cumulative total" is the summation of the model-year emission reductions (e.g., the three model-year 40/80/100 percent phase-in schedule would be calculated as: (40%*3 years) + (80%*2 years) + (100%*1 year) = 380). The required cumulative total for the phase-in of these standards is 380 emission reductions. Any alternative phase-in that results in an equal or larger cumulative total than the required cumulative total by the end of the last model year of the scheduled phase-in shall be considered acceptable by the Executive Officer only if all vehicles subject to the phase-in comply with the respective requirements in the last model year of the required phase-in schedule. A manufacturer shall be allowed to include vehicles introduced before the first model year of the scheduled phase-in (e.g., in the previous example, 10 percent introduced one year before the scheduled phase-in begins would be calculated as: (10%*4 years) = 40) and added to the cumulative total.

(c) These evaporative emission standards do not apply to zero-emission vehicles.

(2) In-use compliance whole vehicle testing shall not begin until the motor vehicle is at least one year from the production date and has accumulated a minimum of 10,000 miles. For vehicles introduced prior to the 2007 model year, in-use compliance standards of 1.75 times the "Three-Day Diurnal + Hot-Soak" and "Two-Day Diurnal + Hot-Soak" gram per test standards shall apply for only the first three model years of an evaporative family certified to a new standard.

(e) For 2015 and subsequent model motor vehicles, the following evaporative emission requirements apply:

(i) A manufacturer must certify all vehicles subject to this section to the emission standards specified in either Option 1 or Option 2 below.

(A) Option 1. The total hydrocarbon evaporative emissions from 2015 and subsequent model motor vehicles, tested in accordance with the test procedure sequence set forth in Part III, shall not exceed:

Vehicle Type	Hydrocarbon Emission Standards		
	Running Loss (grams per mile)	Three-Day Diurnal + Hot Soak and Two-Day Diurnal + Hot Soak	
		Whole Vehicle (grams per test)	Fuel Only[1] (grams per test)
Passenger Cars	0.05	0.350	0.0
Light-Duty Trucks 6,000 lbs. GVWR and under	0.05	0.500	0.0
Light-Duty Trucks 6,001 - 8,500 lbs. GVWR	0.05	0.750	0.0
Medium-Duty Passenger Vehicles	0.05	0.750	0.0
Medium-Duty Vehicles (8,501 - 14,000 lbs. GVWR)	0.05	0.750	0.0
Heavy-Duty Vehicles (over 14,000 lbs. GVWR)	0.05	0.750	0.0

(1) In lieu of demonstrating compliance with the fuel-only emission standard (0.0 grams per test) over the three-day and two-day diurnal plus hot soak tests, a manufacturer may, with

advance Executive Officer approval, demonstrate compliance through an alternate test plan.

(B) Option 2. The total hydrocarbon evaporative emissions from 2015 and subsequent model motor vehicles, tested in accordance with the test procedure sequence set forth in Part III, shall not exceed:

Vehicle Type	Hydrocarbon Emission Standards		
	Running Loss (grams per mile)	Highest Whole Vehicle Diurnal + Hot Soak(1)(2)(3) (grams per test)	Canister Bleed(4) (grams per test)
Passenger Cars; and Light-Duty Trucks 6,000 lbs. GVWR and under, and 0 - 3,750 lbs. LVW	0.05	0.300	0.020
Light-Duty Trucks 6,000 lbs. GVWR and under, and 3,751 – 5,750 lbs. LVW	0.05	0.400	0.020
Light-Duty Trucks 6,001 - 8,500 lbs. GVWR; and Medium-Duty Passenger Vehicles	0.05	0.500	0.020
Medium-Duty Vehicles (8,501 - 14,000 lbs. GVWR); and Heavy-Duty Vehicles (over 14,000 lbs. GVWR)	0.05	0.600	0.030

(1) The manufacturer shall determine compliance by selecting the highest whole vehicle diurnal plus hot soak emission value of the Three-Day Diurnal Plus Hot Soak Test and of the Two-Day Diurnal Plus Hot Soak Test.

(2) Fleet-Average Option for the Highest Whole Vehicle Diurnal Plus Hot Soak Emission Standard Within Each Emission Standard Category. A manufacturer may optionally comply with the highest whole vehicle diurnal plus hot soak emission standards by using fleet-average hydrocarbon emission values. To participate, a manufacturer must utilize the fleet-average option for all of its emission standard categories and calculate a separate fleet-average hydrocarbon emission value for each emission standard category. The emission standard categories are as follows: (1) passenger cars and light-duty trucks 6,000 pounds GVWR and under, and 0 - 3,750 pounds LVW; (2) light-duty trucks 6,000 pounds GVWR and under, and 3,751 – 5,750 pounds LVW; (3) light-duty trucks 6,001 -

8,500 pounds GVWR and medium-duty passenger vehicles; and (4) medium-duty and heavy-duty vehicles. The fleet-average hydrocarbon emission value for each emission standard category shall be calculated as follows:

$$\frac{\sum_{i=1}^{n} [(\text{number of vehicles in the evaporative family})_i \times (\text{family emission limit})_i]}{\sum_{i=1}^{n} (\text{number of vehicles in the evaporative family})_i}$$

where "n" = a manufacturer's total number of Option 2 certification evaporative families within an emission standard category for a given model year;

"number of vehicles in the evaporative family" = the number of vehicles produced and delivered for sale in California in the evaporative family;

"family emission limit" = the numerical value selected by the manufacturer for the evaporative family that serves as the emission standard for the evaporative family with respect to all testing, instead of the emission standard specified in this section I.E.1.(e)(i)(B). The family emission limit shall not exceed 0.500 grams per test for passenger cars; 0.650 grams per test for light duty trucks 6,000 pounds GVWR and under; 0.900 grams per test for light-duty trucks 6,001 - 8,500 pounds GVWR; and 1.000 grams for medium-duty passenger vehicles, medium-duty vehicles, and heavy-duty vehicles. In addition, the family emission limit shall be set in increments of 0.025 grams per test.

(3) Calculation of Hydrocarbon Credits or Debits for the Fleet-Average Option.

(A) Calculation of Hydrocarbon Credits or Debits. For each emission standard category in the model year, a manufacturer shall calculate the hydrocarbon credits or debits, as follows:

[(Applicable Hydrocarbon Emission Standard for the Emission Standard Category) – (Manufacturer's Fleet-Average Hydrocarbon Emission Value for the Emission Standard Category)] X (Total Number of Affected Vehicles)

where "Total Number of Affected Vehicles" = the total number of vehicles in the evaporative families participating in the fleet-average option, which are produced and delivered for sale in California, for the emission standard category of the given model year.

A negative number constitutes hydrocarbon debits, and a positive number constitutes hydrocarbon credits accrued by the manufacturer for the given model year. Hydrocarbon credits earned in a given model year shall retain full value through the fifth model year after they are earned. At the beginning of the sixth model year, the hydrocarbon credits will have no value.

(B) Procedure for Offsetting Hydrocarbon Debits. A manufacturer shall offset hydrocarbon debits with hydrocarbon credits for each emission standard category within three model years after the debits have been incurred. If total hydrocarbon debits are not equalized within three model years after they have been incurred, the manufacturer shall be subject to the Health and Safety Code section 43211 civil penalties applicable to a manufacturer which 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 hydrocarbon debits are not equalized 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 emission standards shall be determined by dividing the total amount of hydrocarbon debits for the model year in the emission standard category by the applicable hydrocarbon emission standard for the model year in which the debits were first incurred.

Additionally, to equalize the hydrocarbon debits that remain at the end of the three model year offset period: (1) hydrocarbon credits may be exchanged between passenger cars and light-duty trucks 6,000 pounds GVWR and under and 0-3,750 pounds LVW, and light-duty trucks 6,000 pounds GVWR and under and 3,751-5,750 pounds LVW and (2) hydrocarbon credits may be exchanged between light-duty trucks 6,001-8,500 pounds GVWR and medium-duty passenger vehicles, and medium-duty vehicles and heavy-duty vehicles.

(4) Vehicle Canister Bleed Emission. Compliance with the canister bleed emission standard shall be determined based on the Bleed Emission Test Procedure described in section III.D.12. of these procedures and demonstrated on a stabilized canister system. Vehicles with a non-integrated refueling canister-only system are exempt from the canister bleed emission standard.

(ii) Phase-In Schedule. For each model year, a manufacturer shall certify, at a minimum, the specified percentage of its vehicle fleet to the evaporative emission standards set forth in section I.E.1.(e)(i), according to the implementation schedule set forth below. For the purpose of this section I.E.1.(e)(ii), the manufacturer's vehicle fleet consists of the vehicles produced and delivered for sale by the manufacturer in California that are subject to the emission standards in section I.E.1.(e)(i). All 2015 through 2022 model motor vehicles that are not subject to these standards pursuant to the phase-in schedule shall comply with the requirements for 2004 through 2014 model motor vehicles, as described in section I.E.1.(d).

Model Years	*Minimum Percentage of Vehicle Fleet*(1)(2)
2015, 2016, and 2017	Average of vehicles certified to section I.E.1.(c) in model years 2012, 2013, and 2014(3)(4)
2018 and 2019	60
2020 and 2021	80
2022 and subsequent	100

(1) For the 2018 through 2022 model years only, a manufacturer may use an alternate phase-in schedule to comply with the phase-in requirements. An alternate phase-in schedule must achieve equivalent compliance volume by the end of the last model year of the scheduled phase-in (2022). The compliance volume is the number calculated by multiplying the percent of vehicles (based on the manufacturer's projected sales volume of all vehicles) meeting the new requirements in each model year by the number of years implemented prior to and including the last model year of the scheduled phase-in, then summing these yearly results to determine a cumulative total. The cumulative total of the five year (60/60/80/80/100) scheduled phase-in set forth above is calculated as follows: (60*5 years) + (60*4 years) + (80*3 years) + (80*2 years) + (100*1 year) = 1040. Accordingly, the required cumulative total for any alternate phase-in schedule of these emission standards is 1040. The Executive Officer shall consider acceptable any alternate phase-in schedule that results in an equal or larger cumulative total by the end of the last model year of the scheduled phase-in (2022).

(2) Small volume manufacturers are not required to comply with the phase-in schedule set forth in this table. Instead, they shall certify 100 percent of their 2022 and subsequent model year vehicle fleet to the evaporative emission standards set forth in section I.E.1.(e)(i)(A) or section I.E.1.(e)(i)(B).

(3) The percentage of vehicle fleet averaged across the 2015, 2016, and 2017 model years shall be used to determine compliance with this requirement.

(4) The minimum percentage required in the 2015, 2016, and 2017 model years is determined by averaging the percentage of vehicles certified to the emission standards in section I.E.1.(c) in each of the manufacturer's 2012, 2013, and 2014 model motor vehicle fleets. For the purpose of calculating this average, a manufacturer shall use the percentage of vehicles produced and delivered for sale in California for the 2012, 2013, and 2014 model years. A manufacturer may calculate this average percentage using the projected sales for these model years in lieu of actual sales.

(iii) Carry-Over of 2014 Model-Year Evaporative Families Certified to the Zero-Fuel Evaporative Emission Standards. A manufacturer may carry over 2014 model motor vehicles certified to the zero-fuel (0.0 grams per test) evaporative emission standards set forth in section I.E.1.(c) through the 2018 model year and be considered compliant with the requirements of section I.E.1.(e). If the manufacturer chooses to participate in the fleet-average option for the highest whole vehicle diurnal plus hot soak emission standard, the following family emission limits are assigned to these evaporative families for the calculation of the manufacturer's fleet-average hydrocarbon emission value.

Vehicle Type	Highest Whole Vehicle Diurnal + Hot Soak (grams per test)
Passenger Cars	0.300
Light-Duty Trucks 6,000 lbs. GVWR and under, and 0 - 3,750 lbs. LVW	0.300
Light-Duty Trucks 6,000 lbs. GVWR and under, and 3,751 – 5,750 lbs. LVW	0.400
Light-Duty Trucks 6,001 - 8,500 lbs. GVWR	0.500

(iv) Pooling Provision. The following pooling provision applies to the fleet-average option for the Highest Whole Vehicle Diurnal Plus Hot Soak Emission Standard in section I.E.1.(e)(i)(B). and to the phase-in requirements in section I.E.1.(e)(iii).

(A) For the fleet-average option set forth in section I.E.1.(e)(i)(B), a manufacturer must demonstrate compliance, for each model year, based on one of two options applicable throughout the model year, either:

Pooling Option 1: the total number of passenger cars, light-duty trucks, medium-duty passenger vehicles, medium-duty vehicles, and heavy-duty vehicles that are certified to the California evaporative emission standards in section I.E.1.(e)(i)(B), and are produced and delivered for sale in California; or

Pooling Option 2: the total number of passenger cars, light-duty trucks, medium-duty passenger vehicles, medium-duty vehicles, and heavy-duty vehicles that are certified to the California evaporative emission standards in section I.E.1.(e)(i)(B), and are produced and delivered for sale in California, the District of Columbia, and all states that have adopted California's evaporative emission standards set forth in section I.E.1.(e)(i) for that model year pursuant to section 177 of the federal Clean Air Act (42 U.S.C. § 7507).

(B) For the phase-in requirements in section I.E.1.(e)(iii), a manufacturer must demonstrate compliance, for each model year, based on one of two options applicable throughout the model year, either:

Pooling Option 1: the total number of passenger cars, light-duty trucks, medium-duty passenger vehicles, medium-duty vehicles, and heavy-duty vehicles that are certified to the California evaporative emission standards in section I.E.1.(e)(i), and are produced and delivered for sale in California; or

Pooling Option 2: the total number of passenger cars, light-duty trucks, medium-duty passenger vehicles, medium-duty vehicles, and heavy-duty vehicles that are certified to the California evaporative emission standards in section I.E.1.(e)(i), and are produced and delivered for sale in California, the District of Columbia, and all states that have adopted California's evaporative emission standards set forth in section I.E.1.(e)(i) for that model year pursuant to section 177 of the federal Clean Air Act (42 U.S.C. § 7507).

(C) A manufacturer that selects Pooling Option 2 must notify the Executive Officer of that selection in writing prior to the start of the applicable model year or must comply with Pooling Option 1. Once a manufacturer has selected compliance Option 2, that selection applies unless the manufacturer selects Option 1 and notifies the Executive Officer of that selection in writing before the start of the applicable model year.

(D) When a manufacturer is demonstrating compliance using Pooling Option 2 for a given model year, the term "in California" as used in section I.E.1.(e) means California, the District of Columbia, and all states that have adopted California's evaporative emission standards for that model year pursuant to Section 177 of the federal Clean Air Act (42 U.S.C. § 7507).

(E) A manufacturer that selects Pooling Option 2 must provide to the Executive Officer separate values for the number of vehicles in each evaporative family produced and delivered for sale in the District of Columbia and for each individual state within the average.

(v) Optional Certification for 2014 Model Motor Vehicles. A manufacturer may optionally certify its 2014 model motor vehicles to the evaporative emission standards set forth in section I.E.1.(e)(i), using the test fuel specified in section III.F.2.

2. Evaporative Emission Standards for 2001 and Subsequent Model Year Motorcycles. The maximum projected evaporative emission standards for 2001 and subsequent model gasoline-fueled motorcycles are:

Motorcycle Class	Hydrocarbons (grams per test)
Class I and Class II (50-279 cc)	2.0
Class III (280 cc and greater)	2.0

PART II. DURABILITY DEMONSTRATION

A. Light- and Medium-Duty Vehicles

1. Evaporative/refueling emission family determination. §86.1821-01 [No change.]

2. Durability Demonstration Procedures for Evaporative Emissions

2.1. §86.1824-01 Amend as follows:

(a) and (b) Delete.
(c) [No change.]
(d) Delete.
(e) [No change.]

2.2. For all passenger cars, light-duty trucks and chassis-certified medium-duty vehicles subject to the standards specified in section I.E. of these test procedures, demonstration of system durability and determination of three-day diurnal plus hot soak, two-day diurnal plus hot soak, and running loss emission deterioration factors ("evaporative DFs") for each evaporative/refueling family shall be based on tests of representative vehicles and/or systems. For purposes of evaporative emission durability testing, a representative vehicle is one which, with the possible exception of the engine and drivetrain, was built at least three months prior to the commencement of evaporative emission testing, or is one which the manufacturer demonstrates has stabilized non-fuel-related evaporative emissions.

2.3. Prior to commencement of a durability program, the manufacturer shall propose a method for durability testing and for determination of evaporative DFs for each evaporative/refueling family. The 4,000 and full useful life mile test points (or their equivalent) used in determining a DF must be within the standards of section I.E. or data will not be acceptable for use in the calculation of a DF, except for the following provision. For evaporative families certified to the emission standards in section I.E.(e)(i)(B) that utilize the fleet-average option, the 4,000 and full useful life mile test points for the highest whole vehicle diurnal plus hot soak emissions may exceed the emission standards of section I.E.(e)(i)(B) but must be less than the maximum allowed family emission limits set forth in footnote (2) of the table in section I.E.(e)(i)(B). A manufacturer is not required to obtain a new approval to use a previously approved evaporative emission durability procedure. The Executive Officer shall review the method, and shall approve it if it meets the following requirements:

2.3.1. The method must cycle and test the complete evaporative emission control system for the equivalent of the applicable vehicle useful life (i.e., 100,000 ~~or~~, 120,000, or 150,000 miles) of typical customer use.

2.3.2. The method must reflect the flow of liquid and gaseous fuel through the evaporative emission control system, and the exposure (both peak and cyclical) to heat, vibration, and ozone expected based on typical customer use through the applicable useful life.

2.3.3. The method must have the specifications for acceptable system performance, including maximum allowable leakage based on typical customer use through the applicable vehicle useful life.

2.4. (a) In addition to the requirements of section II.A.2.3. above, for evaporative/refueling families subject to testing for exhaust emission durability, at least one evaporative emission test shall be conducted at 5,000, 40,000, 70,000, and 100,000 mile test points for all passenger car, and light-duty truck durability vehicles and at 5,000, 40,000, 70,000, 90,000, and 120,000 mile test points for all medium-duty durability vehicles. For all vehicles subject to the useful life requirement of 150,000 miles or 15 years for exhaust emissions, at least one evaporative emission test shall also be conducted at the 150,000 mile test point if the durability vehicle will be tested for exhaust emissions at the 150,000 mileage point. With prior written approval from the Executive Officer, manufacturers may terminate evaporative emissions testing at the mileage corresponding to 75 percent of the vehicle’s useful life if no significant vehicle maintenance or emissions change are observed. Testing may be performed at different intervals as determined by the manufacturer using good engineering judgment. Evaporative emission testing may be performed at corresponding exhaust emission mileage points as set forth in section F.4. (40 CFR §86.1823) of the “California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and ~~for 2001 and Subsequent~~ 2009 through 2016 Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles~~.”~~ and the “California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles.” The 4,000 and full useful life mile test points (or their equivalent) used in determining a DF must be within the standards of section I.E. or data will not be acceptable for use in the calculation of a DF, except for the following provision. For evaporative families certified to the emission standards in section I.E.(e)(i)(B) that utilize the fleet-average option, the 4,000 and full useful life mile test points for the highest whole vehicle diurnal plus hot soak emissions may exceed the emission standards in section I.E.(i)(B), but must be less than the maximum allowed family emission limits set forth in footnote (2) of the table in section I.E.(e)(i)(B).

As Amended: March 22, 2012
Date of Hearing: January 26-27, 2012

(b) For evaporative families subject to the requirements of section II.A.2.4.(a), manufacturers may demonstrate compliance by conducting an exhaust and evaporative emission test sequence at the end of the useful life of the exhaust durability data vehicle if the procedure set forth in section II.A.2.3. includes on-road, useful life deterioration on the evaporative test vehicle. The evaporative test vehicle used to meet the criteria in section II.A.2.3. must be deteriorated based on typical customer use throughout the applicable useful life. The manufacturer may perform unscheduled maintenance on the evaporative test vehicle at the final test point only upon prior Executive Officer approval, which shall be granted if the Executive Officer determines that the exhaust emission control system will not be affected, and the manufacturer demonstrates that the effectiveness of the evaporative emission control system is not diminished. The unscheduled maintenance must be conducted in accordance with 40 CFR §86.1834-01 as amended by the "California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and ~~for 2001 and Subsequent~~ 2009 through 2016 Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles," and the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles."

2.5. The evaporative DFs determined under section II.A.2.4., if any, shall be averaged with the evaporative DFs determined under section II.A.2.3. to determine a single evaporative DF for each evaporative/refueling family. Evaporative DFs shall be generated for the running loss test and for the hot soak and the diurnal test in the three-day diurnal sequence, and for the hot soak and the diurnal test in the two-day diurnal sequence. The manufacturer may carry-across the DF generated in the three-day diurnal sequence to the two-day diurnal sequence if the manufacturer can demonstrate that the DF generated in the three-day diurnal sequence is at least as great as the DF generated in the two-day diurnal sequence.

3. Assigned DFs

3.1. §86.1826-01. [No change.]

3.2. A small volume manufacturer, as defined in section 1900(b), title 13, CCR, ~~Any manufacturer~~ may request to certify evaporative/refueling families using assigned DFs ~~for a combined total of 4,500 projected annual California sales of passenger cars, light-duty trucks, medium-duty vehicles, and heavy-duty engines per manufacturer regardless of total sales~~.

3.3. Assigned DFs shall be used only where specific evaporative durability data do not exist. Assigned DFs shall be used in lieu of data from durability vehicle(s) only when a manufacturer demonstrates that it has control over design specifications, can provide development data, has in-house testing capabilities including accelerated aging of components/systems, and has evaluation criteria to ensure emission control system (ECS) durability for the vehicle's useful life. The applying manufacturer must demonstrate that evaporative emission control system(s) developed or adapted for the particular vehicle will be durable and comply with the applicable emission standards for the vehicle's useful life. In evaluating any information provided, all relevant test data and design factors shall be considered, including but not limited to: canister nominal working capacity and location, purge strategy, method of purge control, fuel tank capacity, variables affecting fuel temperature (use of fuel return, material, shape of fuel tank, distance of fuel tank from road surface and distance from exhaust pipe, total underbody airflow), fuel and vapor hose materials, use of sensors and auxiliary control devices, technical comparison to an evaporative emission control system and the durability of any evaporative emission control system components that may have been used in other vehicle applications. The assigned DFs shall be applied only to entire evaporative/refueling families.

3.3.1. If emission control parts from other certified vehicles are utilized, then parameter comparisons of the above data must also be provided including part numbers where applicable. Evaporative emission control durability may include special in-house specifications.

3.4. The criteria for evaluating assigned DFs for evaporative/refueling families are the same as those for exhaust families. However, in determining evaporative/refueling family DFs these test procedures require that an evaporative family DF be determined by averaging DFs obtained from durability vehicle testing and from bench testing. Therefore, if a manufacturer meets the criteria as specified above, the Executive Officer may grant assigned DFs for either (or both) the durability vehicle DF or the bench DF.

3.5. The use of ~~A~~assigned DFs for bench test requirements does not depend upon the ~~4,500~~small volume manufacturer maximum sales limit (as defined in section 1900(b), title 13, CCR)~~. The assigned bench DF~~ and is applicable only to evaporative emission control systems which are similar to those used by the manufacturer for 1998 or later model-year vehicles and where an evaporative DF was determined.

4. Emission Data Vehicle Selection

4.1. §86.1828-01 [No change.]

4.2. In selecting medium-duty test vehicles, the Executive Officer shall consider the availability of test data from comparably equipped light-duty vehicles and the size of medium-duty vehicles as it relates to the practicability of evaporative emission testing.

5. Durability and Emission Testing Requirements; waivers

5.1. §86.1829-01 (December 8, 2005). [No change, except as otherwise noted.]

5.2. References to the "EPA" shall mean the Executive Officer of the Air Resources Board.

5.3. The optional provision for a manufacturer to provide a statement of compliance in lieu of a demonstration of compliance with the supplemental two-day diurnal plus hot soak emission standard for certification purposes, as contained in §86.1829-01(b)(2)(iii), shall be applicable to gasoline- and ethanol-fueled passenger cars, light-duty trucks, and medium-duty vehicles, including hybrid electric, fuel-flexible, dual fuel, and bi-fuel vehicles. Heavy-duty vehicles over 14,000 lbs. GVWR and incomplete medium-duty vehicles shall comply with the requirements of section I.D.2.

5.4. For purposes of certification, a 2012 and subsequent off-vehicle charge capable hybrid electric vehicle shall demonstrate the capability to purge its evaporative canister(s) during the exhaust emission test of the supplemental two-day diurnal plus hot soak emission test sequence.

5.4.1. This capability shall be demonstrated through compliance with the supplemental two-day diurnal plus hot soak emission standard, using the test sequence as specified in section III.D.3.1.18., except that the battery state-of-charge setting prior to the standard three-phase exhaust test shall be at the lowest level allowed by the manufacturer in order to maximize the cumulative amount of the auxiliary power unit activation during the three-phase exhaust test. Performance of this demonstration shall be in addition to the demonstration of compliance with the supplemental two-day diurnal plus hot soak emission standard required under section I.E.1., using the test sequence specified in section III.D.3.1.18.

5.4.2. In lieu of conducting the demonstration described in section II.A.5.4.1., a manufacturer may optionally conduct an engineering evaluation that demonstrates the evaporative emission control system's capability to purge its evaporative canister(s) during the exhaust emission test of the supplemental two-day diurnal plus hot soak emission test sequence. Such an evaluation shall be submitted to the Executive Officer, if requested. The manufacturer shall provide a statement of compliance in the certification application to indicate that the evaporative emission control system will purge the system's evaporative canister(s) during the supplemental two-day diurnal plus hot-soak test sequence. The evaluation would include, but not be limited to, canister type, canister volume, canister working capacity, fuel tank volume, fuel tank geometry, fuel delivery system, description of the input parameters and software strategy used to control canister purge, and nominal purge flow volume (i.e., amount of bed volumes) achieved by a test vehicle after completing the exhaust test of a supplemental two-day diurnal plus hot soak emission test sequence.

5.4.2.1. In lieu of the optional engineering demonstration specified in section II.A.5.4.2., manufacturers of 2012 and subsequent model-year off-vehicle charge capable hybrid electric vehicles that are equipped with non-integrated refueling canister-only systems may attest that the system's canister(s) shall have attained a purged condition when the vehicle has consumed at least 85% of its nominal fuel tank capacity.

5.4.2.1.1. This provision shall apply to such non-integrated refueling canister-only systems that inherently allow only refueling vapors to be stored in the canister(s); and, in which the inherent battery-charge operational mode characteristics cause the canister(s) to experience only either no purge or partial purge during the supplemental two-day diurnal plus hot soak test sequence.

5.4.2.1.2. The manufacturer shall provide the following statement in the application for certification, "The canisters in all vehicles equipped with the [indicate a specific evaporative/refueling family] shall have attained a purged condition when the vehicles have consumed at least 85% of their nominal fuel tank capacity. Assurance with this performance is based on the particular design specifications of the evaporative/refueling family, other inherent battery-charge operational mode characteristics of the vehicle's related systems, and other knowledge possessed by the manufacturer. Providing this assurance relieves the manufacturer of conducting a separate engineering evaluation for demonstrating the evaporative/refueling family's capability of purging its canister(s) during a supplemental two-day diurnal plus hot soak emission test sequence in which the battery state-of-charge setting is at the lowest level allowed by the manufacturer."

5.4.2.2. The manufacturer shall provide the specific information that supports its assurance of the system's performance with these requirements when requested by the Executive Officer.

5.4.2.3. The Executive Officer may withdraw the allowance to use the provision specified in section II.A.5.4.2.1., when information, including but not limited to, ~~that~~ obtained from in-use vehicle testing, indicates non-compliance by the applicable evaporative/refueling family with the requirement.

B. Motorcycles

1. Durability Requirements. Certification of a motorcycle evaporative emission control system requires that the manufacturer demonstrate the durability of each evaporative emission control system family.

1.1. The motorcycle manufacturer can satisfy the vehicle durability testing requirements by performing an evaporative emission test at each scheduled exhaust emission test (40 CFR §86.427-78) during the motorcycle exhaust emission certification test (40 CFR §86.425-78) for each evaporative emission family. The minimum mileage accumulated shall be the total distance (one-half the useful life distance), although the manufacturer may choose to extend the durability test to the useful life distance (40 CFR §86.436-78). The displacement classes and test distances are shown below:

Displacement Class	Engine Displacement Range (cc)	Total Test Distance (km)	Useful Life Distance (km)
I	50-169	6,000	12,000
II	170-279	9,000	18,000
III	280 and greater	15,000	30,000

(i) All durability vehicles shall be built at least one month before the evaporative emissions test, or the manufacturer must demonstrate that the non-fuel related evaporative emissions have stabilized.

(ii) Testing at more frequent intervals than the scheduled exhaust emissions tests may be performed only when authorized in writing by the Executive Officer.

(iii) The DF shall be determined by calculating a least-squares linear regression of the evaporative emissions data with respect to mileage. The DF is defined as the extrapolated (from the regression) value at the useful life distance minus the interpolated value at the total test distance, where these distances are taken from the table in section II.B.1.1., above.

(iv) The extrapolated useful life and total test distance emissions shall be less than the applicable evaporative emission standards of section I.E.2. or the data will not be acceptable for use in the calculation of a DF and demonstration of compliance.

(v) Motorcycle manufacturers may use the ARB Component Bench Test Procedures or propose in their application a method for durability bench testing and determination of a DF for each evaporative family. The Executive Officer shall review the method, and shall approve it if it is similar to the requirements specified below. Any reference to 4,000 miles and 50,000 miles shall mean total test distance and useful life distance, respectively, as defined in section II.B.1.1. for the appropriate engine displacement class.

The manufacturer shall propose in its preliminary application for certification a method for durability testing and for determination of a DF for each evaporative family. The 4,000 and 50,000 mile test points (or their equivalent) used in determining the DF must be within the standards of section II.B1.1. or data will not be acceptable for use in the calculation of a DF. The Executive Officer shall review the method, and shall approve it if it meets the following requirements:

(A) The method must cycle and test the complete evaporative emission control system for the equivalent of at least 50,000 miles of typical customer use.

(B) The method must reflect the flow of liquid and gaseous fuel through the evaporative emission control system, and the exposure (both peak and cyclical) to heat, vibration, and ozone expected through 50,000 miles of typical customer use.

(C) The method must have the specifications for acceptable system performance, including maximum allowable leakage after 50,000 miles of typical customer use.

(vi) The DF determined under section II.B.1.1.(iii) shall be averaged with the DF determined under section II.B.1.1.(v) to determine a single evaporative emission DF for each evaporative family. For those motorcycles that do not require exhaust emission control system durability testing, the evaporative emission control system DF shall be determined under section II.B.1.1.(v) only. Compliance with the standard shall be demonstrated by performing an evaporative emission test on a stabilized motorcycle. The motorcycle shall have accumulated at least the minimum test distance. The extrapolated useful life distance emissions after applying the bench test-derived DF shall be less than the applicable evaporative emission standards of section I.E.2.

(vii) (A) Manufacturers of Class III motorcycles may elect to use an assigned evaporative emission control system DF, provided they meet the following requirements:

- Annual California motorcycle sales do not exceed 500 units, and

- The evaporative emission control system has been previously certified to meet the emission standards specified in these procedures, or the manufacturer provides test data from previous certification demonstrating that the system complies with the durability requirements set forth in this section.

(B) Manufacturers of Class III motorcycles using an assigned evaporative emission control system DF pursuant to section II.B.1.1.(vii)(A) may submit a written request for a waiver of evaporative emission testing. The waiver shall be granted if the Executive Officer determines that the motorcycles will comply with the evaporative emission standard. The determination shall be based on the performance of the evaporative emission control system on other motorcycles, the capacity of vapor storage containers, the routing of lines to prevent siphoning, and other emission-related factors determined by the Executive Officer to be relevant to evaluation of the waiver request.

(C) Nothing in this section shall be construed as an exemption from the exhaust emission standards and test procedures applicable pursuant to section 1958, title 13, CCR or section IV.4.(ii) of these test procedures.

(viii) The emission label (40 CFR §86.413-78) shall identify the evaporative emission family.

1.2. Motorcycle manufacturers with annual sales of less than 2,000 units for the three displacement classes in California are not required to submit the information specified by these test procedures to the Executive Officer. However, all information required by these test procedures must be retained on file and be made available on request to the Executive Officer for inspection. These manufacturers shall submit the following information for evaporative emission certification:

(i) A brief description of the vehicles to be covered by the Executive Order. (The manufacturer's sales data book or advertising, including specifications, will satisfy this requirement for most manufacturers.)

(ii) A statement signed by an authorized representative of the manufacturer stating "The vehicles described herein have been tested in accordance with the provisions of the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles," and on the basis of those tests, are in conformance with the aforementioned standards and test procedures."

1.3. The definitions for motorcycle evaporative emission families as set forth in EPA's MSAPC Advisory Circular No. 59, section D shall apply.

PART III. EVAPORATIVE EMISSION TEST PROCEDURES FOR LIGHT- AND MEDIUM-DUTY VEHICLES

A. Instrumentation

The instrumentation necessary to perform evaporative emission testing is described in 40 CFR 86.107-90. The following language is applicable in lieu of 40 CFR §86.107-90(a)(1):

1. **Diurnal Evaporative Emission Measurement Enclosure**

1.1. The diurnal evaporative emissions measurement enclosure shall be equipped with an internal blower or blowers coupled with an air temperature management system (typically air to water heat exchangers and associated programmable temperature controls) to provide for air mixing and temperature control. The blower(s) shall provide a nominal total flow rate of 0.8 ± 0.2 ft^3/min per ft^3 of the nominal enclosure volume, V_n. The inlets and outlets of the air circulation blower(s) shall be configured to provide a well dispersed air circulation pattern that produces effective internal mixing and avoids significant temperature or hydrocarbon and alcohol stratification. The discharge and intake air diffusers in the enclosure shall be configured and adjusted to eliminate localized high air velocities which could produce non-representative heat transfer rates between the vehicle fuel tank(s) and the air in the enclosure. The air circulation blower(s), plus any additional blowers if needed, shall also maintain a minimum wind speed of 5 mph under the fuel tank of the test vehicle. The Executive Officer may adjust wind speed and location to ensure sufficient air circulation around the fuel tank. The wind speed requirement may be satisfied by consistently using a blower configuration that has been demonstrated to meet a broad 5-mph air flow in the vicinity of the vehicle's fuel tank, subject to verification by the Executive Officer.

1.1.1. The enclosure temperature shall be taken with thermocouples located 3 feet above the floor of the approximate mid-length of each side wall of the enclosure and within 3 to 12 inches of each side wall and with a thermocouple located underneath the vehicle where it would provide a temperature measurement representative of the temperature of the air under the fuel tank. The temperature conditioning system shall be capable of controlling the internal enclosure air temperature to follow the prescribed temperature versus time cycle as specified in 40 CFR §86.133-90 as modified by section III.D.10. (diurnal breathing loss test) of these procedures within an instantaneous tolerance of ± 3.0^{o}F and an average tolerance of ± 2.0^{o}F as measured by the vehicle underbody thermocouple, and within an instantaneous tolerance of ± 5.0^{o}F as measured by the side wall thermocouples. The control system shall be tuned to provide a smooth temperature pattern which has a minimum of overshoot, hunting, and instability about the desired long term temperature profile.

1.2. The enclosure shall be of sufficient size to contain the test vehicle with personnel access space. It shall use materials on its interior surfaces which do not adsorb or desorb hydrocarbons, or alcohols (if the enclosure is used for alcohol-fueled vehicles). The enclosure shall be insulated to enable the test temperature profile to be achieved with a heating/cooling system which has minimum surface temperatures in the enclosure no less than 25.0^{o}F below the minimum diurnal temperature specification. The enclosure shall be equipped with a pressure transducer with an accuracy and precision of ± 0.1 inches H_2O. The enclosure shall be constructed with a minimum number of seams and joints which provide potential leakage paths. Particular attention shall be given to sealing and gasketing of such seams and joints to prevent leakage.

1.3. The enclosure shall be equipped with features which provide for the effective enclosure volume to expand and contract in response to both the temperature changes of the air mass in the enclosure, and any fluctuations in the ambient barometric pressure during the duration of the test. Either a variable volume enclosure or a fixed volume enclosure may be used for diurnal emission testing.

1.3.1. The variable volume enclosure shall have the capability of latching or otherwise constraining the enclosed volume to a known, fixed value, V_n. The V_n shall be determined by measuring all pertinent dimensions of the enclosure in its latched configuration, including internal fixtures, based on a temperature of 84^{o}F, to an accuracy of ± 1/8 inch (0.5 cm) and calculating the net V_n to the nearest 1 ft^3. In addition, V_n shall be measured based on a temperature of 65^{o}F and 105^{o}F. The latching system shall provide a fixed volume with an accuracy and repeatability of 0.005xV_n. Two potential means of providing the volume accommodation capabilities are a moveable ceiling which is joined to the enclosure walls with a flexure; or a flexible bag or bags of Tedlar or other suitable materials which are installed in the enclosure and provided with flowpaths which communicate with the ambient air outside the enclosure. By moving air into and out of the bag(s), the contained volume can be adjusted dynamically. The total enclosure volume accommodation shall be sufficient to balance the volume changes produced by the difference between the extreme enclosure temperatures and the ambient laboratory temperature with the addition of a superimposed barometric pressure change of 0.8 in. Hg. A minimum total volume accommodation range of ± 0.07xV_n shall be used. The action of the enclosure volume accommodation system shall limit the differential between the enclosure internal pressure and the external ambient barometric pressure to a maximum value of ± 2.0 inches H_2O.

1.3.2. The fixed volume enclosure shall be constructed with rigid panels that maintain a fixed enclosure volume, which shall be referred to as V_n. V_n shall be determined by measuring all pertinent dimensions of the enclosure including internal fixtures to an accuracy of ± 1/8 inch (0.5 cm) and calculating the net V_n to the nearest 1 ft^3. The enclosure shall be equipped with an outlet flow stream that withdraws air at a low, constant rate and provides makeup air as needed, or by reversing the flow of air into and out of the enclosure in response to rising or falling temperatures. If inlet air is added continuously throughout the test, it must be filtered with activated carbon to provide a relatively constant hydrocarbon and alcohol level. Any method of volume accommodation shall maintain the differential between the enclosure internal pressure and the barometric pressure to a maximum value of ±2.0 inches of water. The equipment shall be capable of measuring the mass of hydrocarbon, and alcohol (if the enclosure is used for alcohol-fueled vehicles) in the inlet and outlet flow streams with a resolution of 0.01 gram. A bag sampling system may be used to collect a proportional sample of the air withdrawn from and admitted to the enclosure. Alternatively, the inlet and outlet flow streams may be continuously analyzed using an on-line Flame Ionization Detector (FID) analyzer and integrated with the flow measurements to provide a continuous record of the mass hydrocarbon and alcohol removal.

1.4. An online computer system or stripchart recorder shall be used to record the following parameters during the diurnal evaporative emissions test sequence:

-Enclosure internal air temperature
-Diurnal ambient air temperature specified profile as defined in 40 CFR §86.133-90 as modified in section III.D.10. (diurnal breathing loss test).
-Vehicle fuel tank liquid temperature
-Enclosure internal pressure
-Enclosure temperature control system surface temperature(s)
-FID output voltage recording the following parameters for each sample analysis:

-zero gas and span gas adjustments
-zero gas reading
-enclosure sample reading
-zero gas and span gas readings

1.4.1. The data recording system shall have a time resolution of 30 seconds and shall provide a permanent record in either magnetic, electronic or paper media of the above parameters for the duration of the test.

1.5. Other equipment configurations may be used if approved in advance by the Executive Officer. The Executive Officer shall approve alternative equipment configurations if the manufacturer demonstrates that the equipment will yield test results equivalent to those resulting from use of the specified equipment.

2. Running Loss Measurement Facility

2.1. For all types of running loss measurement test facilities, the following shall apply:

2.1.1. The measurement of vehicle running loss fuel vapor emissions shall be conducted in a test facility which is maintained at a nominal ambient temperature of 105.0°F. Manufacturers have the option to perform running loss testing in either an enclosure incorporating atmospheric sampling equipment, or in a cell utilizing point source sampling equipment. Confirmatory testing or in-use compliance testing may be conducted by the Executive Officer using either sampling procedure. The test facility shall have space for personnel access to all sides of the vehicle and shall be equipped with the following test equipment:

-A chassis dynamometer which meets the requirements of 40 CFR §86.108-00 with the following addition to §86.108-00(d):

> Another dynamometer configuration may be used for running loss testing if approved in advance by the Executive Officer based on a demonstration that measured running loss emissions are equivalent to the emissions using the single-roll electric dynamometer described in 86.108-00(b)(2).

-A fuel tank temperature management system which meets the requirements specified in section III.A.2.1.3.

-A running loss fuel vapor hydrocarbon analyzer which meets the requirements specified in 40 CFR §86.107-90(a)(2)(i) and a running loss fuel vapor alcohol analyzer which meets the requirements specified in 40 CFR §86.107-90(a)(2)(ii).

-A running loss test data recording system which meets the requirements specified in section III.A.2.1.4.

2.1.2. All types of running loss test facilities shall be configured to provide an internal ambient temperature of 105°F ± 5°F maximum and ± 2°F on average throughout the running loss test sequence. This shall be accomplished by any one or combination of the following techniques:

-Using the test facility without artificial cooling and relying on the residual heat in the test vehicle for temperature achievement.

-Adding insulation to the test facility walls.

-Using the test facility artificial cooling system (if so equipped) with the setpoint of the cooling system adjusted to a value not lower than 105.0°F, where the cooling system set point refers to the internal test facility air temperature.

-Using a full range test facility temperature management system with heating and cooling capabilities.

2.1.3. Cell/enclosure temperature management shall be measured at the inlet of the vehicle cooling fan. The vehicle cooling fan shall be a road speed modulated fan which is controlled to a discharge velocity which matches the dynamometer roll speed at least up to 30 mph throughout the driving cycle. The fan outlet may discharge airflow to both the vehicle radiator air inlet(s) and the vehicle underbody. An additional fan, not to exceed 8,000 cfm, may be used to discharge airflow from the front of the vehicle directly to the vehicle underbody to control fuel temperatures.

2.1.3.1. The fuel tank temperature management system shall be configured and operated to control the fuel tank temperature profile of the test vehicle during the running loss test sequence. The use of a discrete fuel tank temperature management system is not required provided that the existing temperature and airflow conditions in the test facility are sufficient to match the on-road fuel tank liquid (T_{liq}) temperature profile of the test vehicle within a tolerance of ± 3.0°F throughout the running loss driving cycle, and, if applicable, the fuel tank vapor (T_{vap}) temperature profile of the test vehicle within a tolerance of ± 5°F throughout the running loss driving cycle and ± 3.0°F during the final 120 second idle period of the test. The system shall provide a ducted air flow directed at the vehicle fuel tank which can be adjusted in flow rate and/or temperature of the discharge air to manage the fuel tank temperature. The system shall monitor the vehicle fuel tank temperature sensors located in the tank according to the specifications in section III.C.1. (40 CFR §86.129-80) during the running loss drive cycle. The measured temperature shall be compared to a reference on-road profile for the same platform/powertrain/fuel tank combination developed according to the procedures in section III.C.1. (40 CFR §86.129-80). The system shall adjust the discharge flow and/or temperature of the outlet duct to maintain the tank liquid temperature profile within ± 3.0°F of the reference on-road liquid temperature profile throughout the test. If applicable, the vapor temperature shall match the reference on-road vapor temperature profile within ± 5.0°F throughout the test and ± 3.0°F during the final 120 second idle period. The system shall be designed to avoid heating or cooling of the fuel tank vapor space in a way that would cause vapor temperature behavior to be unrepresentative of the vehicle's on-road vapor profile. The system shall provide a discharge airflow up to 4,000 cfm. With advance Executive Officer approval, the system may provide a discharge airflow with a maximum of 6,000 cfm.

2.1.3.2. Blowers or fans shall be used to mix the enclosure contents during evaporative emission testing. The blowers or fans shall have a total capacity of at least 1.0 ft^3/min per ft^3 of V_n. The inlets and outlets of the air circulation blower(s) shall be configured to provide a well dispersed air circulation pattern that produces effective internal mixing and avoids significant temperature or hydrocarbon and alcohol stratification.

2.1.3.3. The temperature of the air supplied to the outlet duct shall be within a range of 90°F to 160°F for systems which utilize artificial heating and/or cooling of the air supply to the outlet duct. This requirement does not apply to systems which recirculate air from inside the test cell without temperature conditioning the airflow. The control system shall be tuned and operated to provide a smooth and continuous fuel tank temperature profile which is representative of the on-road temperature profile.

2.1.3.4. Direct fuel heating may be used to control fuel temperatures for vehicles under exceptional circumstances in which airflow alone is insufficient to control fuel temperatures. The heating system must not cause hot spots on the tank wetted surface that could cause local overheating of the fuel. Heat must not be applied to the vapor in the tank above the liquid fuel, nor near the liquid-vapor interface.

2.1.4. An on-line computer system or strip-chart recorder shall be used to record the following parameters during the running loss test sequence:

-Cell/enclosure ambient temperature
-Vehicle fuel tank liquid (T_{liq}) and, if applicable, vapor space (T_{vap}) temperatures
-Vehicle coolant temperature
-Vehicle fuel tank headspace pressure
-Reference on-road fuel tank temperature profile developed according to section III.C.1. (40 CFR §86.129-80)
-Dynamometer rear roll speed (if applicable)
-FID output voltage recording the following parameters for each sample analysis:
    -zero gas and span gas adjustments
    -zero gas reading
    -dilute sample bag reading (if applicable)
    -dilution air sample bag reading (if applicable)
    -zero gas and span gas readings

-methanol sampling equipment data:
    -the volumes of deionized water introduced into each impinger
    -the rate and time of sample collection
    -the volumes of each sample introduced into the gas chromatograph
    -the flow rate of carrier gas through the column
    -the column temperature
    -the chromatogram of the analyzed sample

2.2. If an enclosure, or atmospheric sampling, running loss facility is used, the following requirements (in addition to those in section III.A.2.1. above) shall also be applicable:

2.2.1. The enclosure shall be readily sealable and rectangular in shape. When sealed, the enclosure shall be gas tight in accordance with 40 CFR 86.117-90. Interior surfaces shall be impermeable and non-reactive to hydrocarbons, and to alcohol (if the enclosure is used for alcohol-fueled vehicles). One surface should be of flexible, impermeable, and non-reactive material to allow for minor volume changes, resulting from temperature changes.

2.2.2. In the event an artificial cooling or heating system is used, the surface temperature of the heat exchanging elements shall be a minimum of 70.0°F.

2.2.3. The enclosure shall be equipped to supply air to the vehicle, at a temperature of 105 ± 5°F, from sources outside of the running loss enclosure directly into the operating engine's air intake system. Supplemental air requirements shall be supplied by drawing air from the engine intake source.

2.3. If a point source running loss measurement facility (cell) is used, the following requirements (in addition to those in section III.A.2.1. above) shall also be applicable:

2.3.1. The running loss vapor collection system shall be configured to collect all running loss emissions from each of the discrete emissions sources, which include vehicle fuel system vapor vents, and transport the collected vapor emissions to a CFV or PDP based dilution and measurement system. The collection system shall consist of a collector at each discrete vehicle emissions source, lengths of heated sample line connecting each collector to the inlet of the heated sample pump, and lengths of heated sample line connecting the outlet of the heated sample pump to the inlet of the running loss fuel vapor sampling system. Up to 3 feet of unheated line connecting each of the vapor collectors to the heated sample lines shall be allowed. Each heated sample pump and its associated sample lines shall be maintained at a temperature between 175.0°F and 200.0°F to prevent condensation of fuel vapor in the sample lines. The heated sample pump(s) and its associated flow controls shall be configured and operated to draw a flow of ambient air into each collector at a flow rate of at least 40 standard cubic feet per hour (SCFH). The flow controls on each heated sampling system shall include an indicating flow meter which provides an alarm output to the data recording system if the flow rate drops below 40 SCFH by more than 5 percent. The collector inlet for each discrete emissions source shall be placed in proximity to the source as necessary to capture any fuel vapor emissions without significantly affecting flow or pressure of the normal action of the source. The collector inlets shall be designed to interface with the configuration and orientation of each specific source. For vapor vents which terminate in a tube or hose barb, a short length of tubing of an inside diameter larger throughout its length than the inside diameter of the vent outlet, may be used to extend the vent into the mouth of the collector as illustrated in Figure 1. For those vapor vent designs which are not compatible with such collector configurations and other emissions sources, the vehicle manufacturer shall supply a collector which is configured to interface with the vapor vent design or the specific emissions source design, and which terminates in a fitting approved by the Executive Officer. The Executive Officer shall approve the fitting if the manufacturer demonstrates that it is capable of capturing all vapors emitted from the source.

2.3.2. The running loss fuel vapor sampling system shall be a CFV or PDP based dilution and measurement system which further dilutes the running loss fuel vapors collected by the vapor collection system(s) with ambient air, collects continuously proportional samples of the diluted running loss vapors and dilution air in sample bags, and measures the total dilute flow through the sampling system over each test interval. In practice, the system shall be configured and operated in a manner which is directly analogous to an exhaust emissions constant volume sampling system, except that the input flow to the system is the flow from the running loss vapor collection system(s) instead of vehicle exhaust flow. The system shall be configured and operated to meet the following requirements:

2.3.2.1. The running loss fuel vapor sampling system shall be designed to measure the true mass of fuel vapor emissions collected by the running loss vapor collection system from the specified discrete emissions source. The total volume of the mixture of running loss emissions and dilution air shall be measured, and a continuously proportionated sample of volume shall be collected for analysis. Mass emissions shall be determined from the sample concentration and total flow over the test period.

2.3.2.2. The PDP-CVS shall consist of a dilution air filter and mixing assembly, heat exchanger, positive displacement pump, sampling system, and associated valves, pressure and temperature sensors. The PDP-CVS shall conform to the following requirements:

-The gas mixture temperature, measured at a point immediately ahead of the positive displacement pump, shall be within ± 10^{o}F of the designed operating temperature at the start of the test. The gas mixture temperature variation from its value at the start of the test shall be limited to ± 10^{o}F during the entire test. The temperature measuring system shall have an accuracy and precision of ± 2^{o}F.

-The pressure gauges shall have an accuracy and precision of ± 1.6 inches of water (± 0.4 kPa).

-The flow capacity of the CVS shall not exceed 350 CFM (0.165 m^3/s).

- Sample collection bags for dilution air and running loss fuel vapor samples shall be sufficient size so as not to impede sample flow.

2.3.2.3. The CFV sample system shall consist of a dilution air filter and mixing assembly, a sampling venturi, a critical flow venturi, a sampling system and assorted valves, and pressure and temperature sensors. The CFV sample system shall conform to the following requirements:

-The temperature measuring system shall have an accuracy and precision of ± 2^{o}F and a response time of 0.100 seconds of 62.5 percent of a temperature change (as measured in hot silicone oil).

-The pressure measuring system shall have an accuracy and precision of ± 1.6 inches of water (0.4 kPa).
-The flow capacity of the CVS shall not exceed 350 CFM (0.165 m^3/s).
-Sample collection bags for dilution air and running loss fuel vapor samples shall be of sufficient size so as not to impede sample flow.

2.3.3. The on-line computer system or strip-chart recorder specified in section III.A.2.1.4. shall be used to record the following additional parameters during the running loss test sequence, if applicable:

-CFV (if used) inlet temperature and pressure
-PDP (if used) inlet temperature and pressure and differential pressure
-Running loss vapor collection system low flow alarm events

2.4. Other equipment configurations may be used if approved in advance by the Executive Officer. The Executive Officer shall approve alternate equipment configurations if the manufacturer demonstrates that the equipment will yield test results equivalent to those resulting from use of the specified equipment.

3. Hot Soak Evaporative Emission Measurement Enclosure

3.1. The enclosure shall be readily sealable, rectangular in shape, with space for personnel access to all sides of the vehicle. When sealed, the enclosure shall be gas tight in accordance with §86.117-90. Interior surfaces shall be impermeable and non-reactive to hydrocarbon, and to alcohol (if the enclosure is used for alcohol-fueled vehicles). One surface shall be of flexible, impermeable and non-reactive material to allow for minor volume changes, resulting from temperature changes. The enclosure shall be configured to provide an internal enclosure ambient temperature of 105°F ± 5°F maximum and ±2°F on average during the test time interval from 5 minutes after the enclosure is closed and sealed until the end of the one hour hot soak interval. For the first 5 minutes, the ambient temperature shall be maintained at 105°F ± 10°F. The enclosure shall be equipped with an internal air circulation blower(s). The blower(s) shall be sized to provide a nominal total flow rate within a range of 0.8 ± 0.2 ft^3/min per ft^3 of V_n. The inlets and outlets of the blower(s) shall be configured to provide a well dispersed air circulation pattern that produces effective internal mixing and avoids significant temperature or hydrocarbon and alcohol stratification. The discharge and intake air diffusers in the enclosure shall be configured and adjusted to eliminate localized high air velocities which could produce non-representative heat transfer rates between the vehicle fuel tank(s) and the air in the enclosure. The enclosure temperature shall be taken with thermocouples located 3 feet above the floor of the approximate mid-length of each side wall of the enclosure and within 3 to 12 inches of each side wall. This shall be accomplished by any one or combination of the following techniques:

-Using the enclosure without artificial cooling and relying on the residual heat in the test vehicle for temperature achievement.

-Adding insulation to the enclosure walls.

-Using the enclosure artificial cooling system (if so equipped) with the set point of the cooling system adjusted to a value not lower than 105.0^oF, where the cooling system set point refers to the internal enclosure air temperature.

-Using a full range enclosure temperature management system with heating and cooling capabilities.

3.2. In the event an artificial cooling or heating system is used, the surface temperature of the heat exchanging elements shall be a minimum of 70.0^oF.

3.3. The requirements in 40 CFR §86.107-90(a)(4) shall not apply.

B. Calibrations

1. Evaporative emission enclosure calibrations are specified in 40 CFR §86.117-90. Methanol measurements may be omitted when methanol-fueled vehicles will not be tested in the evaporative enclosure. Amend 40 CFR §86.117-90 to include an additional section III.B.1.1., to read:

1.1. Diurnal evaporative emission enclosure. The diurnal evaporative emission measurement enclosure calibration consists of the following parts: initial and periodic determination of enclosure background emissions, initial determination of enclosure volume, and periodic hydrocarbon (HC) and methanol retention check and calibration. Calibration for HC and methanol may be conducted in the same test run or in sequential test runs.

1.1.1. The initial and periodic determination of enclosure background emissions shall be conducted according to the procedures specified in §86.117-90(a)(1) through (a)(6). The enclosure shall be maintained at a nominal temperature of 105.0^oF throughout the four hour period. Variable volume enclosures may be operated in either the latched volume configuration, or with the variable volume feature active. Fixed volume enclosures shall be operated with inlet and outlet flow streams closed. The allowable enclosure background emissions of HC and/or methanol as calculated according to 40 CFR §86.117-90(a)(7) shall not be greater than 0.05 grams in 4 hours. The enclosure may be sealed and the mixing fan operated for a period of up to 12 hours before the initial HC concentration reading (C_{HCi}) and the initial methanol concentration reading (C_{CH3OHi}) is taken and the four hour background measurement period begins.

1.1.2. The initial determination of enclosure internal volume shall be performed according to the procedures specified in section III.A.1.3. If the enclosure will be used for hot soak determination, the determination of enclosure internal volume shall also be performed based on 105°F.

1.1.3. The HC and methanol measurement and retention checks shall evaluate the accuracy of enclosure HC and methanol mass measurements and the ability of the enclosure to retain trapped HC and methanol. The check shall be conducted over a 24-hour period with all of the normally functioning subsystems of the enclosure active. A known mass of propane and/or methanol shall be injected into the enclosure and an initial enclosure mass measurement(s) shall be made. The enclosure shall be subjected to the temperature cycling specified in section III.D.10.3.7. of these procedures (revising 40 CFR §86.133-90(l)) for a 24 hour period. The temperature cycle shall begin at 105ºF (hour 11) and continue according to the schedule until a full 24-hour cycle is completed. A final enclosure mass measurement(s) shall be made. The following procedure shall be performed prior to the introduction of the enclosure into service and following any modifications or repairs to the enclosure that may impact the integrity of this enclosure; otherwise, the following procedure shall be performed on a monthly basis. (If six consecutive monthly retention checks are successfully completed without corrective action, the following procedure may be determined quarterly thereafter as long as no corrective action is required.)

1.1.3.1. Zero and span the HC analyzer.

1.1.3.2. Purge the enclosure until a stable enclosure HC level is attained.

1.1.3.3. Turn on the enclosure air mixing and temperature control system and adjust it for an initial temperature of 105.0°F and a programmed temperature profile covering one diurnal cycle over a 24 hour period according to the profile specified in section III.D.10.3.7. of these procedures (revising 40 CFR §86.133-90). Close the enclosure door. On variable volume enclosures, latch the enclosure to the enclosure volume measured at 105°F. On fixed volume enclosures, close the outlet and inlet flow streams.

1.1.3.4. When the enclosure temperature stabilizes at 105.0°F ± 3.0°F seal the enclosure; measure the enclosure background HC concentration (C_{HCe1}) and/or background methanol concentration (C_{CH3OH1}) and the temperature (T_1), and pressure (P_1) in the enclosure.

1.1.3.5. Inject into the enclosure a known quantity of propane between 2 to 6 grams and/or a known quantity of methanol in gaseous form between 2 to 6 grams. For evaporative emission enclosures that will be used for testing motor vehicles certified to the reduced evaporative standards in sections I.E.1.(c) and (d), use a known amount of propane or gaseous methanol between 0.5 to 1.0 grams. The injection method shall use

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a critical flow orifice to meter the propane and/or methanol at a measured temperature and pressure for a measured time period. Techniques which provide an accuracy and precision of ± 0.5 percent of the injected mass are also acceptable. Allow the enclosure internal HC and/or methanol concentration to mix and stabilize for up to 300 seconds. Measure the enclosure HC concentration (C_{HCe2}) and/or the enclosure methanol concentration (C_{CH3OH2}). For fixed volume enclosures, measure the temperature (T_2) and pressure in the enclosure (P_2). On variable volume enclosures, unlatch the enclosure. On fixed volume enclosures, open the outlet and inlet flow streams. Start the temperature cycling function of the enclosure air mixing and temperature control system. These steps shall be completed within 900 seconds of sealing the enclosure.

1.1.3.6. For fixed volume enclosures, calculate the initial recovered HC mass (M_{HCe1}) according to the following formula:

$$M_{HCe1} = (3.05 \text{ x } V \text{ x } 10^{-4} \text{ x } [P_2 (C_{HCe2} - rC_{CH3OH2})/T_2 - P_1 (C_{HCe1} - rC_{CH3OH1})/T_1])$$

where:

V is the enclosure volume at 105°F (ft^3)
P_1 is the enclosure initial pressure (inches Hg absolute)
P_2 is the enclosure final pressure (inches Hg absolute)
C_{HCen} is the enclosure HC concentration at event n (ppm C)
C_{CH3OHn} is the enclosure methanol concentration calculated according to 40 CFR §86.117-90 (d)(2)(iii) at event n (ppm C)
r is the FID response factor to methanol
T_1 is the enclosure initial temperature (°R)
T_2 is the enclosure final temperature (°R)

1.1.3.6.1. For variable volume enclosures, calculate the initial recovered HC mass and initial recovered methanol mass according to the equations used above except that P_2 and T_2 shall equal P_1 and T_1.

1.1.3.6.2. Calculate the initial recovered methanol mass (M_{CH3OH1}) according to 40 CFR §86.117-96(d)(1), as amended March 24, 1993.

1.1.3.6.3. If the recovered HC mass agrees with the injected mass within 2.0 percent and/or the recovered methanol mass agrees with the injected mass within 6.0 percent, continue the test for the 24-hour temperature cycling period. If the recovered mass differs from the injected mass by greater than the acceptable percentage(s) for HC and/or methanol, repeat the enclosure concentration measurement in section III.B.1.1.3.5. and recalculate the initial recovered HC mass (M_{HCe1}) and/or methanol mass (M_{CH3OH1}). If the recovered mass based on the latest concentration measurement agrees within the acceptable percentage(s) of the injected mass, continue the test for the 24-hour temperature cycling period and substitute this second enclosure concentration measurement for C_{HCe2} and/or C_{CH3OH2} in all subsequent calculations. In order to be a valid calibration, the final measurement of C_{HCe2} and C_{CH3OH2} shall be completed within the 900-second time limit outlined above. If the discrepancy persists, the test shall be terminated and the cause of the difference determined, followed by the correction of the problems(s) and the restart of the test.

1.1.3.7. At the completion of the 24 hour temperature cycling period, measure the final enclosure HC concentration (C_{HCe3}) and/or the final enclosure methanol concentration (C_{CH3OH3}). For fixed-volume enclosures, measure the final pressure (P_3) and final temperature (T_3) in the enclosure.

1.1.3.7.1. For fixed volume enclosures, calculate the final recovered HC mass (M_{HCe2}) as follows:

$$M_{HCe2} = [3.05 \text{ x } V \text{ x } 10^{-4} \text{ x}(P_3 (C_{HCe3} - rC_{CH3OH3})/T_3 - P_1 (C_{HCe1} - rC_{CH3OH1})/T_1)] + M_{HC,out} - M_{HC,in}$$

where:

V is the enclosure volume at 105°F (ft^3)
P_1 is the enclosure initial pressure (inches Hg absolute)

P_3 is the enclosure final pressure (inches Hg absolute)
C_{HCe3} is the enclosure HC concentration at the end of the 24-hour temperature cycling period (ppm C)
C_{CH3OH3} is the enclosure methanol concentration at the end of the 24-hour temperature cycling period, calculated according to 40 CFR §86.117-90(d)(2)(iii) (ppm C)
r is the FID response factor to methanol
T_1 is the enclosure initial temperature (^oR)
T_3 is the enclosure final temperature (^oR)
$M_{HC,out}$ is mass of HC exiting the enclosure, (grams)
$M_{HC,in}$ is mass of HC entering the enclosure, (grams)

1.1.3.7.2. For variable volume enclosures, calculate the final recovered HC mass and final recovered methanol mass according to the equations used above except that P_3 and T_3 shall equal P_1 and T_1 , and $M_{HC, out}$ and $M_{HC, in}$ shall equal zero.

1.1.3.7.3. Calculate the final recovered methanol mass (M_{CH3OH2}) according to 40 CFR §86.117-96(d)(1), as amended March 24, 1993.

1.1.3.8. If the calculated final recovered HC mass for the enclosures is not within 3 percent of the initial enclosure mass or the calculated final recovered methanol mass for the enclosures is not within 6 percent of the initial enclosure mass, then action shall be required to correct the error to the acceptable level.

1.2. The running loss equipment shall be calibrated as follows:

1.2.1. The chassis dynamometer shall be calibrated according to the requirements of 40 CFR §86.118-78. The calibration shall be conducted at a typical ambient temperature of 75^{o}F ± 5^{o}F.

1.2.2. The running loss HC analyzer shall be calibrated according to the requirements of 40 CFR §86.121- 90.

1.2.3. If a point source facility is used, the running loss fuel vapor sampling system shall be calibrated according to the requirements of 40 CFR§86.119-90, with the additional requirement that the CVS System Verification in 40 CFR §86.119-90(c) be conducted by injecting the known quantity of propane into the inlet of the most frequently used fuel vapor collector configured to collect vapors from the source of the evaporative emission vapor storage canister. This procedure shall be conducted in the running loss test cell with the collector installed in a vehicle in the normal test configuration, except that the vent hose from the vehicle evaporative emission canister shall be routed to a ventilation outlet to avoid unrepresentative background HC concentration levels. The propane injection shall be conducted by injecting approximately 4 grams of propane into the collector while the vehicle is operated over one Urban Dynamometer Driving

Schedule (UDDS) test procedure, as described in 40 CFR §86.115-78 and Appendix I. The propane injection shall be conducted at a typical ambient temperature of 75^{o}F ± 5^{o}F.

1.2.4. In the event the running loss test is conducted using the atmospheric sampling measurement technique, the following procedure shall be used for the enclosure calibration:

1.2.4.1. The initial and periodic determination of enclosure background emissions shall be conducted according to the procedures specified in 40 CFR §86.117-90(a)(1) through (a)(6). The enclosure shall be maintained at a nominal temperature of 105.0^{o}F throughout the four hour period. The allowable enclosure background emissions as calculated according to 40 CFR §86.117-90 (a)(7) shall not be greater than 0.2 grams in 4 hours. The enclosure may be sealed and the mixing fan operated for a period of up to 12 hours before the initial HC concentration reading is taken.

1.2.4.2. The initial determination of enclosure internal volume shall be performed according to the procedures specified in 40 CFR §86.117-90 (b).

1.2.4.3. The enclosure shall meet the calibration and retention requirements of 40 CFR §86.117-90(c). The propane injection recovery test shall be conducted with a test vehicle being driven over one UDDS cycle in the enclosure during the propane injection test. The vehicle used shall be configured and operated under conditions which ensure that its own running loss contribution is negligible, by using fuel of the lowest available volatility (7.0 psi RVP), maintaining the tank temperature at low levels (<100^{o}F), and routing the canister vent to the outside of the enclosure.

1.2.5. Hot soak enclosure. The hot soak enclosure calibration consists of the following parts: initial and periodic determination of enclosure background emissions, initial determination of enclosure volume, and periodic HC and methanol retention check and calibration. The hot soak enclosure calibration shall be conducted according to the method specified in section III.B.1.1. with a retention check of 4 hours at 105^{o}F or the method specified in section III.B.1.2.4. If the hot soak enclosure is also for diurnal testing, the 4 hour retention check at 105^{o}F may be replaced by the 24 hour diurnal retention check.

1.2.6. Diurnal and hot soak enclosure HC analyzer. The HC analyzers used for measuring the diurnal and hot soak samples shall be calibrated according to the requirements of 40 CFR §86.121-90.

1.2.7. Other equipment. Other test equipment including temperature and pressure sensors and the associated amplifiers and recorders, flow measurement devices, and other instruments shall be calibrated and operated according to the manufacturer's specifications and recommendations, and good engineering practice.

C. Road Load Power, Test Weight, Inertia Weight Class, and Running Loss Fuel Tank Temperature Profile Determination

Amend 40 CFR §86.129-80 to include an additional section III.C.1. to read:

1. Determination of running loss test fuel tank temperature profile. The manufacturer shall establish for each combination of vehicle platform/powertrain/fuel tank submitted for certification a representative profile of fuel tank liquid and vapor temperature versus time to be used as the target temperature profile for the running loss evaporative emissions test drive cycle. If a vehicle has more than one fuel tank, a profile shall be established for each tank. If manufacturers use a vehicle model to develop a profile to represent multiple vehicle models, the vehicle model selected must have the greatest expected fuel liquid temperature and fuel vapor temperature increase during driving of all of the vehicle models it will represent. Manufacturers must select test vehicles with any available vehicle options that could increase fuel temperature during driving, such as any feature that limits underbody air flow. The profile shall be established by driving the vehicle on-road over the same driving schedule as is used for the running loss evaporative emissions test according to the following sequence:

1.1. The vehicle to be used for the fuel tank temperature profile determination shall be equipped with at least 2 thermocouples installed so as to provide a representative bulk liquid average fuel temperature. The specific placement of the thermocouples shall take into account the tank configuration and orientation and shall be along the major axis of the tank. The thermocouples shall not be placed within internal reservoirs or other locations which are thermally isolated from the bulk volume of the fuel. The thermocouples shall be placed at a vertical depth equivalent to the mid-volume of the liquid fuel at a fill level of 40 percent of nominal tank capacity. A third thermocouple, shall be installed in the approximate center of the vapor space of the fuel tank. A pressure transducer with a minimum precision and accuracy of ± 1.0 inches H_2O shall be connected to the vapor space of the fuel tank. A means of conveniently draining the fuel tank shall be provided. The vehicle shall be equipped with a driver's aid which shall be configured to provide the test driver with the desired UDDS vehicle speed versus time trace as defined in Part 86, Appendix I and with the desired NYCC vehicle speed versus time trace as defined in Part 86, Appendix I of the CFR, amended as of March 24, 1993, and the actual vehicle speed. Vehicle coolant temperature shall be monitored to ensure adequate vehicle coolant air to the radiator intake(s). A computer, data logger, or strip chart data recorder shall record the following parameters during the test run:

- Desired speed
- Actual speed
- Average liquid fuel temperature (T_{liq})
- Vapor space temperature (T_{vap})
- Vapor space pressure

1.1.1. The data recording system shall provide a time resolution of 1 second, and an accuracy of ± 1 mph, ± 2.0^{o}F, and ± 1.0 inches H_2O. The temperature and pressure signals may be recorded at intervals of up to 30 seconds.

1.2. The temperature profile determination shall be conducted during ambient conditions which include:

- ambient temperature above 95^{o}F and increasing or stable (± 2^{o}F)
- sunny or mostly sunny with a maximum cloud cover of 25 percent
- wind conditions calm to light with maximum sustained wind speeds of 15 mph; temporary gusts of wind between 15 and 25 mph may occur up to 5 percent of the total driving time
- road surface temperature (T_{sur}) at least 30^{o}F above T_{amb} or at least 135^{o}F, whichever is less

1.2.1. The track surface temperature shall be measured with an embedded sensor, a portable temperature probe, or an infrared pyrometer which can provide an accuracy of ± 2.0^{o}F. Temperatures must be measured on a surface representative of the surface where the vehicle is driven. The test shall be conducted on a track or other restricted access facility so that the speed versus time schedule can be maintained without undue safety risks.

1.2.2. Prior to the start of the profile generation, the fuel tank may be artificially heated to the ambient temperature to a maximum of 105^{o}F. The vehicle may be soaked in a temperature-controlled enclosure. Fans blowing ambient air may be used to help control fuel temperatures. Engine idling may not be used to control fuel temperatures. If the fuel tank is artificially heated, the liquid fuel temperature and the vapor temperature must be stabilized for at least one hour at the ambient temperature within ± 2^{o}F to a maximum of 105^{o}F before the profile generation begins. If the allowance for a lower initial fuel temperature established in section III.D.7. is used, the fuel in the test vehicle may not be stabilized at a temperature higher than the established lower initial temperature.

1.2.3. Tank pressure shall not exceed 10 inches of water 30 seconds after the start of the engine until the end of engine operation during the temperature profile determination unless a pressurized system is used and the manufacturer demonstrates in a separate test that vapor would not be vented to the atmosphere if the fuel fill pipe cap was removed at the end of the running loss fuel tank temperature profile determination.

1.3. The vehicle fuel tank shall be drained and filled to 40 percent of the nominal tank capacity with fuel meeting the requirements of section III.D.1. of these procedures. For all hybrid electric vehicles, except for 2012 and subsequent model-year off-vehicle charge capable hybrid electric vehicles, the battery state-of-charge shall be set at a level such that the auxiliary power unit would be activated by the vehicle's control strategy within 30 seconds of starting the first UDDS of the fuel tank temperature profile determination test sequence. If the auxiliary power unit is capable of being manually activated, the auxiliary power unit shall be manually activated at the beginning of and operating throughout the fuel tank temperature profile determination. For 2012 and subsequent model-year off-vehicle charge capable hybrid electric vehicles, the battery state-of-charge shall be set at the level that results when the battery state-of-charge is initially set at the highest level allowed by the manufacturer and then decreased, as applicable, by the performance of a standard three-phase exhaust test, The vehicle shall be moved to the location where the driving cycle is to be conducted. It may be driven a maximum distance of 5.0 miles, longer distances shall require that the vehicle be transported by other means. For 2012 and subsequent model-year off-vehicle charge capable hybrid electric vehicles, the vehicle shall be either only pushed or towed to avoid disturbing the battery state-of-charge setting. The vehicle shall be parked for a minimum of 12 hours in an open area on a surface that is representative of the test road. The orientation of the front of the vehicle during parking (N, SW, etc.) shall be documented. Once the 12-hour minimum parking time has been achieved and the ambient temperature and weather conditions and track surface temperature are within the allowable ranges, the vehicle engine shall be started. The vehicle air conditioning system (if so equipped) shall be set to the "NORMAL" air conditioning mode and adjusted to the minimum discharge air temperature and high fan speed. Vehicles equipped with automatic temperature controlled air conditioning systems shall be operated in "AUTOMATIC" temperature and fan modes with the system set at 72°F. The vehicle may be operated at minimum throttle for periods up to 60 seconds prior to beginning the first UDDS cycle in order to move from the parking location onto the road surface. The driver's aid shall be started and the vehicle operated over one UDDS cycle, then two NYCCs, and another UDDS cycle. The end of each UDDS cycle and the end of the two NYCCs shall be followed by an idle period of 120 seconds during which the engine shall remain on with the vehicle in the same transmission range and clutch (if so equipped) actuation mode as specified in 40 CFR §86.128-79 except for the following:

> Revise subparagraph (c) to include: Idle modes may be run with automatic transmission in "Neutral" and shall be placed in "Drive" with the wheels braked at least 5 seconds before the end of the idle mode. Manual transmission may be in "Neutral" with the clutch engaged and shall be placed in gear with the clutch disengaged at least 5 seconds before the end of the idle mode.

1.3.1. The data recording system shall provide a record of the required parameters over the entire sequence from the initiation of the first UDDS cycle to the end of the third 120 second idle period. Following the completion of the test, the data recording system and driver's aid shall be turned off.

1.4. In addition to the vehicle data recording, the following parameters shall be documented for the running loss test fuel tank temperature determination:

- Date and time of vehicle fueling
- Odometer reading at vehicle fueling
- Date and time vehicle was parked and parking location and orientation
- Odometer reading at parking
- Time and temperature of fuel tank heating, if applicable
- Date and time engine was started
- Time of initiation of first UDDS cycle
- Time of completion of third 120 second idle period
- Ambient temperature and track surface temperature at initiation of first UDDS cycle (T_{amb1} and T_{sur1})
- Ambient temperature and track surface temperature at completion of third 120 second idle period (T_{amb2} and T_{sur2})

1.5. The two UDDS and two NYCC driving traces shall be verified to meet the speed tolerance requirements of 40 CFR 86.115-78 (b)(1), amended as follows:

1.5.1. Revise subparagraph (v) to read: When conducted to meet the requirements of 40 CFR §86.129, up to three additional occurrences of speed variations greater than the tolerance are acceptable, provided they occur for less than 15 seconds on any occasion. All speed variations must be clearly documented as to the time and speed at that point in relation to the driving schedule.

1.5.2. Add subparagraph (vi) to read: When conducted to meet the requirements of 40 CFR §86.129 and §86.132, the speed tolerance shall be as specified above, except that the upper and lower limits shall be 4 mph.

1.6. The following temperature conditions shall be verified:

$(T_{amb1}) \geq 95.0^{o}F$
$(T_{amb2}) \geq (T_{amb1} - 2.0^{o}F)$
$(T_{sur(n)} - T_{amb\,(n)}) \geq 30.0^{o}F$

where n is the incremental measurements in time.

or $T_{sur} > 135^{o}F$

1.7. Failure to comply with any of these requirements shall result in a void test, and require that the entire test procedure be repeated beginning with the fuel drain specified in section III.C.1.3.

1.8. If all of these requirements are met, the following calculations shall be performed:

$T_{corr} = T_{(i)} - T_o$

where: $T_{(i)}$ is the liquid fuel temperature (^oF) or vapor fuel temperature (^oF) during the drive where i is the incremental measurements in time.

T_o is the corresponding liquid fuel temperature (^oF) or vapor fuel temperature (^oF) observed at the start of the specified driving schedule

1.8.1. The individual tank liquid (T_{liq}) and vapor space (T_{vap}) temperatures recorded during the test run shall be adjusted by arithmetically adding the corresponding temperature correction (T_{corr}) adjustment calculated above to 105^{o}F. If T_o is higher than the corresponding ambient temperature by 2^{o}F, the temperature correction shall be determined by the above equation plus the difference in T_o and the corresponding ambient temperature.

1.9. Other methodologies for developing corrected liquid and vapor space temperature profiles are acceptable if approved in advance by the Executive Officer. The Executive Officer shall approve an alternate method if the manufacturer demonstrates equivalence to data collected at 105^{o}F.

D. Test Procedure

The test sequence described in 40 CFR §86.130 through §86.140 shall be performed with the following modifications:

1. General Requirements

1.0. The following language shall be applicable in lieu of 40 CFR §86.130-78:

1.1. The test sequence shown in Figure 2 (Figure 3A or 3B for hybrid electric vehicles) describes the steps encountered as the vehicle undergoes the three-day diurnal sequence and the supplemental two-day diurnal sequence to determine conformity with the standards set forth. Methanol measurements may be omitted when methanol-fueled vehicles will not be tested in the evaporative enclosure. Ethanol shall be accounted for via measurement or mass adjustment factor, using the methods described in this test procedure, for vehicles tested with the gasoline set forth in part II, section A.100.3.1.2. of the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles." Ambient temperature levels encountered by the test vehicle throughout the entire duration of this test sequence shall not be less than 68^{o}F nor more than 86^{o}F, unless otherwise specified. The temperatures monitored during testing shall be representative of those experienced by the test vehicle. The test vehicle shall be approximately level during all phases of the test sequence to prevent abnormal fuel distribution. The temperature tolerance of a soak period may be waived for up to 10 minutes to allow purging of the enclosure or transporting the vehicle into the enclosure.

1.2. If tests are invalidated after collection of emission data from previous test segments, the test may be repeated to collect only those data points needed to complete emission measurements. Compliance with emission standards may be determined by combining emission measurements from these different test runs. If any emission measurements are repeated, the new measurements supersede previous values.

1.3. The three-day diurnal test sequence shown in Figure 2 (and Figure 3A or 3B for hybrid electric vehicles) is briefly described as follows:

1.3.1. For 2001 through 2008 model-year hybrid electric vehicles, the manufacturer may elect to perform the All-Electric Range Test (as indicated in Figure 3A or 3B, as applicable) pursuant to the "California Exhaust Emission Standards and Test Procedures for 2005 – 2008 Model Zero-Emission Vehicles, and 2001 – 2008 Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes," prior to the initial fuel drain and fill step in this test sequence.

1.3.2. For 2009 and subsequent model-year hybrid electric vehicles, a manufacturer may elect to perform the All-Electric Range Test separately from the test sequences specified under these evaporative emission test procedures, and pursuant to the "California Exhaust Emission Standards and Test Procedures for 2009 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes,"

1.4. For 2001 through 2011 model-year vehicles, the fuel tank shall be initially drained and filled to the prescribed tank fuel volume of 40 percent of the manufacturer's nominal fuel tank capacity, as specified in 40 CFR §86.1803-01, in preparation for the vehicle preconditioning.

1.5. For 2001 through 2011 model-year vehicles, the vehicle preconditioning drive shall be performed in accordance with 40 CFR §86.132-90, except that following the initial fuel drain and fill step in this test sequence, as specified in 40 CFR §86.132-90(a)(1), an initial preconditioning soak period of a minimum of 6 hours shall be provided to allow the vehicle to stabilize to ambient temperature prior to the preconditioning drive. Vehicles performing consecutive tests at a test point with the same fuel specification and while remaining under laboratory ambient temperature conditions for at least 6 hours, may eliminate both the initial fuel drain and fill and vehicle soak. In such cases, each subsequent test shall begin with the preconditioning drive.

1.5.1. Following the vehicle preconditioning drive, a second fuel drain and fill step shall be performed, in accordance with 40 CFR §86.132-90(a)(1), The fuel tank shall be filled to the prescribed tank fuel volume of 40 percent of the manufacturer's nominal fuel tank capacity, as specified in 40 CFR §86.1803-01.

1.6. For 2012 and subsequent model-year vehicles, the vehicle preconditioning shall be performed in accordance with 40 CFR §86.132-00, except as amended by section III.D.3.

1.6.1. For a 2012 and subsequent model-year off-vehicle charge capable hybrid electric vehicle, the vehicle preconditioning drive shall include at least one complete UDDS performed entirely under a charge-sustaining mode of operation, The battery state-of-charge net change tolerance provisions specified in section F.10., of the "California Exhaust Emission Standards and Test Procedures for 2009 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, In The Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes" shall not apply.

1.7. For 2012 and subsequent model-year off-vehicle charge capable hybrid electric vehicles that are equipped with non-integrated refueling canister-only systems, the following exceptions apply.

1.7.1. After completion of the vehicle preconditioning drive, the second fuel drain and tank refill step specified in 40 CFR §86.132-00(f)(1) shall be replaced by the 95% tank fill step specified in 40 CFR 86.153-98(d).

1.7.2. After completion of the second fuel drain and tank refill step, the initial testing state of the canister shall be established by purging while performing either the chassis dynamometer procedure or the test track procedure, as described in subparagraphs (d)(1) and (d)(2) of 40 CFR 86.153-98. For vehicles equipped with dual fuel tanks that can be individually selected or isolated, the required volume of fuel shall be driven out of one tank, the second tank shall be selected as the fuel source, and the required volume of fuel shall be driven out of the second tank. A manufacturer shall plan for interruptions in the vehicle drivedowns due to factors such as work schedules, driver relief, and test equipment considerations, using good engineering practice.

1.7.3. With advance Executive Officer approval, a manufacturer may optionally elect to bench purge the canister either during the initial soak period, specified in 40 CFR §86.132-00(c)(1), or after the vehicle preconditioning drive step specified in section III.D.1.6.1., in lieu of performing the second fuel drain/fill and vehicle drivedown steps specified in sections III.D.1.7.1. and III.D.1.7.2. Approval by the Executive Officer shall be based upon assurance that the canister will be bench purged by an equivalent volume of air corresponding to a consumption of 85%, or less as determined by the manufacturer, of the manufacturers' nominal fuel tank capacity, and that the characteristics of the purge flow through the canister, such as flow rates, shall be representative of flow that occurs under the specified vehicle drivedown UDDS cycles. Within 60 minutes of completing the bench purging, the fuel drain and fill step specified in section III.D.1.7.4. shall be performed.

1.7.4. Within 60 minutes of completing the vehicle drivedown, a third fuel drain and fill step shall be performed in which the fuel tank shall be filled to a prescribed tank fuel volume of 10 percent of the manufacturer's nominal fuel tank capacity, determined to the nearest one-tenth of a U.S. gallon (0.38 liter) with the specified fuel. The manufacturer may isolate the canister using any method that does not compromise the integrity of the system. A description of the canister isolation method shall be included in the manufacturer's certification application. When the refueling canister is isolated from its system, fuel vapors shall be allowed to be vented from the fuel tank, as appropriate, during this fill step.

1.7.5 After completion of the third fuel drain and fill step, a second vehicle soak period of not less than 6 hours and not more than 24 hours shall be performed.

1.7.6. After completion of the second vehicle soak period, the fuel-tank-refill canister-loading step specified in section III.D.3.3.6. shall be performed.

1.7.7. After completion of the canister loading, a fourth drain and fill step shall be performed, as specified in section III.D.3.3.6.13.

1.7.8. After completion of the fourth drain and fill step, a third preconditioning soak period of not less than 12 hours and not more than 36 hours shall be performed.

1.7.9. After completion of the 12-to-36 hour preconditioning soak period, a test vehicle shall proceed to the exhaust emission test specified in section III.D.1.11.

1.7.10.When conducting only an exhaust emission test sequence, a manufacturer may elect to perform the canister preconditioning and loading method specified in sections III.D.1.9., III.D.1.10., and III.3.3.4., in lieu of the canister loading method specified in sections III.D.1.7.6. and III.D.3.3.6. Under such an election, the exceptions specified in sections III.D.1.7.4., III.D.1.7.5, and III.D.1.7.6. shall not apply.

1.7.10.1. The Executive Officer may elect to use either canister loading method when conducting exhaust emission testing for certification confirmatory testing and in-use compliance purposes.

1.8. A second preconditioning soak period of not less than 12 hours and not more than 36 hours shall be performed prior to the exhaust emission test.

1.9. During the 12-to-36 hour soak specified in section III.D.1.8 above, the vehicle's evaporative control canister shall be purged with a volume of air equivalent to 300 carbon canister bed volumes at a flow rate of 48 SCFH (22.7 slpm).

1.10. The evaporative control canister shall then be loaded using a butane-nitrogen mixture.

1.11. Perform exhaust emission tests in accordance with procedures as provided in “California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and ~~for 2001 and Subsequent~~ 2009 through 2016 Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles,” the “California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles,” and these procedures.

1.12. For 2001 through 2008 model-year hybrid electric vehicles, a four-phase exhaust test shall be performed as shown in Figure 3A pursuant to the "California Exhaust Emission Standards and Test Procedures for 2005 – 2008 Model Zero-Emission Vehicles, and 2001 – 2008 Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes."

1.12.1. For 2009 and subsequent model-year hybrid electric vehicles, a manufacturer may elect to perform the four-phase exhaust emission test separately from the test sequence specified under these evaporative emission test procedures, and pursuant to the "California Exhaust Emission Standards and Test Procedures for 2009 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes."

1.12.2. When a four-phase exhaust test is performed with the evaporative emission test sequence as shown in Figure 3A, the evaporative emission test sequence shall begin at the second drain and fill step in the test sequence, after the four-phase exhaust test is completed. The ensuing standard three-phase exhaust test shall then be performed without exhaust emission sampling.

1.12.3. For 2001 through 2008 model-year hybrid electric vehicles, the four-phase exhaust testing may be performed in conjunction with evaporative testing, as shown in Figure 3B, with advance Executive Officer approval if the manufacturer is able to provide data demonstrating compliance with evaporative emission standards using the standard three-phase test.

1.12.4. For 2001 through 2008 model-year hybrid electric vehicles, battery state-of-charge setting prior to the standard three-phase test shall be performed pursuant to the supplemental requirements specified in section E.6.1.6. of the "California Exhaust Emission Standards and Test Procedures for 2005 – 2008 Model Zero-Emission Vehicles, and 2001 – 2008 Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes."

1.12.5. For 2009 and subsequent model-year hybrid electric vehicles, except for 2012 and subsequent model-year off-vehicle charge capable hybrid electric vehicles, battery state-of-charge setting prior to the standard three-phase test shall be performed pursuant to the supplemental requirements specified in section E.6.1.5 of the "California Exhaust Emission Standards and Test Procedures for 2009 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes."

1.12.6. For 2012 and subsequent model-year off-vehicle charge capable hybrid electric vehicles, battery state-of-charge setting prior to the standard three-phase test shall be at the highest level allowed by the manufacturer in order to eliminate or minimize the cumulative amount of the auxiliary power unit activation during either of the ensuing three-phase exhaust or running loss tests. This requirement shall be applicable regardless of a vehicle's ability to allow, or not to allow, manual activation of the auxiliary power unit. If off-vehicle charging is required to increase the battery state-of-charge for the proper setting, then this charging shall occur during the 12-to-36 hour soak period. The battery state-of-charge net change tolerance provisions specified in section F.10., of the "California Exhaust Emission Standards and Test Procedures for 2009 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, In The Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes" shall not apply.

1.13. Upon completion of the hot start test, the vehicle shall be parked in a temperature controlled area between one to six hours to stabilize the fuel temperature at 105°F for one hour. Artificial cooling or heating of the fuel tank may be induced to achieve a fuel temperature of 105°F. The initial fuel and, if applicable, vapor temperatures for the running loss test may be less than 105°F with advance Executive Order approval if the manufacturer is able to provide data demonstrating initial temperatures at least 3°F lower than the required 105°F starting temperature.

1.14. A running loss test shall be performed after the fuel tank is stabilized at 105°F. The fuel tank temperature shall be controlled using a specified tank temperature profile for that vehicle during the test. The temperature profile shall be achieved either using temperature controllers or by an air management system that would simulate airflow conditions under the vehicle during driving.

1.15. The hot soak enclosure test shall then be performed at an enclosure ambient temperature of 105°F.

1.16. Upon completion of the hot soak enclosure test, the vehicle shall be soaked for not less than 6 hours and not more than 36 hours. For at least the last 6 hours of this period, the vehicle shall be soaked at 65°F.

1.17. A three-day diurnal test shall be performed in a variable temperature enclosure.

1.18. The supplemental two-day diurnal sequence in Figure 2 (and Figure 3A or 3B for hybrid electric vehicles) shall be conducted according to sections III.D.1.4. through III.D.1.17., with the following exceptions:

1.18.1. Sections III.D.1.9., III.D.1.12., III.D.1.13., and III.D.1.14., shall not apply,

1.18.2. In section III.D.1.15., the ambient temperature of the hot soak test is conducted at an ambient temperature between 68°F and 86°F at all times.

1.18.3. In section III.D.1.17., the diurnal test will consist of a two-day test.

1.18.4. For 2001 through 2008 model-year hybrid electric vehicles, battery state-of-charge setting prior to the standard three-phase exhaust test in the supplemental two-day diurnal test sequence shall be performed pursuant to the supplemental requirements specified in section E.6.1.6. of the "California Exhaust Emission Standards and Test Procedures for 2005 – 2008 Model Zero-Emission Vehicles, and 2001 – 2008 Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes."

1.18.5. For 2009 and subsequent model-year hybrid electric vehicles, except for 2012 and subsequent model-year off-vehicle charge capable hybrid electric vehicles, battery state-of-charge setting prior to the standard three-phase test in the supplemental two-day diurnal test sequence shall be performed pursuant to the supplemental requirements specified in section E.6.1.5 of the “California Exhaust Emission Standards and Test Procedures for 2009 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, In The Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes.”

1.18.6. For 2012 and subsequent model-year off-vehicle charge capable hybrid electric vehicles, battery state-of-charge setting prior to the standard three-phase exhaust test in the supplemental two-day diurnal sequence shall be at the highest level allowed by the manufacturer in order to eliminate or minimize the cumulative amount of the auxiliary power unit activation during either of the ensuing three-phase exhaust or running loss tests. This requirement shall be applicable regardless of a vehicle’s ability to allow, or not to allow, manual activation of the auxiliary power unit. If off-vehicle charging is required to increase the battery state-of-charge for the proper setting, then this charging shall occur during the 12-to-36 hour soak period. The battery state-of-charge net change tolerance provisions specified in section F.10., of the “California Exhaust Emission Standards and Test Procedures for 2009 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, In The Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes” shall not apply.

1.18.7. Emission sampling is not required for the standard three-phase exhaust test performed in the supplemental two-day diurnal test sequence shown in Figure 3A.

1.19. The Executive Officer may conduct certification confirmatory tests and in-use compliance tests of 2012 and subsequent off-vehicle charge capable hybrid electric vehicles using any of the following battery state-of-charge levels:

1.19.1. As specified in sections III.D.1.12.6. or III.D.1.18.6., as applicable.

1.19.2. At the lowest level allowed by the manufacturer.

1.19.3. At any level in-between the levels indicated by sections III.D.1.19.1. and III.D.1.19.2., above, if applicable.

2. Vehicle Preparation

2.0. Amend 40 CFR §86.131-90 to read:

2.1. Prepare the fuel tank(s) for recording the temperature(s) of the prescribed test fuel liquid and, if applicable, fuel vapor according to the requirements of section III.C.1.1. (40 CFR §86.129-80). Measurement of the fuel vapor temperature is optional. If vapor temperature is not measured, the measurement of the fuel tank pressure is not required.

2.2. If applicable, the vehicle shall be equipped with a pressure transducer to monitor the fuel tank headspace pressure during the test. The transducer shall have an accuracy and precision of ± 1.0 inches water.

2.3. Provide additional fittings and adapters, as required, to accommodate a fuel drain at the lowest point possible in the fuel tank(s) as installed on the vehicle.

2.4. Provide valving or other means to allow purging and loading of the evaporative emission canister(s). Special care shall be taken during this step not to alter normal functions of the fuel vapor system components.

2.5. For vehicles to be tested for running loss emissions, prepare the exhaust system by sealing and/or plugging all detectable sources of exhaust gas leaks. The exhaust system shall be tested or inspected to ensure that detectable exhaust hydrocarbons are not emitted into the running loss enclosure during the running loss test.

3. Vehicle Preconditioning

3.1.1. For supplemental vehicle preconditioning requirements for 2001 through 2008 model-year hybrid electric vehicles, refer to the "California Exhaust Emission Standards and Test Procedures for 2005 – 2008 Model Zero-Emission Vehicles, and 2001 – 2008 Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes."

3.1.2. For supplemental vehicle preconditioning requirements for 2009 and subsequent model-year hybrid electric vehicles, refer to the "California Exhaust Emission Standards and Test Procedures for 2009 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes."

3.2. The following language shall be applicable in lieu of 40 CFR §86.132-90(a)(4) for 2001 through 2011 model-year vehicles; and, in lieu of 40 CFR §86.132-00(e) for 2012 and subsequent model-year vehicles.

The Executive Officer may also choose to conduct or require the performance of optional or additional preconditioning to ensure that the evaporative emission control system is subjected to conditions typical of normal driving. The optional preconditioning shall consist of no less than 20 and no more than 50 miles of on-road mileage accumulation under typical driving conditions.

3.3. The following language shall be applicable in lieu of 40 CFR §86.132-90(b) for 2001 through 2011 model-year vehicles. For 2012 and subsequent model-year vehicles, the vehicle preconditioning shall be performed in accordance with 40 CFR §86.132-00(f) through (j), except when amended by the following language.

3.3.1. Within five minutes of completion of vehicle preconditioning drive, the vehicle shall be driven off the dynamometer to a work area. For hybrid electric vehicles following battery state-of-charge setting, the vehicle shall only be pushed or towed to avoid disturbing the battery state-of-charge setting.

3.3.2. Except for 2012 and subsequent model-year off-vehicle charge capable hybrid electric vehicles that are equipped with non-integrated refueling canister-only systems, the fuel tank(s) of the prepared vehicle shall undergo the second fuel drain and fill step of the test sequence, with the applicable test fuel, as specified in section III.F. of these procedures, to the prescribed tank fuel volume of 40 percent of the manufacturer's nominal fuel tank capacity, as defined in 40 CFR §86.1803-01. The vehicle shall be refueled within 1 hour of completion of the preconditioning drive.

3.3.2.1. For 2012 and subsequent model-year off-vehicle charge capable hybrid electric vehicles that are equipped with non-integrated refueling canister-only systems, the exceptions specified in sections III.D.1.7.1 through III.D.1.7.10., shall apply, along with the applicable test fuel specified in section III.F.

3.3.3. Following the second fuel drain and fill described in section III.D.3.3.2. above, the test vehicle shall be allowed to soak for a period of not less than 12 and not more than 36 hours prior to the exhaust emissions test. Except for 2012 and subsequent model-year off-vehicle charge capable hybrid electric vehicles that are equipped with non-integrated refueling canister-only systems, during the soak period, the canister shall be connected to a pump or compressor and loaded with butane as described in section III.D.3.3.4. below for the three-day diurnal sequence and in section III.D.3.3.5. below for the supplemental two-day diurnal sequence. For all vehicles subjected to exhaust emissions testing only, the canister loading procedure as set forth in section III.D. 3.3.4. below shall be used. For 2012 and subsequent model-year off-vehicle charge capable hybrid electric vehicles that are equipped with non-integrated refueling canister-only systems, the canister shall be loaded according to the fuel-tank-refill canister-loading method specified in section III.D.3.3.6., for both the three-day diurnal sequence and the supplemental two-day diurnal sequence.

3.3.3.1. For methanol-fueled and flexible-fueled vehicles, canister preconditioning shall be performed with a fuel vapor composition representative of that which the vehicle would generate with the fuel mixture used for the current test. Manufacturers shall develop a procedure to precondition the canister, if the vehicle is so equipped for the different fuel. The procedure shall represent a canister loading equivalent to that specified in section III.D.3.3.4. below for the three-day diurnal sequence and in section III.D.3.3.5. below for the supplemental two-day diurnal sequence and shall be approved in advance by the Executive Officer.

3.3.4. For the three-day diurnal sequence, the evaporative emissions storage canister(s) shall be preloaded with an amount of butane equivalent to 1.5 times the nominal working capacity. For vehicles with multiple canisters in a series configuration, the set of canisters must be preconditioned as a unit. For vehicles with multiple canisters in a parallel configuration, each canister shall be preconditioned separately. For vehicles equipped with a non-integrated refueling emission control system, the non-integrated canisters shall be preconditioned for the three-day diurnal test sequence according to the procedure in section III.D.3.3.5.1. All 2012 and subsequent model-year off-vehicle charge capable hybrid electric vehicles equipped with non-integrated refueling canister-only systems shall be preconditioned for the three-day diurnal test sequence according to the procedure specified in section III.D.3.3.6., unless a manufacturer is conducting only an exhaust emission test sequence, in which case the optional canister preconditioning and loading method allowed by section III.D.1.7.10. may apply. If a vehicle is designed to actively control evaporative or refueling emissions without a canister, the manufacturer shall devise an appropriate preconditioning procedure subject to the approval of the Executive Officer. If canisters on both certification and production vehicles are equipped with purge and load service ports, the service port shall be used for the canister preconditioning. The nominal working capacity of a carbon canister shall be established by determining the mass of butane required to load a stabilized canister to a

2-gram breakthrough. The 2-gram breakthrough is defined as the point at which the cumulative quantity of hydrocarbons emitted is equal to 2 grams, as defined in section I.B.1.3. The determination of nominal capacity shall be based on the average capacity of no less than five canisters which are in a stabilized condition. For stabilization, each canister must be cycled no less than 10 times and no more than 100 times to a 2-gram breakthrough with a 50/50 mixture by volume of butane and nitrogen, at a rate of 15 ± 2 grams butane per hour. Each canister loading step must be preceded by canister purging with 300 canister bed volume exchanges at 48 SCFH. The following procedure shall be used to preload the canister:

3.3.4.1. Prepare the evaporative emission canister(s) for the canister purging and loading operation. The canister shall not be removed from the vehicle, unless access to the canister in its normal location is so restricted that purging and loading can only reasonably be accomplished by removing the canister from the vehicle. Special care shall be taken during this step so that the normal functions of the fuel system components or the normal pressure relationships in the system are not disturbed. The canister purge shall be performed with ambient air of controlled humidity to 50 ± 25 grains per pound of dry air. This may be accomplished by purging the canister in a room which is conditioned to this level of absolute humidity. The flow rate of the purge air shall be maintained at a nominal flow rate of 48 SCFH (22.7 slpm), and the duration shall be determined to provide a total purge volume flow through the canister equivalent to 300 carbon canister bed volume exchanges.

3.3.4.1.2. The evaporative emission canister(s) shall then be loaded with an amount of commercial grade butane vapors equivalent to 1.5 times the nominal working capacity. Canister loading shall not be less than 1.5 times the nominal canister capacity. The canister shall be loaded with a mixture composed of 50 percent butane and 50 percent nitrogen by volume. The butane shall be loaded into the canister at a rate of 15 ± 2 grams of butane per hour. If the canister loading at this rate takes longer than 12 hours, a manufacturer may determine a new rate, based on completing the canister loading in no less than 12 hours. A Critical Flow Orifice (CFO) butane injection device, a gravimetric method, or electronic mass flow controllers shall be used to fulfill the requirements of this step. The time of completion of the canister loading activity shall be recorded. Manufacturers shall disclose to the Executive Officer their canister loading procedure. The protocol may not allow for the replacement of components. In addition, the Executive Officer may require that the manufacturer demonstrate that the procedure does not unduly disturb the components of the evaporative system.

3.3.4.1.3. Reconnect the evaporative emission canister(s), if applicable.

3.3.5. For the supplemental two-day diurnal sequence, the evaporative emission storage canister(s) shall be loaded to the point of breakthrough using the method specific in either section III.D.3.3.5.1. or section III.D.3.3.5.2. For vehicles with multiple canisters in a series configuration, the set of canisters must be preconditioned as a unit. For vehicles with multiple canisters in a parallel configuration, each canister shall be preconditioned separately. For vehicles equipped with a non-integrated refueling emission control system, the non-integrated canisters shall be preconditioned for the supplemental two-diurnal test sequence according to the procedure in section III.D.3.3.5.1. Breakthrough may be determined by emission measurement in an enclosure or by measuring the weight gain of an auxiliary evaporative canister connected downstream of the vehicle's canister, in which case, the following references to the enclosure can be ignored. The auxiliary canister shall be well purged with ambient air of humidity controlled to 50±25 grains per pound of dry air prior to loading. Breakthrough is defined as the point at which the cumulative quantity of hydrocarbons emitted is equal to 2 grams, as defined in section I.B.1.3.

3.3.5.1. The following procedure provides for loading of the canister to breakthrough with a mixture composed of 50 percent butane and 50 percent nitrogen by volume. If the canisters on both certification and production vehicles are equipped with purge and load service ports, the service port shall be used for the canister preconditioning.

3.3.5.1.1. Prepare the evaporative/refueling emission canister(s) for the canister loading operation. The canister shall not be removed from the vehicle, unless access to the canister in its normal location is so restricted that loading can only reasonably be accomplished by removing the canister from the vehicle. Special care shall be taken during this step to avoid damage to the components and the integrity of the fuel system. The evaporative emission enclosure shall be purged for several minutes. The FID hydrocarbon analyzer shall be zeroed and spanned immediately prior to the canister loading procedure. If not already on, the evaporative enclosure mixing fan shall be turned on at this time. Place the vehicle in the sealed enclosure and measure emissions with the FID.

3.3.5.1.2. Load the canister with a mixture composed of 50/50 mixture by volume of butane and nitrogen at a rate of 40 ± 2 grams butane per hour. As soon as the canister reaches breakthrough, the vapor source shall be shut off.

3.3.5.1.3. Reconnect the evaporative/refueling emission canister, if applicable.

3.3.5.2. The following procedure provides for loading the canister with repeated diurnal heat builds to breakthrough.

3.3.5.2.1. The evaporative emission enclosure shall be purged for several minutes. The FID hydrocarbon analyzer shall be zeroed and spanned immediately prior to the diurnal heat builds. If not already on, the evaporative enclosure mixing fan shall be turned on at this time. The average temperature of the dispensed fuel shall be 60 ± 12^{o}F. Within one hour of being refueled, the vehicle shall be placed, with the engine shut off, in the evaporative emission enclosure. The fuel tank temperature sensor shall be connected to the temperature recording system. A heat source, specified in 40 CFR §86.107-90(a)(4), shall be properly positioned with respect to the fuel tank(s) and connected to the temperature controller.

3.3.5.2.2. The fuel may be artificially heated or cooled to the starting diurnal temperature of 65°F. Turn off purge blower (if not already off); close and seal enclosure doors; and initiate measurement of the hydrocarbon level in the enclosure. When the fuel temperature reaches 65°F, start the diurnal heat build. The diurnal heat build should conform to the following function to within ± 4°F:

$$F = T_o \pm 0.4t$$

F is the fuel temperature, °F
T_o is the initial temperature, °F
t is the time since beginning of test, minutes

3.3.5.2.3. As soon as breakthrough occurs or when the fuel temperature reaches 105°F, whichever occurs first, the heat source shall be turned off, the enclosure doors shall be unsealed and opened. If breakthrough has not occurred by the time the fuel temperature reaches 105°F, the heat source shall be removed from the vehicle, the vehicle shall be removed (with the engine still off) from the evaporative emission enclosure and the entire procedure outlined above shall be repeated until breakthrough occurs.

3.3.5.2.4. After breakthrough occurs, the fuel tank(s) of the prepared vehicle shall be drained and filled with test fuel, as specified in section III.F. of these procedures, to the "tank fuel volume" defined in 40 CFR §86.1803-01. The fuel shall be stabilized to a temperature within ± 3°F of the lab ambient temperature before beginning the driving cycle for the exhaust emission test.

3.3.6. After the soak period specified in section III.D.1.7.5., is completed, the canister for a 2012 and subsequent model-year off-vehicle charge capable hybrid electric vehicle equipped with a non-integrated refueling canister-only system shall be preconditioned and loaded according to the following steps. Prior to conducting the applicable test sequence, the canister shall have already achieved a stabilized state, such as is accomplished using the stabilization method described in section III.D.3.3.4. Good engineering practice and safety considerations, such as, but not limited to, adequate ventilation and appropriate electrical groundings, shall apply.

3.3.6.1. Ambient temperature levels encountered by the test vehicle throughout these steps shall not be less than 68ºF (20ºC) or more than 86ºF (30ºC).

3.3.6.2. The test vehicle shall be approximately level, during the performance of these steps, to prevent abnormal fuel distribution.

3.3.6.3. In order to be moved, the test vehicle shall be pushed, as necessary, without starting its engine, throughout the performance of these steps~~,~~.

3.3.6.4. The test vehicle shall be allowed to soak for a minimum of 6 hours and a maximum of 24 hours, at 80ºF ±3ºF (27ºC ±1.7ºC), prior to starting the fuel-tank-fill canister-loading step. The refueling canister shall remain isolated from its system during this soak period, in order to prevent any abnormal purging or loading of it during this soak period.

3.3.6.5. The refueling canister shall not be isolated from its system during the fuel-tank-refill canister-loading step.

3.3.6.6. The test vehicle’s fuel fill pipe cap shall be removed.

3.3.6.7. The dispensed fuel temperature recording system shall be started.

3.3.6.8. The fuel nozzle shall be inserted into the fill pipe neck of the test vehicle, to its maximum penetration, and the refueling operation shall start. The plane of the nozzle's handle shall be approximately perpendicular to the floor. The fuel shall be dispensed at a temperature of 67ºF ±3.0ºF (19.4ºC ±1.7ºC), and at a dispensing rate of 9.8 gal/min ±0.3 gal/min (37.1 liter/min ±1.1 liter/min). When this refueling operation is conducted by the Executive Officer, a dispensing rate that is not less than 4.0 gal/min (15.1 liter/min) may be used.

3.3.6.9. The fuel flow shall continue until the refueling nozzle automatic shut-off is activated. The amount of fuel dispensed must be at least 85 percent of the nominal fuel tank volume, determined to the nearest one-tenth of a U.S. gallon (0.38 liter). If an automatic nozzle shut-off occurs prior to this point, the dispensing shall be reactivated within 15 seconds, and fuel dispensing continued as needed. A minimum of 3 seconds shall elapse between any automatic nozzle shutoff and the subsequent resumption of fuel dispensing.

3.3.6.10. As soon as possible after completing the refilling step, remove the fuel nozzle from the fill pipe neck, and replace the test vehicle’s fuel fill pipe cap.

3.3.6.11. The refueling canister shall be isolated from its system as soon as possible after completing the refilling step.

3.3.6.12. For vehicles equipped with more than one fuel tank, the steps described in this section shall be performed for each fuel tank.

3.3.6.13. After the fuel-tank-refill canister-loading process is completed, a fourth fuel drain and fill step shall be performed. The fuel tank shall be filled to the prescribed fuel thank volume of 40 percent of the manufacturer's nominal fuel tank capacity, as specified in 40 CFR §86.1803-01. When the refueling canister is isolated from its system, fuel vapors shall be allowed to be vented out of the fuel tank, as appropriate, during this refilling step. The required fuel tank volume of 40 percent may be accomplished by using a measured drain of the fuel tank, in place of the specified complete fuel tank drain and fill step.

3.3.6.14. Upon completion of the fourth fuel drain and fill step, the test vehicle shall proceed to the 12-to-36 hour preconditioning soak step which is performed prior to the three-phase exhaust cold start test step. The canister shall not be isolated from its system during this soak step, and shall not be isolated from its system from this point onward in the test sequence.

3.3.6.15. The Executive Officer may approve modifications to this fuel-tank-refill canister-loading method when such modifications are supported by good engineering judgment, and do not reduce the stringency of the method.

3.4. As allowed under the provisions of section III.G. of these test procedures, a manufacturer may propose, for Executive Officer approval, the use of an alternative method to precondition canisters in lieu of the methods required under sections III.D.3.3.4.; III.D.3.3.5.1.; and, III.D.3.3.5.2., and III.D.3.3.6. The Executive Officer may conduct certification confirmatory tests and in-use compliance tests with the either the alternative canister loading method or the methods specified in sections III.D.3.3.4; III.D.3.3.5.1.; III.D.3.3.5.2.; and, III.D.3.3.6, as applicable.

4. Dynamometer Procedure.

4.1. To be conducted according to 40 CFR §86.135-90 (December 8, 2005).

4.2. For 2001 through 2008 model-year hybrid electric vehicles, the dynamometer procedure shall be performed pursuant to the "California Exhaust Emission Standards and Test Procedures for 2005 – 2008 Model Zero-Emission Vehicles, and 2001 – 2008 Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes."

4.3. For 2009 and subsequent model-year hybrid electric vehicles, the dynamometer procedure shall be performed pursuant to the "California Exhaust Emission Standards and Test Procedures for 2009 Subsequent Model Zero-Emission Vehicles and Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes."

5. Engine Starting and Restarting.

5.1. Amend 40 CFR §86.136-90 to read as follows:

5.1.1. Revise subparagraph (c) to read: Except for hybrid electric vehicles, if the vehicle does not start after the manufacturer's recommended cranking time (or 10 continuous seconds in the absence of a manufacturer's recommendation), cranking shall cease for the period recommended by the manufacturer (or 10 seconds in the absence of a manufacturer's recommendation). This may be repeated for up to three start attempts. If the vehicle does not start after three attempts, the reason for failure to start shall be determined. The gas flow measuring device on the CVS (usually a revolution counter) or CFV shall be turned off and the sampler selector valves, including the alcohol sampler, placed in the "standby" position during this diagnostic period. In addition, either the CVS should be turned off, or the exhaust tube disconnected from the tailpipe during the diagnostic period. If failure to start is an operational error, the vehicle shall be rescheduled for testing from a cold start.

6. Dynamometer Test Run, Gaseous and Particulate Emissions.

6.1. To be conducted according to 40 CFR §86.137-90.

6.2. For 2001 through 2008 model-year hybrid electric vehicles, the dynamometer test run, gaseous and particulate emissions shall be performed pursuant to the "California Exhaust Emission Standards and Test Procedures for 2005 – 2008 Model Zero-Emission Vehicles, and 2001 – 2008 Model Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes."

6.3. For 2009 and subsequent model-year hybrid electric vehicles, the dynamometer test run, gaseous and particulate emissions shall be performed pursuant to the "California Exhaust Emission Standards and Test Procedures for 2009 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes."

7. Vehicle Fuel Tank Temperature Stabilization

7.1. Immediately after the hot transient exhaust emission test, the vehicle shall be soaked in a temperature controlled area between one hour to six hours, until the fuel and, if applicable, vapor temperatures are stabilized at $105^{o}F \pm 3^{o}F$ for one hour. This is a preparatory step for the running loss test. Cooling or heating of the fuel tank may be induced to bring the fuel to $105^{o}F$. The fuel heating rate shall not exceed $5^{o}F$ in any 1-hour interval. Higher fuel heating rates are allowed with Executive Officer approval if the $5^{o}F$ per hour heating rate is insufficient to heat the fuel to $105^{o}F$ in the allowed soak time. The vehicle fuel temperature stabilization step may be omitted on vehicles whose tank fuel and, if applicable, vapor temperatures are already at $105^{o}F$ upon completion of the exhaust emission test.

7.2. The initial fuel and, if applicable, vapor temperatures for the running loss test may be less than 105°F with advance Executive Officer approval if the manufacturer is able to provide data justifying initial temperatures at least 3°F lower than the required 105°F starting temperature. The test data shall include the maximum fuel temperatures experienced by the vehicle during an extended parking event and after a UDDS cycle and be conducted on a day which meets the ambient conditions specified in section III.C.1.2., except the ambient temperature must be at least 105°F. During the profile generation, the temperature offset shall apply.

7.3. The vehicle air conditioning system (if so equipped) shall be set to the "NORMAL" air conditioning mode and adjusted to the minimum discharge air temperature and high fan speed. Vehicles equipped with automatic temperature controlled air conditioning systems shall be operated in "AUTOMATIC" temperature and fan modes with the system set at 72°F.

8. Running Loss Test

8.0. After the fuel temperature is stabilized at 105°F or at the temperature specified by the manufacturer, the running loss test shall be performed. During the test, the running loss measurement enclosure shall be maintained at 105°F ± 5°F maximum and within ± 2°F on average throughout the running loss test sequence. Control of the vapor temperature throughout the test to follow the vapor temperature profile generated according to the procedures in section III.C. is optional. In those instances where vapor temperature is not controlled to follow the profile, the measurement of the fuel tank pressure is not required, and sections III.D.8.1.10. and III.D.8.2.5. below shall not apply. In the event that a vehicle exceeds the applicable emission standard during confirmatory testing or in-use compliance testing, and the vapor temperature was not controlled, the manufacturer may, utilizing its own resources, test the vehicle to demonstrate if the excess emissions are attributable to inadequate control of vapor temperature. If the vehicle has more than one fuel tank, the fuel temperature in each tank shall follow the profile generated in section III.C. If a warning light or gauge indicates that the vehicle's engine coolant has overheated, the test run may be stopped.

8.1. If running loss testing is conducted using an enclosure which incorporates atmospheric sampling equipment, the manufacturer shall perform the following steps for each test:

8.1.1. The running loss enclosure shall be purged for several minutes immediately prior to the test. If at any time the concentration of hydrocarbons, of alcohol, or of alcohol and hydrocarbons exceeds 15,000 ppm C, the enclosure should be immediately purged. This concentration provides at least a 4:1 safety factor against the lean flammability limit.

8.1.2. Place the drive wheels of the vehicle on the dynamometer without starting the engine.

8.1.3. Attach the exhaust tube to the vehicle tailpipe(s).

8.1.4. The test vehicle windows and the luggage compartments shall be closed.

8.1.5. The fuel tank temperature sensor and the ambient temperature sensor shall be connected to the temperature recording system and, if required, to the air management and temperature controllers. The vehicle cooling fan shall be positioned as described in 40 CFR §86.135-90(b). During the running loss test, the cover of the vehicle engine compartment shall be closed as much as possible, windows shall be closed, and air conditioning system (if so equipped) shall be operated according to the requirements of section III.C. (§86.129-80 (d)(3)). Vehicle coolant temperature shall be monitored to ensure adequate vehicle coolant air to the radiator intake(s). The temperature recording system and the hydrocarbon and alcohol emission data recording system shall be started.

8.1.6. Close and seal enclosure doors.

8.1.7. When the ambient temperature is $105^{o}F \pm 5^{o}F$, the running loss test shall begin. Analyze enclosure atmosphere for hydrocarbons and alcohol at the beginning of each phase of the test (i.e., each UDDS and 120 second idle; the two NYCCs and 120 second idle) and record. This is the background hydrocarbon concentration, herein denoted as $C_{HCa(n)}$ for each phase of the test and the background methanol concentration, herein denoted as $C_{CH3OHa(n)}$ for each phase of the test. The methanol sampling must start simultaneously with the initiation of the hydrocarbon analysis and continue for 4.0 ± 0.5 minutes. Record the time elapsed during this analysis. If the 4 minute sample period is inadequate to collect a sample of sufficient concentration to allow accurate Gas Chromatography analysis, rapidly collect the methanol sample in a bag and then bubble the bag sample through the impingers at the specified flow rate. The time elapsed between collection of the bag sample and flow through the impingers should be minimized to prevent any losses.

8.1.8. The vehicle shall be driven through one UDDS, then two NYCCs and followed by one UDDS. Each UDDS and the NYCC driving trace shall be verified to meet the speed tolerance requirements of 40 CFR §86.115-78 (b) as modified by III.C. The end of each UDDS cycle and the two NYCCs shall be followed by an idle period of 120 seconds during which the engine shall remain on with the vehicle in the same transmission range and clutch (if so equipped) actuation mode as specified in §86.128-79, modified by section III.C.1.3.

8.1.8.1. The fuel tank liquid temperature during the dynamometer drive shall be controlled within $\pm 3^{o}F$ of the fuel tank temperature profile obtained on the road according to the procedures in section III.C. (40 CFR §86.129-80) for the same vehicle platform/powertrain/fuel tank configuration. If applicable, the fuel tank vapor temperature throughout the running loss test shall agree with the corresponding vapor temperature with a tolerance of ± 5^{o}F. A running loss test with a fuel tank vapor temperature that exceeded the corresponding vapor temperature profile by more than the ± 5^{o}F tolerance may be considered valid if test results comply with the applicable running loss evaporative emission standards. In addition, the fuel tank vapor temperature during the final 120 second idle period shall agree with the corresponding vapor temperature from the on-road profile within ± 3^{o}F. For testing conducted by the Executive Officer, vapor temperatures may be cooler than the specified tolerances without invalidating test results. The fuel tank temperatures shall be monitored at a frequency of at least once every 15 seconds.

8.1.9. For engine starting and restarting, the provisions of §86.136-90(a) and (e) shall apply. If the vehicle does not start after the manufacturer's recommended cranking time or 10 continuous seconds in the absence of a manufacturer's recommendation, cranking shall cease for the period recommended by the manufacturer or 10 seconds in the absence of a manufacturer's recommendation. This may be repeated for up to three start attempts. If the vehicle does not start after these three attempts, cranking shall cease and the reason for failure to start shall be determined. If the failure is caused by a vehicle malfunction, corrective action of less than 30 minutes duration may be taken (according to 40 CFR §86.1830-01), and the test continued, provided that the ambient conditions to which the vehicle is exposed are maintained at 105^{o}F ± 5^{o}F. When the engine starts, the timing sequence of the driving schedule shall begin. If the vehicle cannot be started, the test shall be voided.

8.1.10. Tank pressure shall not exceed 10 inches of water during the running loss test unless a pressurized system is used and the manufacturer demonstrates in a separate test that vapor would not be vented to the atmosphere if the fuel fill pipe cap was removed at the end of the test. For 2012 and subsequent model-year off-vehicle charge capable hybrid electric vehicles that are equipped with non-integrated refueling canister-only systems, a manufacturer shall demonstrate in either a separate test or an engineering evaluation, that vapor would not be vented to the atmosphere if the fuel fill pipe cap was removed at the end of the test. Transitory incidents of the pressure exceeding 10 inches of water, not greater than 10 percent of the total driving time, shall be acceptable during the running loss test if the manufacturer can demonstrate that the tank pressure does not exceed 10 inches of water during in-use operation. No pressure checks of the evaporative system shall be allowed. If the manufacturer suspects faulty or malfunctioning instrumentation, a repair of the test instrumentation may be performed. Under no circumstances will any changes/repairs to the evaporative emissions control system be allowed.

8.1.11. The FID hydrocarbon analyzer shall be zeroed and spanned immediately prior to the end of each phase of the test.

8.1.12. Analyze the enclosure atmosphere for hydrocarbons and for alcohol following each phase. This is the sample hydrocarbon concentration, herein denoted as $C_{HCs(n)}$ for each phase of the test and the sample alcohol concentration, herein denoted as $C_{CH3OHs\ (n)}$ for each phase of the test. The sample hydrocarbon and alcohol concentration for a particular phase of the test shall serve as the background concentration for the next phase of the test. The running loss test ends with completion of the final 120 second idle and occurs 72 ± 2 minutes after the test begins. The elapsed time of this analysis shall be recorded.

8.1.13. Turn off the vehicle cooling fan and the vehicle underbody fan if used. The test vehicle windows and luggage compartment shall be opened. This is a preparatory step for the hot soak evaporative emission test.

8.1.14. The technician may now leave the enclosure through one of the enclosure doors. The enclosure door shall be open no longer than necessary for the technician to leave.

8.2. If running loss testing is conducted using a cell which incorporates point source sampling equipment, the manufacturer shall perform the following steps for each test:

8.2.1. The running loss test shall be conducted in a test cell meeting the specifications of 40 CFR §86.107-90 (a)(1) as modified by section III.A.2. of these procedures. Ambient temperature in the running loss test cell shall be maintained at 105 ± 5^{o}F maximum and within ± 2^{o}F on average throughout the running loss test sequence. The ambient test cell temperature shall be measured in the vicinity of the vehicle cooling fan, and it shall be monitored at a frequency of at least once every 15 seconds. The vehicle running loss collection system and underbody cooling apparatus (if applicable) shall be positioned and connected. The vehicle shall be allowed to re-stabilize until the liquid fuel tank temperature is within ± 3.0^{o}F of the initial liquid fuel temperature calculated according to section III.C.1.5. (40 CFR §86.129-80) before the running loss test may proceed.

8.2.2. The vehicle cooling fan shall be positioned as described in 40 CFR §86.135-90(b). During the running loss test, the cover of the vehicle engine compartment shall be closed as much as possible, windows shall be closed, and air conditioning system (if so equipped) shall be operated according to the requirements of section III.C.1.3. (40 CFR §86.129-80). Vehicle coolant temperature shall be monitored to ensure adequate vehicle coolant air to the radiator intake(s).

8.2.3. The vehicle shall be operated on the dynamometer over one UDDS, two NYCCs, and one UDDS. Each UDDS and NYCC driving trace shall be verified to meet the speed tolerance requirements of 40 CFR §86.115-78 (b) as modified by section III.C. Idle periods of 120 seconds shall be added to the end of each of the UDDS and to the end of the two NYCCs. The transmission may be operated according to the specifications of 40 CFR §86.128-79 as modified by section III.C.1.3. Engine starting and restarting shall be conducted according to section III.D.8.1.9.

8.2.4. The fuel tank liquid temperature during the dynamometer drive shall be controlled within ± 3^{o}F of the fuel tank liquid temperature profile obtained on the road according to the procedures in section III.C. (40 CFR §86.129-80) for the same vehicle platform/powertrain/fuel tank configuration. If applicable, the fuel tank vapor temperature throughout the running loss test shall agree with the corresponding vapor temperature with a tolerance of ± 5^{o}F. A running loss test with a fuel tank vapor temperature that exceeded the corresponding vapor temperature profile by more than the ± 5^{o}F tolerance may be considered valid if test results comply with the applicable running loss evaporative emission standards. In addition, the fuel tank vapor temperature during the final 120 second idle period shall agree with the corresponding vapor temperature from the on-road profile within ± 3^{o}F. For testing conducted by the Executive Officer, vapor temperatures may be cooler than the specified tolerances without invalidating test results. The fuel tank temperatures shall be monitored at a frequency of at least once every 15 seconds.

8.2.5. Tank pressure shall not exceed 10 inches of water during the running loss test unless a pressurized system is used and the manufacturer demonstrates in a separate test that vapor would not be vented to the atmosphere if the fuel fill pipe cap was removed at the end of the test. For 2012 and subsequent model-year off-vehicle charge capable hybrid electric vehicles that are equipped with non-integrated refueling canister-only systems, a manufacturer shall demonstrate in either a separate test or an engineering evaluation, that vapor would not be vented to the atmosphere if the fuel fill pipe cap was removed at the end of the test. Transitory incidents of the pressure exceeding 10 inches of water, not greater than 10 percent of the total driving time, shall be acceptable during the running loss test if the manufacturer can demonstrate that the tank pressure does not exceed 10 inches of water during in-use operation. No pressure checks of the evaporative system shall be allowed. If the manufacturer suspects faulty or malfunctioning instrumentation, a repair of the test instrumentation may be performed. Under no circumstances will any changes/repairs to the evaporative emissions control system be allowed.

8.2.6. After the test vehicle is positioned on the dynamometer, the running loss vapor collection system shall be properly positioned at the specified discrete emissions sources, which include vapor vents of the vehicle's fuel system, if not already positioned. The typical vapor vents for current fuel systems are the vents of the evaporative emission canister(s) and the tank pressure relief vent typically integrated into the fuel tank cap as depicted in Figure 1. Other designated places, if any, where fuel vapor can escape, shall also be included.

8.2.7. The running loss vapor collection system may be connected to the PDP-CVS or CFV bag collection system. Otherwise, running loss vapors shall be sampled continuously with analyzers meeting the requirements of §86.107-90(a)(2).

8.2.8. The temperature of the collection system until it enters the main dilution airstream shall be maintained between 175^{o}F to 200^{o}F throughout the test to prevent fuel vapor condensation.

8.2.9. The sample bags shall be analyzed within 20 minutes of their respective sample collection phases, as described in 40 CFR §86.137-90(b)(15).

8.2.10. After the completion of the final 120 seconds, turn off the vehicle cooling fan and the vehicle underbody fan if used.

8.3. Manufacturers may use an alternative running loss test procedure if it provides an equivalent demonstration of compliance. The use of an alternative procedure also requires the prior approval of the Executive Officer. The Executive Officer may conduct confirmatory testing or in-use compliance testing using either the running loss measurement enclosure incorporating atmospheric sampling equipment or in a test cell utilizing point source sampling equipment, as specified in section III.A.2. (40 CFR §86.107-90(a)(1)), in conjunction with the procedures as outlined in either section III.D.8.1. or III.D.8.2. of this test procedure, or using the manufacturer's approved alternative running loss test procedure for a specific evaporative family.

9. Hot Soak Test

9.1. Amend the first paragraph of 40 CFR §86.138-90 as follows: For the three-day diurnal sequence, the hot soak evaporative emission test shall be conducted immediately following the running loss test. The hot soak test shall be performed at an ambient temperature of 105^{o}F ± 10.0^{o}F for the first 5 minutes of the test. The remainder of the hot soak test shall be performed at 105^{o}F ± 5.0^{o}F and ± 2.0^{o}F on average.

9.2. Revise subparagraph (a) to read: If the hot soak test is conducted in the running loss enclosure, the final hydrocarbon and alcohol concentration for the running loss test, calculated in section III.D.11.3.1.(b), shall be the initial hydrocarbon concentration (time = 0 minutes) C_{HCe1} and the initial alcohol concentration (time=0 minutes) $C_{CH3OHe1}$ for the hot soak test. If the vehicle must be transported to a different enclosure, sections III.D.9.3. through III.D.9.7., as modified below, shall be conducted.

9.3. Revise subparagraph (d) to include: Analyze the enclosure atmosphere for hydrocarbons and alcohol and record. This is the initial (time=0 minutes) hydrocarbon concentration, C_{HCe1} and the initial (time=0 minutes) alcohol concentration, $C_{CH3OHe1}$, required in section III.D.11.3.1.(a).

9.4. Revise subparagraph (e) to read: If the hot soak test is not conducted in the running loss enclosure, the vehicle engine compartment cover shall be closed, the cooling fan shall be moved, the vehicle shall be disconnected from the dynamometer and exhaust sampling system, and then driven at minimum throttle to the vehicle entrance of the enclosure.

9.5. Revise subparagraph (i) to read: If hot soak testing is not conducted in the same enclosure as running loss testing, the hot soak enclosure doors shall be closed and sealed within two minutes of engine shutdown and within seven minutes after the end of the running loss test. If running loss and hot soak testing is conducted in the same enclosure, the hot soak test shall commence immediately after the completion of the running loss test.

9.6. Revise subparagraph (j) to read: The 60 ± 0.5 minutes hot soak begins when the enclosure door(s) are sealed or when the running loss test ends if the hot soak test is conducted in the running loss enclosure.

9.7. For the supplemental two-day diurnal test sequence, the hot soak test shall be conducted immediately following the hot start exhaust test. The hot soak test shall be performed at an ambient temperature between 68 to 86^{o}F at all times.

9.8. The hot soak test shall be conducted according to 40 CFR §86.138-90, as revised by sections III.D.9.2. through III.D.9.7.

10. Diurnal Breathing Loss Test

10.1. A three-day diurnal test shall be performed in a variable temperature enclosure, described in section III.A.1. of this test procedure. The test consists of three 24-hour cycles. For purposes of this diurnal breathing loss test, all references to methanol shall be applicable to alcohol<u>, unless specific instructions for ethanol are noted</u>.

10.2. If testing indicates that a vehicle design may result in fuel temperature responses during enclosure testing that are not representative of in-use summertime conditions, the Executive Officer may adjust air circulation and temperature during the test as needed to ensure that the test sufficiently duplicates the vehicle's in-use experience.

10.3. Revise 40 CFR §86.133-90 to read as follows:

10.3.1. Revise subparagraph (a)(1) to read: Upon completion of the hot soak test, the test vehicle shall be soaked for not less than 6 hours and not more than 36 hours. For at least the last 6 hours of this period, the vehicle shall be soaked at 65^{o}F ± 3^{o}F. The diurnal breathing loss test shall consist of three 24-hour test cycles.

10.3.2. Omit subparagraph (f).

10.3.3. Omit subparagraph (i).

10.3.4. Revise subparagraph (j) to read: Prior to initiating the emission sampling:

10.3.5. Revise subparagraph (k) to read: Emission sampling shall begin within 10 minutes of closing and sealing the doors, as follows:

10.3.6. Revise subparagraph (k)(3) to read: Start diurnal heat build and record time. This commences the 24 hour ± 2 minute test cycle.

10.3.7. Revise subparagraph (l) to read: For each 24-hour cycle of the diurnal breathing loss test, the ambient temperature in the enclosure shall be changed in real time as specified in the following table:

Hour	0	1	2	3	4	5	6	7	8	9	10	11	12
(^oF)	65.0	66.6	72.6	80.3	86.1	90.6	94.6	98.1	101.2	103.4	104.9	105.0	104.2
Hour	13	14	15	16	17	18	19	20	21	22	23	24	--
(^oF)	101.1	95.3	88.8	84.4	80.8	77.8	75.3	72.0	70.0	68.2	66.5	65.0	--

10.3.8. Omit subparagraph (m).

10.3.9. Revise subparagraph (n) to read: The end of the first 24-hour cycle of the diurnal test occurs 24 hours ± 2 minutes after the heat build begins. Analyze the enclosure atmosphere for hydrocarbons and alcohol and record. This is the final hydrocarbon concentration, C_{HCe2}, and the final alcohol concentration, $C_{CH3OHe2}$, in section III.D.11.3.1.(c) which modifies 40 CFR §86.143-90, for this test cycle. The time (or elapsed time) of this analysis shall be recorded. The procedure, commencing with subparagraph (k)(1) shall be repeated until three consecutive 24-hour tests are completed. The data from the test cycle yielding the highest diurnal hydrocarbon mass shall be used in evaporative emissions calculations as required by section III.D.11.3.1.(c). which modifies 40 CFR §86.143-90.

10.3.10. Revise subparagraph (q) to read: Upon completion of the final 24-hour test cycle, and after the final alcohol sample has been collected, the enclosure doors shall be unsealed and opened.

10.3.11. Omit subparagraph (r).

10.3.12. Add subparagraph (t) to read: For hybrid electric vehicles the manufacturer shall specify the working capacity of the evaporative emission control canister, and shall specify the number of 24-hour diurnals that can elapse before the auxiliary power unit will activate solely for the purposes of purging the canister of hydrocarbon vapor.

10.3.13. Add subparagraph (u) to read: In order to determine that the working capacity of the canister is sufficient to store the hydrocarbon vapor generated over the manufacturer specified number of days between auxiliary power unit activation events for the purposes of purging the evaporative canister, the evaporative canister shall be weighed after completion of the three-day diurnal period. The weight of the vapor contained in the canister shall not exceed the working capacity of the canister multiplied by three days and divided by the manufacturer specified number of days between auxiliary power unit activation events.

10.3.14. Add subparagraph (v) to read: The manufacturer shall specify the time interval of auxiliary power unit operation necessary to purge the evaporative emission control canister, and shall submit an engineering analysis to demonstrate that the canister will be purged to within five percent of its working capacity over the time interval. For 2012 and subsequent model-year off-vehicle charge capable hybrid electric vehicles that are equipped with non-integrated refueling canister-only systems, a manufacturer may satisfy this requirement under the optional provision specified in section II.A.5.4.2.

10.15. The two-day diurnal test shall be performed in an enclosure, described in section III.A.1. of this test procedure. The test consists of two 24-hour diurnals. The test procedure shall be conducted according to 40 CFR §86.133-90, revised by sections III.D.10.3.1. through III.D.10.3.14., except that only two consecutive 24-hour diurnals shall be performed. For the purposes of this diurnal breathing loss test, all references to methanol shall be applicable to alcohol, unless specific instructions for ethanol are noted.

11. Calculations: Evaporative Emissions

11.0. Revise 40 CFR §86.143-90 as follows:

11.1. Revise subparagraph (a) to read: The calculation of the net hydrocarbon plus ethanol (or methanol) mass change in the enclosure is used to determine the diurnal, hot soak, and running loss mass emissions. If the emissions also include alcohol components other than methanol and ethanol ~~and other alcohol components~~, the manufacturer shall determine an appropriate calculation(s) which reflect characteristics of the alcohol component similar to the equations below, subject to the Executive Officer approval. The mass changes are calculated from initial and final hydrocarbon and ~~m~~ethanol concentrations in ppm carbon, initial and final enclosure ambient temperatures, initial and final barometric pressures, and net enclosure volume using the ~~following~~ equations of this section III.D.11. Diurnal, hot soak, and running loss mass emissions for methanol-fueled vehicles shall be conducted according to 40 CFR §86.143-96, as amended August 23, 1995.

11.2. Revise subparagraph (a)(1) to read:

~~Methanol calculations shall be conducted according to 40 CFR §86.143-96(b)(1)(i), as amended March 24, 1993.~~

For ethanol in an enclosure:

$$M_{C2H5OH} = (V_n - 50) \times \left[\frac{\left(C_{S1f} \times AV_{1f}\right) + \left(C_{S2f} \times AV_{2f}\right)}{V_{Ef}}\right] - \left[\frac{\left(C_{S1i} \times AV_{1i}\right) + \left(C_{S2i} \times AV_{2i}\right)}{V_{Ei}}\right] + \left(M_{C2H5OHout} - M_{C2H5OHin}\right)$$

where: M_{C2H5OH} is the ethanol mass emissions (μg)

V_n is the enclosure nominal volume. (ft^3)

C_S is the GC concentration of sample (μg/ml)

AV is the volume of absorbing reagent in impinger (ml)

V_E is the volume of sample withdrawn (ft^3). Sample volumes must be corrected for differences in temperature to be consistent with determination of V_n, prior to being used in the equation.

i = initial sample

f = final sample

1 is the first impinger

2 is the second impinger

$M_{C2H5OH, out}$ is the mass of ethanol exiting the enclosure from the beginning of the cycle to the end of the cycle; this only applies to diurnal testing in fixed-volume enclosures (μg); For variable-volume enclosures, $M_{C2H5OH, out}$ is zero

$M_{C2H5OH, in}$ is the mass of ethanol entering the enclosure from the beginning of the cycle to the end of the cycle; this only applies to diurnal testing in fixed-volume enclosures (µg); For variable-volume enclosures, $M_{C2H5OH, in}$ is zero

The enclosure ethanol mass (M_{C2H5OH}) determined from the equation above goes into the equations of subsequent sections to calculate the total mass emissions, where $M_{C2H5OHhs}$ is the ethanol mass emissions from the hot soak test, $M_{C2H5OHdi}$ is the ethanol mass emissions from the diurnal test, and $M_{C2H5OHrl(n)}$ is the ethanol mass emissions from the running loss test for phase n of the test. For diurnal testing, this calculation shall be made for each 24-hour diurnal period.

11.3. Revise subparagraph (a)(2) to read:

11.3.1. For hydrocarbons in an enclosure:

(a) ~~Hot soak HC mass.~~Hot soak and diurnal testing in an enclosure: For fixed volume enclosures, the ~~hot soak~~ enclosure hydrocarbon mass is determined as:

$$M_{HC\cancel{hs}} = [2.97x\ (V_n - 50)\ x10^{-4}\ x\ \{P_f\ (C_{HCe2} - rC_{C\underline{2}H\underline{5}\cancel{3}OHe2})/T_f - P_i\ (C_{HCe1} - rC_{C\underline{2}H\underline{5}\cancel{3}OHe1})/T_i\}] + M_{HC,\ out} - M_{HC,\ in}$$

where: $M_{HC\cancel{hs}}$ is the ~~hot soak~~ HC mass emissions (grams)

V_n is the enclosure nominal volume ~~if the running loss enclosure is used or the enclosure volume at 105°F if the diurnal enclosure is used~~. (ft^3)

P_i is the initial barometric pressure (inches Hg)

P_f is the final barometric pressure (inches Hg)

C_{HCe2} is the final enclosure hydrocarbon concentration including FID response to ~~m~~ethanol in the sample (ppm C)

C_{HCe1} is the initial enclosure hydrocarbon concentration including FID response to ~~m~~ethanol in the sample (ppm C)

$C_{C\underline{2}H\underline{5}\cancel{3}OHe2}$ is the final ~~m~~ethanol concentration ~~calculated according to §86.143-90 (a)(2)(iii)~~ (ppm C equivalent)

$$= \frac{2.088 \times 10^{-3} \times T_f}{P_f \times V_E} \times \left[\left(C_{S1f} \times AV_{1f}\right) + \left(C_{S2f} \times AV_{2f}\right)\right]$$

$C_{C2H5\cancel{3}OHe1}$ is the initial ~~m~~ethanol concentration ~~calculated according to §86.143-90(a)(2)(iii)~~ (ppm C equivalent)

$$= \frac{2.088 \times 10^{-3} \times T_i}{P_i \times V_E} \times \left[\left(C_{S1i} \times AV_{1i}\right) + \left(C_{S2i} \times AV_{2i}\right)\right]$$

r is the FID response factor to ~~m~~ethanol

T_i is the initial enclosure temperature (^oR)

T_f is the final enclosure temperature (^oR)

V_E is the volume of sample withdrawn (ft^3). Sample volumes must be corrected for differences in temperature to be consistent with determination of V_n, prior to being used in the equation.

C_S is the GC concentration of sample (µg/ml)

AV is the Volume of absorbing reagent in impinger (ml)

1 is the first impinger

2 is the second impinger

i = initial sample

f = final sample

$M_{HC,\,out}$ is the mass of hydrocarbon exiting the enclosure from the beginning of the cycle to the end of the cycle; this only applies to diurnal testing in fixed-volume enclosures (grams)

$M_{HC,\,in}$ is the mass of hydrocarbon entering the enclosure from the beginning of the cycle to the end of the cycle; this only applies to diurnal testing in fixed-volume enclosures (grams)

For vehicles tested in an enclosure with the gasoline set forth in part II, section A.100.3.1.2. of the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles" only, measured ethanol values can be omitted so long as the resultant M_{HC} is multiplied by 1.08. If this option is used, then all terms accounting for ethanol in the applicable equations of this section III.D.11 (including ethanol concentration values of the above equation) shall equal zero.

The enclosure HC mass (M_{HC}) determined from the equation above goes into the equations of subsequent sections to calculate the total mass emissions, where M_{HChs} is the HC mass emissions from the hot soak test, M_{HCdi} is the HC mass emissions from the diurnal test, and $M_{HCrl(n)}$ is the HC mass emissions from the running loss test for phase n of the test if the enclosure method is used for running loss testing. For diurnal testing, this calculation shall be made for each 24-hour diurnal period.

For variable volume enclosures, calculate the ~~hot soak~~ enclosure HC mass ($M_{HC\cancel{hs}}$) according to the equation used above except that P_f and T_f shall equal P_i and T_i and $M_{HC, out}$ and $M_{HC, in}$ shall equal zero.

(b) Running loss ~~HC~~ mass. The running loss HC mass per distance traveled is defined as:

$$M_{HCrlt} = (M_{HCrl(1)} + M_{HCrl(2)} + M_{HCrl\cancel{1}(3)})/(D_{rl(1)} + D_{rl(2)} + D_{rl(3)})$$

where: M_{HCrlt} is the total running loss HC mass per distance traveled (grams HC per mile)

$M_{HCrl(n)}$ is the running loss HC mass for phase n of the test (grams HC)

$D_{rl(n)}$ is the actual distance traveled over the driving cycle for phase n of the test (miles)

The running loss ethanol mass per distance traveled is defined as:

$$M_{C2H5OHrlt} = (M_{C2H5OHrl(1)} + M_{C2H5OHrl(2)} + M_{C2H5OHrl(3)})/(D_{rl(1)} + D_{rl(2)} + D_{rl(3)})$$

where: $M_{C2H5OHrlt}$ is the total running loss ethanol mass per distance traveled (grams ethanol per mile)

$\underline{M_{C2H5OHrl(n)}}$ <u>is the running loss ethanol mass for phase n of the test (grams ethanol)</u>

For the point-source method:

Hydrocarbon emissions:

$$M_{HCrl(n)} = (C_{HCs(n)} - C_{HCa(n)}) \times 16.88 \times V_{mix} \times 10^{-6}$$

where: $C_{HCs(n)}$ is the sample bag HC concentration for phase n of the test (ppm C)

$C_{HCa(n)}$ is the background bag concentration for phase n of
the test (ppm C)

16.88 is the density of pure vapor at $68^{o}F$ (grams/ft^3)

V_{mix} is the total dilute CVS volume (std. ft^3)

and: V_{mix} is calculated per 40 CFR §86.144-90

~~Me~~<u>E</u>thanol emissions:

$$M_{C\underline{2}H\underline{5}\cancel{3}OHrl(n)} = (C_{C\underline{2}H\underline{5}\cancel{3}OHs(n)} - C_{C\underline{2}H\underline{5}\cancel{3}OHa(n)}) \times \cancel{37.74}\underline{54.25} \times V_{mix}$$

where: $C_{C\underline{2}H\underline{5}\cancel{3}OHs(n)}$ is the sample bag ~~m~~ethanol concentration for phase n of the test (ppm C equivalent)

$C_{C\underline{2}H\underline{5}\cancel{3}OHa(n)}$ is the background bag concentration for phase n of the test (ppm C equivalent)

~~37.71~~<u>54.25</u> is the density of pure vapor at $68^{o}F$ (grams/ft^3)

V_{mix} is the total dilute CVS volume (std. ft^3)

and: V_{mix} is calculated per 40 CFR §86.144-90

<u>For vehicles tested for running loss using the point source method with the gasoline set forth in part II, section A.100.3.1.2. of the “California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and</u>

Medium-Duty Vehicles" only, measured ethanol values can be omitted so long as the resultant $M_{HCrl(n)}$ is multiplied by 1.08. If this option is used, then all terms accounting for ethanol in the applicable equations of this section III.D.11 shall equal zero and both $C_{HCs(n)}$ and $C_{HCa(n)}$ in the above equation shall include the FID response to ethanol (the FID response to ethanol shall not be subtracted).

For the enclosure method:

$M_{HCrl(n)}$ is the running loss HC mass for phase n of the test (grams HC) and shall be determined by the ~~same~~ method ~~as the hot soak hydrocarbon mass emissions determination~~ specified in section III.D.11.3.1.(a).

~~(c) Diurnal mass. For fixed volume enclosures, the HC mass for each of the three diurnals is defined for an enclosure as:~~

~~$M_{HCd} = [2.97x(V - 50)x10^{-4}x\{P_f\ (C_{HCe2} - rC_{CH3OHe2})/T_f - P_i\ (C_{HCe1} - rC_{CH3OHe1})/T_i\ \}] + M_{HC,\ out} - M_{HC,\ in}$~~

~~where:~~ ~~M_{HCd} is the diurnal HC mass emissions (grams)~~

~~V is the enclosure volume at 65° F (ft^3)~~

~~P_i is the initial barometric pressure (inches Hg)~~

~~P_f is the final barometric pressure (inches Hg)~~

~~C_{HCe2} is the final enclosure hydrocarbon concentration including FID response to methanol in the sample (ppm C)~~

~~C_{HCe1} is the initial enclosure hydrocarbon concentration including FID response to methanol in the sample (ppm C)~~

~~$C_{CH3OHe2}$ is the final methanol concentration calculated according to 40 CFR §86.143-90 (a)(2)(iii)~~

~~$C_{CH3OHe1}$ is the initial methanol concentration calculated according to 40 CFR §86.143-90 (a)(2)(iii)~~

~~r is the FID response factor to methanol~~

~~T_i is the initial enclosure temperature ($^{\circ}$R)~~

~~T_f is the final enclosure temperature (°R)~~

~~$M_{HC,\ out}$ is the mass of hydrocarbon exiting the enclosure from the beginning of the cycle to the end of the cycle (grams)~~

~~$M_{HC,\ in}$ is the mass of hydrocarbon entering the enclosure from the beginning of the cycle to the end of the cycle (grams)~~

~~For variable volume enclosures, calculate the HC mass for each of the three diurnals (M_{HCd}) according to the equation used above except that P_f and T_f shall equal P_i and T_i and $M_{HC,\ out}$ and $M_{HC,\ in}$ shall equal zero.~~

11.3.2. Revise subparagraph (a)(3) to read:

The total mass emissions shall be adjusted as follows:

(1) $M_{hs} = M_{HChs} + (\cancel{14.2284/32.042}\underline{28.44/46.07}) \times 10^{-6}\ M_{C\underline{2}H\underline{5}\cancel{3}OH}$

(2) $M_{di} = M_{HCd} + (\cancel{14.3594/32.042}\underline{28.66/46.07}) \times 10^{-6} M_{C\underline{2}H\underline{5}\cancel{3}OH}$

(3) $M_{rl} = M_{HCrlt} + (\cancel{14.2284/32.042}\underline{28.44/46.07}) \times 10^{-6}\ M_{C\underline{2}H\underline{5}\cancel{3}OH}$

11.3.3. Revise subparagraph (b) to read: The final evaporative emission test results reported shall be computed by summing the adjusted evaporative emission result determined for the hot soak test (M_{hs}) and the highest 24-hour result determined for the diurnal breathing loss test (M_{di}). The final reported result for the running loss test shall be the adjusted emission result (M_{r1}), expressed on a grams per mile basis.

12. Bleed Emission Test Procedure (BETP)

12.1. Carbon Canister System Stabilization. The carbon canister system shall be stabilized to a 4,000-mile test condition using one of the following methods:

12.1.1. Stabilization on a vehicle. The canister system shall be installed on a representative vehicle, and the vehicle shall be driven for 4,000 miles using the gasoline set forth in part II., section A.100.3.1.2. of the “California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles.” The last part of this drive shall consist of an Urban Dynamometer Driving Schedule (UDDS), specified in appendix I of 40 CFR §86.

12.1.2. Carbon Canister System Purge/Load Cycling with Fuel Vapor. The carbon canister system shall be cycle aged no less than 10 cycles using the gasoline referenced in section III.D.12.1.1 by loading the canister system to 2-gram breakthrough with either a mixture of fuel vapor and nitrogen (50 ± 15 percent fuel vapor by volume) or a mixture of fuel vapor and air (50 ± 15 percent fuel vapor by volume), at a fuel vapor fill rate of 40 to 80 grams per hour. Each loading is followed by purging the canister system with 300 canister bed volume exchanges at 0.8 cfm.

12.1.3. Alternative Carbon Canister System Purge/Load Cycling with Fuel Vapor. The carbon canister system shall be aged no less than 10 cycles using the gasoline referenced in section III.D.12.1.1 by loading and purging the carbon canister system with a method approved in advance by the Executive Officer. The alternative method shall be demonstrated to yield test results equivalent to or more stringent than, those resulting from the use of the method set forth in section III.D.12.1.1 or III.D.12.1.2.

12.2. Fuel Tank Drain/Fill and Soak. A fuel tank that represents the worst case as determined by engineering evaluation shall be drained and filled to 40 percent with the gasoline referenced in section III.D.12.1.1. The tank shall be soaked for a minimum of 6 hours to a maximum of 72 hours at 65 ± 3°F. The canister system load (section III.D.12.3) and soak (section III.D.12.4) can be performed in series or in parallel with the 6 to 72 hour fuel tank soak.

12.3. Carbon Canister System Loading. The canister system shall be loaded according to the canister loading procedure in the supplemental two-day diurnal sequence, as specified in sections III.D.3.3.5. through III.D.3.3.5.1.2. This procedure requires loading the canister with a 50/50 mixture by volume of butane and nitrogen at a rate of 40 grams butane per hour to a 2-gram breakthrough.

12.4. Carbon Canister System Soak. The canister system shall then be soaked for a minimum of 1 hour.

12.5. Carbon Canister System Purge. The carbon canister system shall be purged using one of the following methods:

12.5.1. The canister system shall be attached to a vehicle and driven on the drive cycle of the supplemental two-day diurnal sequence, as specified in section III.D.6., to purge the canister system.

12.5.2. Alternatively, the canister system may be purged at a rate and volume in a laboratory simulation, based on an engineering evaluation, to represent the net mass of hydrocarbons desorbed from the canister system during the drive cycle of the supplemental two-day diurnal sequence, as specified in section III.D.6.

12.6. Connection of Carbon Canister System and Fuel Tank. The canister system load port shall be connected to the fuel tank vent port of the otherwise sealed fuel tank and soaked for a minimum of 12 hours and a maximum of 36 hours at 65 ± 3°F. The canister system purge (engine) port shall be plugged for the remainder of the bleed emissions test.

12.7. Two-Day Diurnal Temperature Cycling. The fuel tank and canister system shall be cycled between 65°F and 105°F according to the two-day diurnal test in section III.D.10.15.

12.7.1. If using Method A (section III.D.12.8.1.) for the hydrocarbon capture method, temperature cycling and hydrocarbon capture shall occur in an environmental chamber. This chamber shall provide air circulation over the fuel tank as described in section III.A.1.1. Also, chamber temperature shall be measured and controlled as described in section III.A.1.1.1, except the wall thermocouples shall be approximately level with the fuel tank, and the fuel tank thermocouple shall measure the air within 10 inches of the exposed portion of the fuel tank. In addition, the chamber shall be insulated to enable the test temperature profile to be achieved with a heating/cooling system which has surface temperatures in the enclosure no less than 25.0°F below the minimum diurnal temperature specification.

12.7.2. If using Method B (section III.D.12.8.2.) for the hydrocarbon capture method, temperature cycling and hydrocarbon capture shall occur in a diurnal evaporative emission measurement enclosure. An enclosure as described in section III.A.1. shall be used, except that thermocouples shall be arranged per section III.D.12.7.1. and the enclosure shall be of sufficient size to contain the fuel tank and canister system.

12.7.3. If using Method C (section III.D.12.8.3.) for the hydrocarbon capture method, temperature cycling and hydrocarbon capture shall occur either in an environmental chamber as described in section III.D.12.7.1 or in a diurnal evaporative emission measurement enclosure as described in section III.D.12.7.2.

12.8. Hydrocarbon Capture Methods. Either Method A, Method B, or Method C shall be used to capture the hydrocarbon emissions from the carbon canister.

12.8.1. Method A. A Tedlar or equivalent bag of sufficient size to be able to capture the volume of air coming from the canister system during the diurnal shall be attached to the air tube of the test canister system. The bag shall be such a size as to not cause back pressure in the canister and impede vapor flow from the canister. This bag shall stay attached until the fuel reaches peak temperature (approximately 12 hours into the diurnal cycle). Each sample bag shall be analyzed as described in section III.D.12.9.1. within 20 minutes of the sample collection. During the cooling back to the minimum temperature, the air tube can be left open or connected to a new Tedlar or equivalent bag with a sufficient amount of zero air in it to allow air to pass back and forth through the canister system and bag, while not allowing pressure/vacuum to occur in the canister. If air tube is left open, a new Tedlar or equivalent bag shall be attached to the air tube at minimum fuel temperature (approximately 24 hours into the diurnal cycle). This step shall be repeated for each 24-hour diurnal period.

12.8.2. Method B. The outlet of the test canister system shall be open to the diurnal evaporative emission measurement enclosure, as described in section III.A.1., to measure hydrocarbon~~s~~ emissions. The pressure inside the enclosure shall not impede or assist flow through the canister system. This enclosure shall to be sized appropriately to achieve a minimum resolution of ± 5 mg at a total hydrocarbon concentration of 10 mg/total enclosure volume.

12.8.3. Method C. The canister emissions shall be continuously analyzed using a FID and integrated with continuous flow measurements to provide the mass of hydrocarbon emissions from the canister for each 24-hour diurnal period. Method C may be used subject to advance approval by the Executive Officer. Approval would require proof that all canister emissions are routed to the FID and that pressure inside the enclosure does not impede or assist flow through the canister system.

12.9. Hydrocarbon Mass Determination. There is no requirement to separately measure for alcohol emissions in this bleed emission test.

12.9.1. If using Method A (section III.D.12.8.1.) for the hydrocarbon capture method, the FID hydrocarbon analyzer shall be zeroed and spanned coinciding with each sample per 40 CFR §86.140. The removed bags shall be filled to a constant volume with Zero Air and evacuated into a FID through a sample pump to determine the concentration of hydrocarbons. The hydrocarbon mass for each 24-hour period shall then be calculated using the following equation:

$$M_{HC} = 16.88 \times \mathrm{V_{BAG}} \times \mathrm{C_{HC}} \times 10^{-6}$$

where:

M_{HC} is the diurnal hydrocarbon mass emissions (grams)

16.88 is the density of pure vapor at @ 68^{o} F (grams/ft^3)

$\mathrm{V_{BAG}}$ is the total volume of sample gas in the sample bag (std. ft^3)

$\mathrm{C_{HC}}$ is the sample bag hydrocarbon concentration (ppm C)

12.9.2. If using Method B (section III.D.12.8.2.) for the hydrocarbon capture method, the FID hydrocarbon analyzer shall be zeroed and spanned coinciding with each sample per 40 CFR §86.140. The hydrocarbon emissions will be monitored by taking a minimum of 5 measurements, at hours 0, 12, 24, 36, and 48 of the two-day diurnal cycles. The mass of hydrocarbon emissions for each 24-hour period shall be determined and is equal to the maximum hydrocarbon mass value for each 24-hour period. This maximum hydrocarbon mass value is obtained by calculating and comparing the hydrocarbon mass values at each of the measurement time-points for each 24-hour period. The hydrocarbon mass value is defined as:

$$\underline{M_{HC} = [2.97 \times 10^{-4} \times \{(P_x \times V_x \times C_{HC_x}) / T_x - (P_i \times V_i \times C_{HC_i}) / T_i\}]}$$

$$\underline{+ M_{HC_{OUT}} - M_{HC_{IN}}}$$

where, for fixed volume enclosures:

M_{HC} is the diurnal hydrocarbon mass emissions (grams)

P_i is the initial barometric pressure (inches Hg)

P_x is the barometric pressure during the diurnal at time of hydrocarbon measurement (inches Hg)

V_i is the initial enclosure volume (ft^3)

V_x is the enclosure volume during the diurnal at time of hydrocarbon measurement (ft^3)

C_{HC_i} is the initial enclosure hydrocarbon concentration (ppm C)

C_{HC_x} is the enclosure hydrocarbon concentration during the diurnal at time of hydrocarbon measurement (ppm C)

T_i is the initial enclosure temperature (°R)

T_x is the enclosure temperature during the diurnal at time of hydrocarbon measurement (°R)

$M_{HC_{OUT}}$ is the mass of hydrocarbon exiting enclosure from cycle start to time of hydrocarbon measurement (grams)

$M_{HC_{IN}}$ is the mass of hydrocarbon entering enclosure from cycle start to time of hydrocarbon measurement (grams)

The measurements at the end of the first 24 hour period become the initial conditions of the next 24 hour period. For variable volume enclosures, calculate the hydrocarbon mass (M_{HC}) according to the equation used above except that $M_{HC, out}$ and $M_{HC, in}$ shall equal zero.

12.10. The final reported result shall be the highest 24-hour diurnal hydrocarbon mass emissions value out of the two 24-hour cycles.

E. Liquefied Petroleum Gas-fueled Vehicles

1. For 1983 and subsequent model-year LPG-fueled motor vehicles, the introduction of 40 percent by volume of chilled fuel and the heating of the fuel tank under the diurnal part of the evaporative test procedures shall be eliminated.

2. Calculation of LPG Emissions. The evaporative emissions for LPG systems shall be calculated in accordance with 40 CFR §86.143-78 or §86.143-90 except that a H/C ratio of 2.658 shall be used for both the diurnal and hot soak emissions.

F. Fuel Specifications

1. For 2001 through 2014 model motor vehicles (except for 2014 model year vehicles certifying to the evaporative emission standards set forth in section I.E.1.(e)), the ~~Evaporative~~ evaporative emission test fuel shall be the fuel specified for exhaust emission testing ~~as specified~~ in part II. section A.100.3. of the "California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and ~~for 2001 and Subsequent~~ 2009 through 2016 Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles," except as provided in section III.G. of these test procedures.

2. All 2014 through 2019 model gasoline-fueled motor vehicles certifying to evaporative emission standards set forth in the section I.E.1.(e) (except those vehicles produced by a small volume manufacturer, as noted below, and those vehicles belonging to carry-over families allowed per section I.E.1.(e)(iii)) shall be tested for evaporative emissions on the gasoline set forth in part II., section A.100.3.1.2. of the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles." All 2014 through 2019 gasoline-fueled model motor vehicles not certifying to evaporative emission standards set forth in the section I.E.1.(e) that are not tested using this gasoline shall conduct evaporative emission testing with the test fuel specified in section III.F.1.

All 2020 and subsequent model gasoline-fueled motor vehicles (except those vehicles produced by a small volume manufacturer) shall be tested for evaporative emissions on the gasoline set forth in part II., section A.100.3.1.2. of the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles"; evaporative emission testing by the Executive Officer will be performed using said test fuel.

A small volume manufacturer shall certify all 2022 and subsequent model motor vehicles to the evaporative emission requirements using the gasoline set forth in part II., section A.100.3.1.2. of the "California 2015 and Subsequent Model Criteria Pollutant

Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles"; evaporative emission testing by the Executive Officer will be performed using said test fuel. All 2015 to 2021 model motor vehicles produced by a small volume manufacturer that are not tested using this gasoline shall conduct evaporative emission testing with the test fuel in section III.F.1.

3. For 2015 and subsequent model motor vehicles other than gasoline-fueled vehicles (except for flexible fuel vehicles certifying to evaporative emission standards set forth in the section I.E.1.(d), as noted below), the evaporative emission test fuel shall be the applicable fuel specified for evaporative emission testing in part II. section A.100.3.3 – A.100.3.6 of the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles."

For 2015 and subsequent model flexible fuel vehicles certifying to the evaporative emission standards set forth in the section I.E.1.(d), the evaporative emission test fuel shall be either the fuel specified for exhaust emission testing in part II. section A.100.3. of the "California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2009 through 2016 Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles," or the applicable fuel specified for evaporative emission testing in part II. section A.100.3.4 of the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles."

G. Alternative Test Procedures

1. For vehicles that are required to be certified using the test fuel in section III.F.1., ~~If~~ a manufacturer may alternatively demonstrate compliance with the applicable evaporative emission standards using ~~uses for evaporative and exhaust emission testing~~ a gasoline test fuel meeting the specifications set forth in 40 CFR §86.113-94(a)(1)~~,~~ if the manufacturer also ~~may~~ uses the evaporative emission test procedures set forth in 40 CFR §§86.107-96 through 86.143-96 in place of the test procedures set forth in these test procedures.

2. Manufacturers may use an alternative set of test procedures to demonstrate compliance with the standards set forth in section I.E. of these test procedures with advance Executive Officer approval if the alternative procedure is demonstrated to yield test results equivalent to, or more stringent than, those resulting from the use of the test procedures set forth in section III.D. of these test procedures.

3. If the manufacturer uses for certification a test procedure other than section III.D., the Executive Officer has the option to conduct confirmatory and in-use compliance testing with the test procedures set forth in section III.D. of this California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles.

H. Use of Comparable Federal Requirements for Carry-across Specifications and Road Profile Correction Factors

1. Upon prior written approval of the Executive Officer, a manufacturer may use the comparable federal requirements in Title 40, CFR, Part 86 in lieu of the carry-across specifications of section II.A. of these test procedures and the running loss road profile correction factors of section III.C. The Executive Officer shall approve a manufacturer's request if the manufacturer demonstrates to the Executive Officer that the alternative methodology will not adversely affect in-use evaporative emissions.

PART IV. EVAPORATIVE EMISSION TEST PROCEDURES FOR MOTORCYCLES

1. For the purposes of these procedures, the following references in 40 CFR, Part 86, Subpart B to light-duty vehicle evaporative testing shall also apply to motorcycles: 40 CFR §§86.117-78, 86.117-90, 86.121-82 and 86.121-90. In addition, 40 CFR, Part 86, Subparts E, F, and other cited sections of Subpart B are incorporated into this test procedure by reference.

2. Preconditioning shall be performed in accordance with 40 CFR §86.532-78. The provisions of §86.132-78 which prohibit abnormal loading of the evaporative emission control system during fueling and setting the dynamometer horsepower using a test vehicle shall be observed. Additional preconditioning (40 CFR §86.132-82(a)(3) and §86.132-90(a)(3)) may be allowed by the Executive Officer under unusual circumstances.

3. Instrumentation. The instrumentation necessary to perform the motorcycle evaporative emission test is described in 40 CFR §86.107-78 and §86.107-90, with the following changes:

(i) Revise subparagraph (a)(4) to read: Tank fuel heating system. The tank fuel heating system shall consist of two separate heat sources with two temperature controllers. A typical heat source is a pair of heating strips. Other sources may be used as required by circumstances and the Executive Officer may allow manufacturers to provide the heating apparatus for compliance testing. The temperature controllers may be manual, such as variable transformers, or they may be automated. Since vapor and fuel temperature are to be controlled independently, an automatic controller is recommended for the fuel. The heating system must not cause hot spots on the tank wetted surface which could cause local overheating of the fuel or vapor. Heating strips for the fuel, if used, should be located as low as practicable on the tank and should cover at least 10 percent of the wetted surface. The centerline of the fuel heating strips, if used, shall be below 30 percent of the fuel depth as measured from the bottom of the fuel tank and approximately parallel to the fuel level in the tank. The centerline of the vapor heating strips, if used, should be located at the approximate height of the center of the vapor volume. The temperature controller must be capable of controlling the fuel and vapor temperatures to the diurnal heating profile within the specified tolerance.

(ii) Revise subparagraph (a)(5) (Temperature Recording System) to read: In addition to the specifications in this section, the vapor temperature in the fuel tank shall be measured. When the fuel or vapor temperature sensors cannot be located in the fuel tank to measure the temperature of the prescribed test fuel or vapor at the approximate mid-volume, sensors shall be located at the approximate mid-volume of each fuel or vapor containing cavity. The average of the readings from these sensors shall constitute the fuel or vapor temperature. The fuel and vapor temperature sensors shall be located at least one inch away from any heated tank surface. The Executive

Officer may approve alternate sensor locations where the specifications above cannot be met or where tank symmetry provides redundant measurements.

(iii) Calibration shall be performed in accordance with 40 CFR §86.516-78 or §86.516-90.

4. Test Procedure

(i) The motorcycle exhaust emission test sequence is described in 40 CFR §86.530-78 through §86.540-78. The SHED test shall be accomplished by performing the diurnal portion of the SHED test (40 CFR §86.133-78 except subparagraphs a(1), k, and p; §86.133-90 except subparagraphs a(1), l, and s; and neglecting references to windows and luggage compartments in these sections) after preconditioning and soak but prior to the "cold" start test. The fuel will be cooled to below 30°C after the diurnal test. The "cold" and "hot" start exhaust emission tests shall then be run. The motorcycle will then be returned for the hot soak portion of the SHED test. This general sequence is shown in Figure E78-10, under 4- CFR §86.130-78. The specified time limits shall be followed with the exception of soak times which are specified in 40 CFR §86.532-78 for motorcycles.

Running loss tests, when necessary, will be performed in accordance with 40 CFR §86.134-78, except references to §§86.135-82 through 86.137-82 and §§86.135-90 through 86.137-90 shall mean §§86.535-78 through 86.537-78.

(ii) A manufacturer of Class III motorcycles with annual California sales of less than 500 units using an assigned evaporative emission control system DF pursuant to section II.B.2.1.1.(vii) shall measure and report to the Executive Officer exhaust emissions from the CVS test between the diurnal and the hot soak tests even if the test is being conducted for evaporative emissions only. The exhaust emission levels projected for the motorcycle's useful life utilizing the exhaust emission DF determined during previous federal or California certification testing shall not exceed the standards set forth in section 1958, title 13, CCR.

(iii) The fuel and vapor temperatures for the diurnal portion of the evaporative emission test shall conform to the following functions within ± 1.7°C with the tank filled to 50 percent ±2.5 of its actual capacity, and with the motorcycle resting on its center kickstand (or a similar support) in the vertical position.

$$T_f = (1/3)t + 15.5^{o}C$$

$$T_v = (1/3)t + 21.0^{o}C$$

where T_f = fuel temperature, °C
T_v = vapor temperature, °C

As Amended: March 22, 2012
Date of Hearing: January 26-27, 2012

t = time since the start of the diurnal temperature rise, minutes.

The test duration shall be 60 ± 2 minutes, giving a fuel and vapor temperature rise of 20^{o}C. The final fuel temperature shall be 35.5^{o}C ± 0.5 ^{o}C.

An initial vapor temperature up to 5^{o}C above 21^{o}C may be used. For this condition, the vapor shall not be heated at the beginning of the diurnal test. When the fuel temperature has been raised to 5.5^{o}C below the vapor temperature by following the T_f function, the remainder of the vapor heating profile shall be followed.

(iv) An alternate temperature rise for the diurnal test may be approved by the Executive Officer. If a manufacturer has information which shows that a particular fuel tank design will change the temperature rise significantly from the function above, the manufacturer may present the information to the Executive Officer for evaluation and consideration.

(v) The hot soak evaporative emission test shall be performed immediately following the "hot" start exhaust emission test. This test is described in 40 CFR §§86.138-78 and 86.138-90, except for §§86.138-78(d) and 86.138-90(e) which are revised to require that the motorcycle be pushed with the engine off rather than driven at a minimum throttle from the dynamometer to the SHED.

(vi) Calculations shall be performed in accordance with 40 CFR §86.143-78 or 86.143-90, except the standard volume for a motorcycle shall be 5ft^3 instead of 50 ft^3.

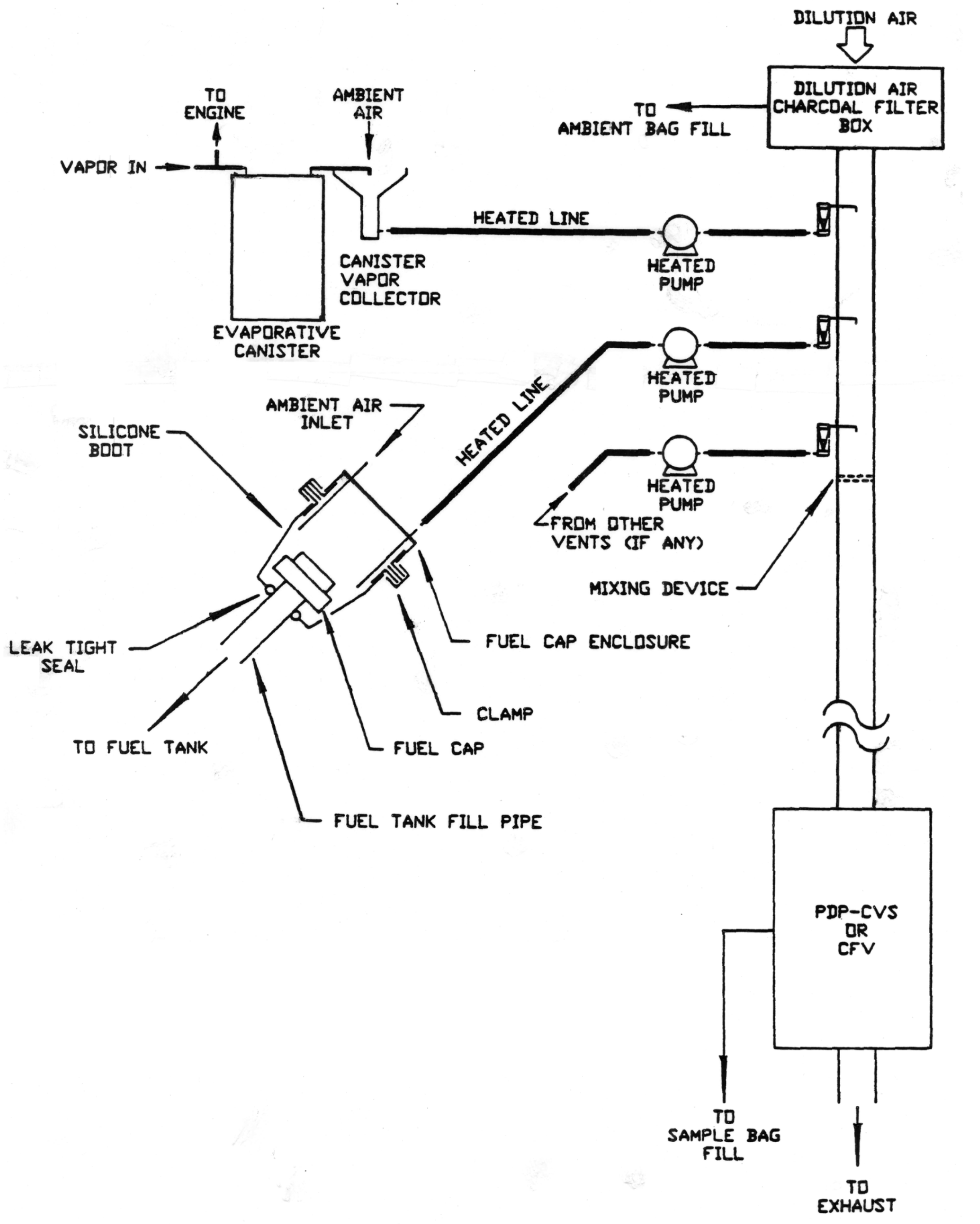


Figure 1: Running Loss Vapor Vent Collection System

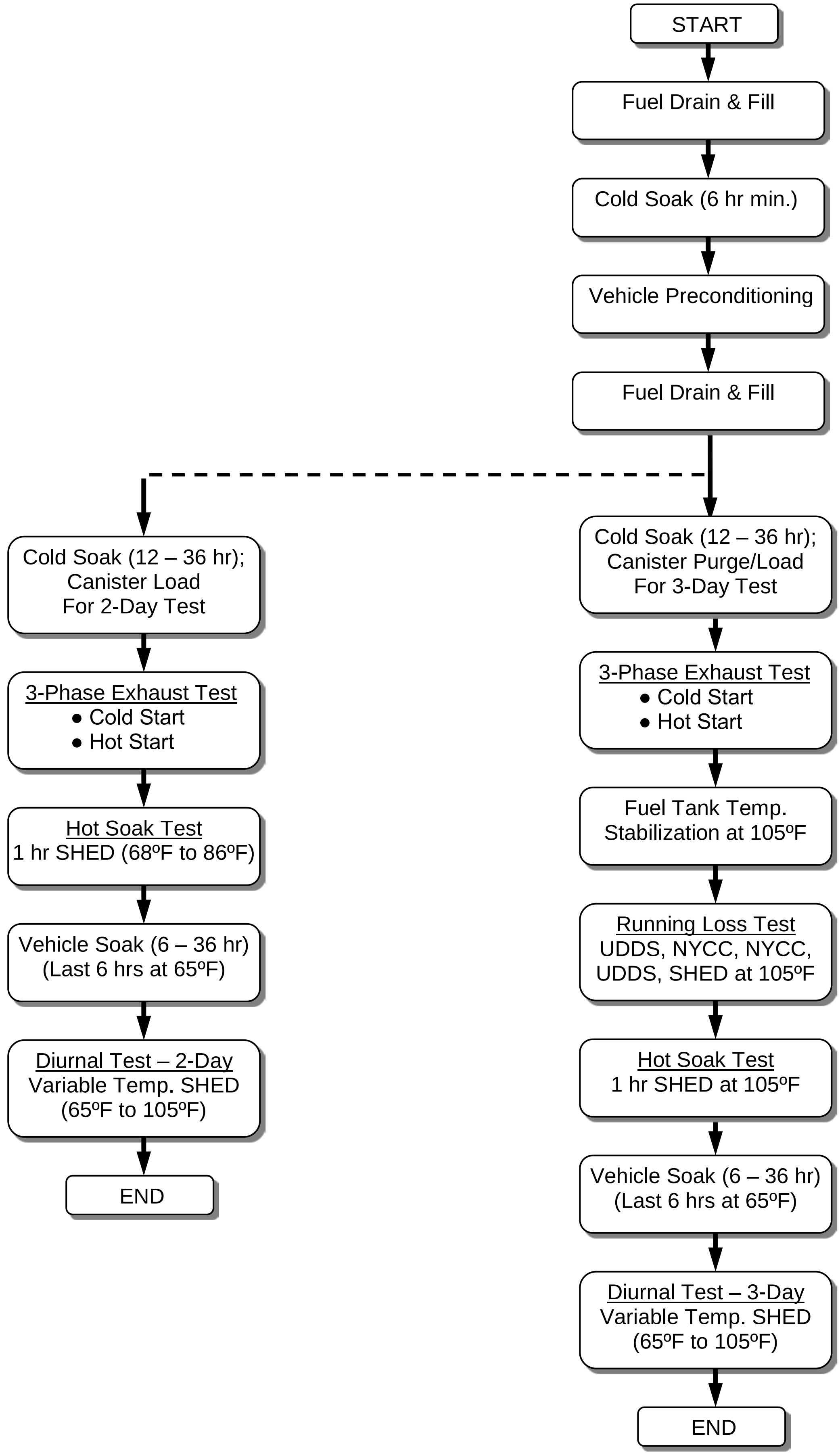


Figure 2: Test Procedure for 2001 and Subsequent Model Motor Vehicles

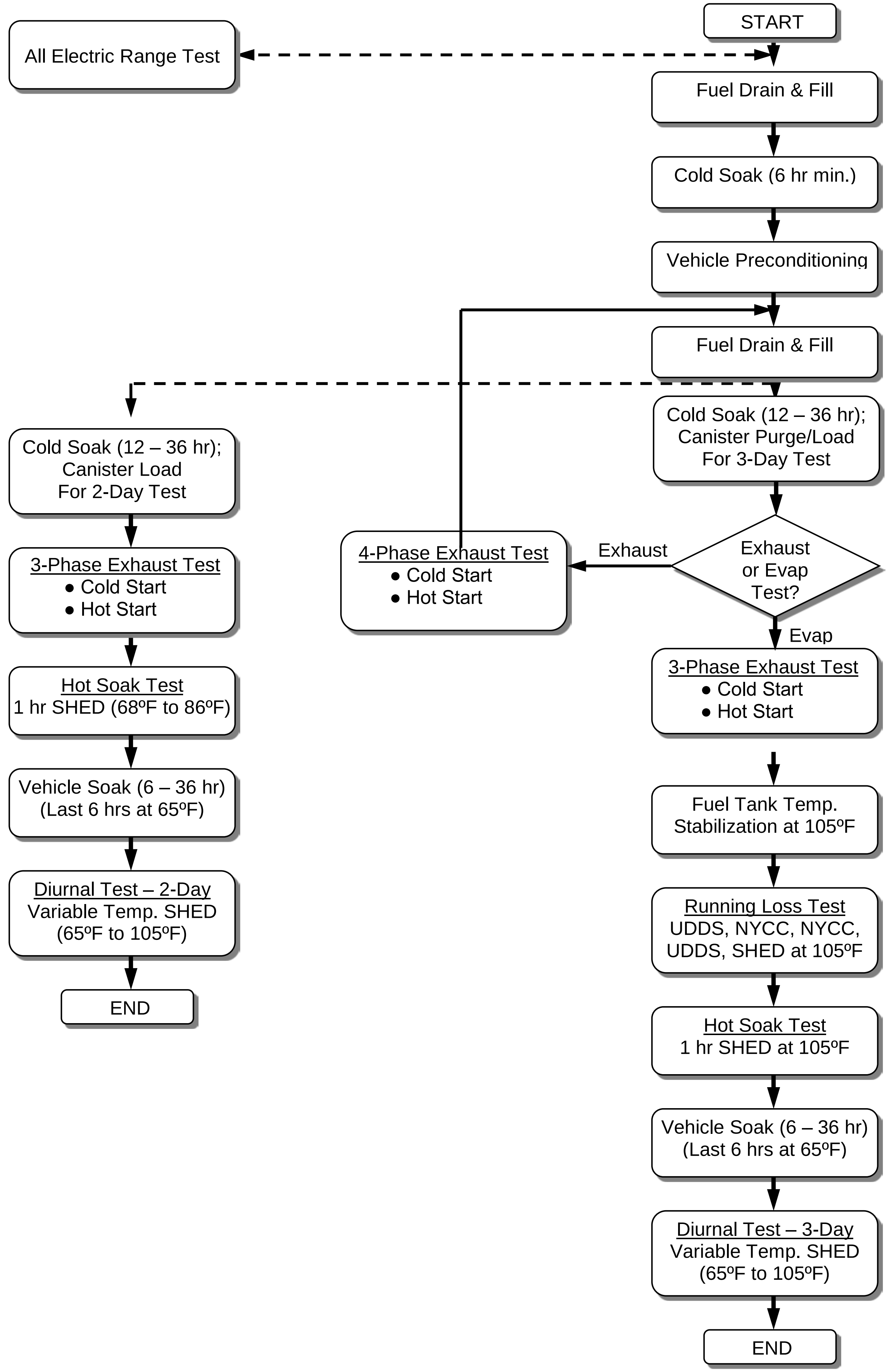


Figure 3A: Test Procedure for 2001 and Subsequent Model Hybrid Electric Vehicles

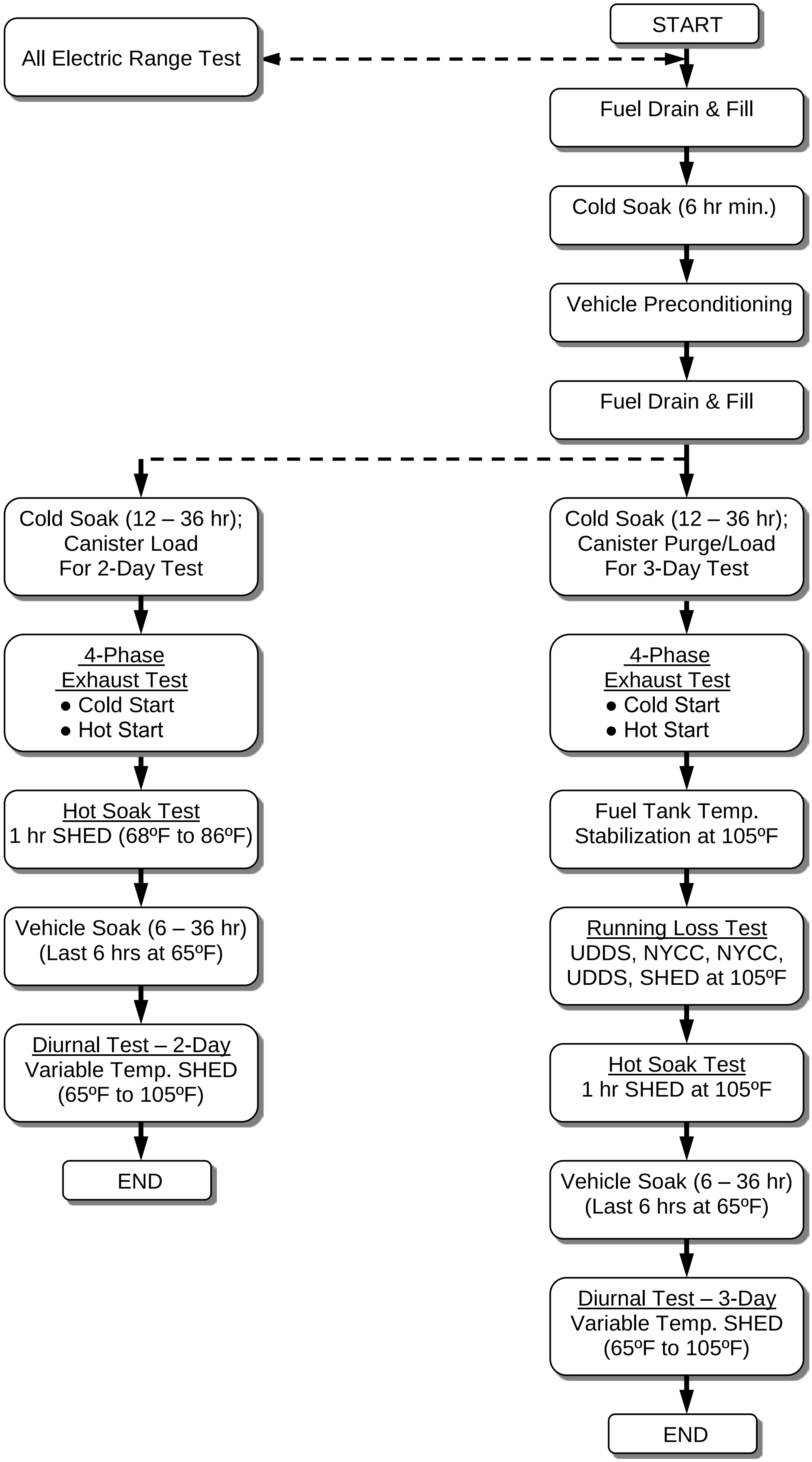


Figure 3B: Test Procedure for 2001 and Subsequent Model Hybrid Electric Vehicles

ATTACHMENT A-6

State of California
AIR RESOURCES BOARD

CALIFORNIA REFUELING EMISSION STANDARDS AND TEST PROCEDURES FOR 2001 AND SUBSEQUENT MODEL MOTOR VEHICLES

Adopted:	August 5, 1999
Amended:	September 5, 2003
Amended:	June 22, 2006
Amended:	October 17, 2007
Amended:	December 2, 2009
Amended:	September 27, 2010
Amended:	March 22, 2012

Note: Proposed amendments to this document are shown in underline to indicate additions and ~~strikeouts~~ to indicate deletions compared to the test procedures as last amended September 27, 2010.

NOTE: This document is incorporated by reference in section 1978(b), title 13, California Code of Regulations (CCR). Additional requirements necessary to complete an application for certification of motor vehicles are contained in other documents that are designed to be used in conjunction with this document. These other documents include:

1. “California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures ~~for 2001 and Subsequent~~ and 2009 through 2016 Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles” (incorporated by reference in section 1961(d), title 13, CCR).

2. “California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles” (incorporated by reference in section 1961.2 (d), title 13, CCR).

3~~2~~. “California Exhaust Emission Standards and Test Procedures for 2009 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes” (incorporated by reference in section 1962.1(h), title 13, CCR).

4~~3~~. “California Evaporative Emission Standards and Test Procedures ~~For~~for 2001 and Subsequent Model Motor Vehicles” (incorporated by reference in section 1976(c), title 13, CCR).

5~~4~~. “Malfunction and Diagnostic System Requirements – 1994 and Subsequent Model-Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines” (incorporated by reference in section 1968.1, title 13, CCR).

6~~5~~. “Malfunction and Diagnostic System Requirements – 2004 and Subsequent Model-Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines” (incorporated by reference in section 1968.2, title 13, CCR).

7~~6~~. “Specifications for Fill Pipes and Openings of Motor Vehicle Fuel Tanks” (incorporated by reference in section 2235, title 13, CCR).

CALIFORNIA REFUELING EMISSION STANDARDS AND TEST PROCEDURES FOR 2001 AND SUBSEQUENT MODEL MOTOR VEHICLES

The provisions of Title 40, Code of Federal Regulations (CFR), Part 86, Subparts B (as adopted or amended by the U.S. Environmental Protection Agency (U.S. EPA) on the date listed) and S (as adopted on May 4, 1999, or as last amended on such other date set forth next to the 40 CFR Part 86 section title listed below) to the extent they pertain to the testing and compliance of vehicle refueling emissions for passenger cars, light-duty trucks and medium-duty vehicles, are hereby adopted as the “California Refueling Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles,” with the following exceptions and additions.

Subpart S Requirements

I. General Certification Requirements for Refueling Emissions

A. Applicability

1. These refueling standards and test procedures are applicable to all new 2001 and subsequent model gasoline-fueled, alcohol-fueled, diesel-fueled, liquefied petroleum gas-fueled, natural gas-fueled, and hybrid electric passenger cars (including 2012 and subsequent model-year off-vehicle charge capable hybrid electric vehicles), light-duty trucks and medium-duty vehicles with a gross vehicle weight rating of less than 8,501 lbs., and to all new complete 2015 and subsequent model gasoline-fueled, alcohol-fueled, diesel-fueled, liquefied petroleum gas-fueled, natural gas-fueled, and hybrid electric (including 2012 and subsequent model-year off-vehicle charge capable hybrid electric vehicles) medium-duty vehicles with a gross vehicle weight rating of 8,501 through 14,000 lbs. A manufacturer may elect to certify 2009 through 2011 model-year off-vehicle charge capable hybrid electric vehicles using these provisions. In cases where a provision applies only to a certain vehicle group based on its model year, vehicle class, motor fuel, engine type, or other distinguishing characteristics, the limited applicability is cited in the appropriate section or paragraph.

2. For general certification purposes, the requirements set forth in the "California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures ~~for 2001 and Subsequent~~ and 2009 through 2016 Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles;” the “California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles;” the “California Exhaust Emission Standards and Test Procedures for 2009 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes;” and the “California Evaporative Emission Standards and Test Procedures For 2001 and Subsequent Model Motor Vehicles,” shall apply, except as otherwise noted in these test procedures.

As amended: March 22, 2012
Board Hearing: January 26-27, 2012

3. Reference to vehicle sales throughout the United States shall mean vehicle sales in California, except when certifying to the refueling standards, in which case, vehicle sales shall mean throughout the United States.

4. A small volume manufacturer is defined as any vehicle manufacturer with California actual sales less than or equal to 4,500 new vehicles per model year based on the average number of vehicles sold by the manufacturer in the previous three consecutive years.

5. Regulations concerning U.S. EPA hearings, inspections, specific language on the Certificate of Conformity, alternative useful life, and selective enforcement audit shall not be applicable to these procedures, except where specifically noted.

6. In those instances where testing conditions or parameters are not practical or feasible for vehicles certified to the refueling standards, the manufacturer shall provide a test plan that provides equal or greater confidence in comparison to these test refueling procedures. The test plan must be approved in advance by the Executive Officer.

7. The term “[no change]” means that these test procedures do not modify the applicable federal requirement.

8. The specifications for the fuel used in testing are set forth in 40 CFR §86.113-94 [February 18, 2000]. Alternatively, California certification fuel specified in Part II, A.100.3.1.2 (test fuel with 10 percent ethanol) of the “California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles” may be used for 2015 and subsequent model vehicles ~~is not allowed~~ for certification or in-use testing as long as California temperatures are applied as described in Subpart B, section II.B.5.2.

B. Definitions, Acronyms, Terminology

1. These test procedures incorporate by reference the definitions set forth in the Code of Federal Regulations; and, the definitions as set forth in the "California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures ~~for 2001 and Subsequent~~ and 2009 through 2016 Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles,” the “California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles,” in the “California Exhaust Emission Standards and Test Procedures for 2009 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty

Truck, and Medium-Duty Vehicle Classes," and in the "California Evaporative Emission Standards and Test Procedures For 2001 and Subsequent Model Motor Vehicles."

C. Useful Life

1. Delete §86.1805-01; §86.1805-04 and replace with:

"Useful life" shall have the same meaning as provided in title 13, CCR, §2112.

D. On-Board Diagnostics

1. Delete §86.1806 and replace with:

The applicable sections of the "Malfunction and Diagnostic System Requirements – 1994 and Subsequent Model-Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines," as set forth in title 13, CCR, section 1968.1; and, the "Malfunction and Diagnostic System Requirements – 2004 and Subsequent Model-Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines," as set forth in title 13, CCR, section 1968.2, are hereby incorporated by reference into this test procedure. For purposes of this test procedure, all references to evaporative system monitoring, malfunction criteria, and MIL illumination and fault code storage shall also apply to refueling systems.

E. General Standards, increase in emissions; unsafe conditions; waivers

1. Amend §86.1810-01 [July 12, 2001] as follows:

1.1. (a) through (j). [See the "California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures ~~for 2001 and Subsequent~~ and 2009 through 2016 Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles;" the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles;" or the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles."]

1.2. (k) [No change.]

1.3. (l) Substitute certification to the applicable refueling emission standards set forth in section I.I.F. of these test procedures instead of with the standards set forth in §86.1811-04(e); §86.1812-01(e); §86.1813-01(e); and, §86.1816-05(e).

1.4. (m) Substitute compliance with applicable refueling emission standards set forth in section I.I.F. of these test procedures instead of with the standards set forth in §86.1811-04(e); §86.1812-01(e); §86.1813-01(e); and, §86.1816-05(e).

1.5. (n) [No change.]

1.6. (o) and (p) [See the "California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures ~~for 2001 and Subsequent~~ and 2009 through 2016 Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles," and the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles."]

1.7. A manufacturer must demonstrate compliance with the fuel spillage test requirements in the "Specifications for Fill Pipes and Openings of Motor Vehicle Fuel Tanks," which is hereby incorporated by reference herein.

2. In addition to the provisions set forth in these test procedures, the ARB reserves the authority to require testing to enforce compliance and to prevent noncompliance with the refueling emission standard.

3. Vehicles certified to the refueling emission standards set forth in Section I.F.2.2. below, shall not be counted in the phase-in sales percentage compliance determinations.

F. Emission Standards

1. Delete 40 CFR §§86.1811 through 86.1816 (all years).

2. The maximum refueling emissions for 2001 and subsequent model passenger cars, light-duty trucks and medium-duty vehicles with a gross vehicle weight rating less than 8,501 lbs., and 2015 and subsequent model complete medium-duty vehicles with a gross vehicle weight rating 8,501 through 14,000 lbs. for the full useful life are:

2.1. For gasoline-fueled, alcohol-fueled, diesel-fueled, fuel-flexible, and hybrid electric vehicles: 0.20 grams hydrocarbons per gallon of fuel dispensed. [For purposes of these test procedures, hydrocarbons shall mean organic material hydrocarbon equivalent for alcohol-fueled vehicles.] For liquefied petroleum gas-fueled vehicles: 0.15 grams hydrocarbons per gallon of fuel dispensed.

2.2. Vehicles powered by diesel fuel are not required to conduct testing to demonstrate compliance with the refueling emission standards set forth above, provided that all of the following provisions are met:

(A) The manufacturer can attest to the following evaluation: "Due to the low vapor pressure of diesel fuel and the vehicle tank temperatures, hydrocarbon vapor concentrations are low and the vehicle meets the 0.20 grams/gallon refueling emission standard without a control system."

(B) The certification requirement described in section I.F.2.2.(A) is provided in writing and applies for the full useful life of the vehicle.

2.3. Incomplete vehicles of 14,000 pounds gross vehicle weight rating or less that are certified as incomplete vehicles for the purposes of evaporative emissions testing as set forth in the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles," are not required to demonstrate compliance with the refueling emission standards set forth in 2.1.

G. Durability Demonstration procedures for refueling emissions.

~~1.~~ §86.1825-01 Durability Demonstration procedures for refueling emissions [October 6, 2000] [No change.] ~~Amend as follows: Add the following sentences to the first paragraph:~~

~~2.~~

Subpart B - Emission Regulations for 1977 and Later Model Year New Light-Duty Vehicles and New Light-Duty Trucks; Test Procedures

40 CFR §§ 86.101 through 86.145 and Appendix I (UDDS Schedule) of this Subpart B, as incorporated by reference and amended in the "California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures ~~for 2001 and Subsequent~~ and 2009 through 2016 Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles;" the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles;" the "California Exhaust Emission Standards and Test Procedures for 2009 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes;" and~~,~~ the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles," are hereby incorporated by reference herein.

II. Refueling Emissions Test Procedures

A. Fuel Spitback Emissions

1. §86.146-96 Fuel dispensing spitback procedure [August 23, 1995] [No change.]

B. Refueling Emissions

1. §86.150-98 Refueling test procedure; overview [September 21, 1994]

1.1. Revise subparagraph (a), first sentence, as follows: The refueling emissions test procedure described in this and subsequent sections is used to determine the conformity of vehicles with the refueling emissions standards set forth in section I.F. of these test procedures for all of the vehicle types specified in section I.A.

2. §86.151-98 General requirements; refueling test [April 6, 1994]

2.1. Revise subparagraph (a), first sentence, as follows: The refueling emissions procedure, shown in Figure B98-12, starts with the stabilizing of the vehicle and the loading of the refueling emissions canister(s) and continues with the vehicle drive for purging of the canister, followed by the refueling emissions measurement.

3. §86.152-98 Vehicle preparation; refueling test [December 8, 2005]

3.1. Amend subparagraph (a) to include: For 2012 and subsequent off-vehicle charge capable hybrid electric vehicles equipped with nonintegrated refueling canister-only systems, the refueling canister shall not be removed from the vehicle.

3.2. Subparagraph (b) [No change.]

3.3. Subparagraph (c) [No change.]

4. §86.153-98 Vehicle and canister preconditioning; refueling test [December 8, 2005]

4.1. Amend subparagraph (a) to include: The vehicle preconditioning drive for 2012 and later model-year off-vehicle charge capable hybrid electric vehicles shall include at least one complete UDDS performed entirely under a charge-sustaining mode of operation, The battery state-of-charge net change tolerance provisions specified in section F.10., of the "California Exhaust Emission Standards and Test Procedures for 2009 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes" shall not apply.

4.1.1. Add subparagraph (a)(1): 2012 and subsequent model-year off-vehicle charge capable hybrid electric vehicles equipped with non-integrated refueling canister-only systems. Such vehicles and vapor storage canisters shall be preconditioned in accordance with the preconditioning procedures for the two-diurnal evaporative emissions test specified in 40 CFR 86.132-96(a) through (j), with the following exceptions.

4.1.2. Prior to conducting the applicable test sequence, the nonintegrated refueling canister shall have already achieved a stabilized state, such as is accomplished using the stabilization method described in section III.D.3.3.4, of the "California Evaporative Emission Standards and Test Procedures ~~For~~<u>for</u> 2001 and Subsequent Model Motor Vehicles." Within 60 minutes of completing the vehicle preconditioning drive, a second fuel drain and fill step shall be performed, The fuel tank shall be filled to the prescribed tank fuel volume of 95 percent of the manufacturer's nominal fuel tank capacity, determined to the nearest one-tenth of a U.S. gallon (0.38 liter) with the specified fuel.

4.1.3. After the second fuel drain and tank refill step is completed, the initial testing state of the canister shall be established by purging while performing vehicle driving, using either the chassis dynamometer procedure or the test track procedure, as described in subparagraphs (d)(1) and (d)(2) of 40 CFR 86.153-98. For vehicles equipped with dual fuel tanks that can be individually selected or isolated, the required volume of fuel shall be driven out of one tank, the second tank shall be selected as the fuel source, and the required volume of fuel shall be driven out of the second tank. A manufacturer shall plan for interruptions in the vehicle drivedowns due to factors such as work schedules, driver relief, and test equipment considerations, using good engineering practice.

4.1.3.1. The vehicle drivedown will consume 85%, or less as determined by the manufacturer, of the manufacturers' nominal fuel tank capacity,

4.1.3.2. In order to reduce the amount of time required to consume 85 percent of the fuel tank capacity, as required by either subparagraph (d)(1) or (d)(2) in 40 CFR 86.153-98, as applicable, a manufacturer may elect to set the battery state-of- charge at a level that maximizes the amount of engine operation, prior to conducting either the chassis dynamometer or the test track driving procedure, as applicable.

4.1.3.3. With advance Executive Officer approval, a manufacturer may optionally elect to bench purge the canister either during the initial soak period, specified in 40 CFR §86.132-96(c)(1), or after the vehicle preconditioning drive step specified in section II.B.4.1., in lieu of performing the second fuel drain/fill and vehicle drivedown steps specified in sections II.B.4.1.2. and II.B.4.1.3. Approval by the Executive Officer shall be based upon assurance that the canister will be bench purged by an equivalent volume of air corresponding to a consumption of 85%, or less as determined by the manufacturer, of the manufacturers' nominal fuel tank capacity, and that the characteristics of the purge flow through the canister, such as flow rates, shall be representative of flow that occurs under the specified vehicle drivedown UDDS cycles. Within 60 minutes of completing the bench purging, the fuel drain and fill step specified in section II.B.4.1.4., shall be performed.

4.1.4. Within 60 minutes of completing the vehicle drivedown, a third fuel drain and fill step shall be performed in which the fuel tank shall be filled to a prescribed tank fuel volume of 10 percent of the manufacturer's nominal fuel tank capacity, determined to the nearest one-tenth of a U.S. gallon (0.38 liter) with the specified fuel. The manufacturer may isolate the canister using any method that does not compromise the integrity of the system. A description of the canister isolation method shall be included in the manufacturer's certification application. When the refueling canister is isolated from its system, fuel vapors shall be allowed to be vented from the fuel tank, as appropriate, during this fill step.

4.1.5. In lieu of performing the third fuel drain and fill step specified in section II.B.4.1.4., the required fuel tank volume of 10 percent may be established by using a measured drain of the fuel tank, within 60 minutes of completing the vehicle drivedown.

4.1.6. Fuel-tank-refill canister loading. Good engineering practice and safety considerations, such as, but not limited to, adequate ventilation and appropriate electrical groundings, shall apply.

4.1.7. The test vehicle shall be allowed to soak for a minimum of 6 hours and a maximum of 24 hours, at 80ºF ±3ºF (27ºC ±1.7ºC), prior to starting the fuel-tank-fill canister-loading step.

4.1.7.1. Off-vehicle charging to increase the battery state-of-charge to the highest level allowed by the manufacturer, prior to either the chassis dynamometer or the test track driving procedures specified in section II.B.4.4., shall occur during the soak period specified in section II.B.4.1.7.

4.1.8. The refueling canister shall not be isolated from its system during the fuel-tank-refill canister-loading step.

4.1.9. The test vehicle's fuel fill pipe cap shall be removed

4.1.10. The dispensed fuel temperature recording system shall be started.

4.1.11. The fuel nozzle shall be inserted into the fill pipe neck of the test vehicle, to its maximum penetration, and the tank refueling operation shall start. The plane of the nozzle's handle shall be approximately perpendicular to the floor. The fuel shall be dispensed at a temperature of 67ºF ±3.0ºF (19.4ºC ±1.7ºC), and at a dispensing rate of 9.8 gal/min ±0.3 gal/min (37.1 liter/min ±1.1 liter/min). If using California certification fuel, the fuel shall be dispensed at a temperature of 79±1.5 ºF (26.1±0.8 ºC) and at a dispensing rate of 9.8±0.3 gal/min (37.1±1.1 liter/min). When

As amended: March 22, 2012
Board Hearing: January 26-27, 2012

this refueling operation is conducted by the Executive Officer, a dispensing rate that is not less than 4.0 gal/min (15.1 liter/min) may be used.

4.1.12. The fuel flow shall continue until the refueling nozzle automatic shut-off is activated. The amount of fuel dispensed must be at least 85 percent of the nominal fuel tank volume, determined to the nearest one-tenth of a U.S. gallon (0.38 liter). If an automatic nozzle shut-off occurs prior to this point, the dispensing shall be reactivated within 15 seconds, and fuel dispensing continued as needed. A minimum of 3 seconds shall elapse between any automatic nozzle shutoff and the subsequent resumption of fuel dispensing.

4.1.13. As soon as possible after completing the refilling step, remove the fuel nozzle from the fill pipe neck, and replace the test vehicle's fuel fill pipe cap.

4.1.14. The refueling canister shall be isolated from its system as soon as possible after completing the refilling step.

4.1.15. For vehicles equipped with more than one fuel tank, the steps described in this section shall be performed for each fuel tank.

4.1.16. When the fuel-tank-refill canister-loading operation is completed, the test vehicle shall proceed to the non-integrated system canister purging procedures specified in section II.B.4.4. The canister shall not be isolated from its system during these canister-purging procedures.

4.1.17. The Executive Officer may approve minor modifications to this canister-~~-~~loading method when such modifications are supported by good engineering judgment, and do not reduce the stringency of the method.

4.2. Subparagraph (b) [No change.]

4.3. Subparagraph (c), amend subparagraph (c)(1) to include: A 2012 and later model-year off-vehicle charge capable hybrid electric vehicle that is tested either for exhaust emissions only or for refueling emissions, shall be processed in accordance with the provisions of section F, of the "California Exhaust Emission Standards and Test Procedures for 2009 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes," with the following exceptions.

4.3.1. For such vehicles, the battery state-of-charge setting prior to the cold start exhaust test shall be at the highest level allowed by the manufacturer. This requirement shall be applicable regardless of a vehicle's ability to allow, or not to allow, manual activation of the auxiliary power unit. If off-vehicle charging is required to increase the battery state-of-charge for the proper setting, then this charging shall occur during the canister preconditioning process.

4.3.2. The battery state-of-charge net change tolerance provisions specified in section F.10., of the "California Exhaust Emission Standards and Test Procedures for 2009 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, ~~In The~~in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes" shall not apply.

4.4. Amend subparagraph (d) as follows: Canister purging: nonintegrated systems. For all vehicles, except for 2012 and subsequent model-year off-vehicle charge capable hybrid electric vehicles equipped with non-integrated refueling canister-only systems, within one hour of completion of canister loading to breakthrough, the fuel tank(s) shall be further filled to 95 percent of nominal tank capacity determined to the nearest one-tenth of a U.S. gallon (0.38 liter) with the fuel specified in Sec. 86.113-94. During this fueling operation, the refueling emissions canister(s) shall be disconnected, unless the manufacturer specifies that the canister(s) should not be disconnected. Following completion of refueling, the refueling emissions canister(s) shall be reconnected, if the canister was disconnected during refueling. Special care shall be taken during this step to avoid damage to the components and the integrity of the fuel system. For all vehicles, including 2012 and subsequent model-year off-vehicle charge capable hybrid electric vehicles equipped with non-integrated refueling canister-only systems, vehicle driving to purge the refueling canister(s) shall be performed using either the chassis dynamometer procedure or the test track procedure, as described in subparagraphs (d)(1) and (d)(2) of 40 CFR 86.153-9. The Executive Officer may choose to shorten the vehicle driving for a partial refueling test as described in subparagraph (d)(3) of 40 CFR 86.153-98. For vehicles equipped with dual fuel tanks that can be individually selected or isolated, the required volume of fuel shall be driven out of one tank, the second tank shall be selected as the fuel source, and the required volume of fuel shall be driven out of the second tank. A manufacturer shall plan for interruptions in the vehicle drivedowns due to factors such as work schedules, driver relief, and test equipment considerations, using good engineering practice.

4.4.1. A 2012 and subsequent model-year off-vehicle charge capable hybrid electric vehicle shall be processed in accordance with the provisions of section F of the “California Exhaust Emission Standards and Test Procedures for 2009 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes,” with the following exception.

4.4.2. For such vehicles, the battery state-of-charge setting prior to either the chassis dynamometer or the test track driving procedures, as applicable, shall be at the highest level allowed by the manufacturer. This requirement shall be applicable regardless of a vehicle’s ability to allow, or not to allow, manual activation of the auxiliary power unit. If off-vehicle charging is required to increase the battery state-of-charge for the proper setting, then this charging shall occur during the soak period specified in section II.B.4.1.7., for 2012 and subsequent model-year off-vehicle charge capable hybrid electric vehicles equipped with non-integrated refueling canister-only systems, and during the canister preconditioning process for all other hybrid electric vehicles.

4.4.2.1. In order to reduce the amount of time required to consume 85 percent of the fuel tank capacity, as required by either subparagraph (d)(1) or (d)(2) in 40 CFR 86.153-98, as applicable, a manufacturer may elect to set the battery state-of--charge at a level that is less than specified in section II.B.4.4.2., prior to conducting either the chassis dynamometer or the test track driving procedure, as applicable. Such an election shall be allowed by the Executive Officer unless information, such as in-use test results, or other applicable information that may become available, indicates that such an election compromises the stringency of the test procedures.

4.4.3. The battery state-of-charge net change tolerance provisions specified in section F.10., of the “California Exhaust Emission Standards and Test

Procedures for 2009 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, ~~In~~in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes" shall not apply.

4.4.4. The Executive Officer may use any of the following battery state-of-charge levels for purposes of either certification confirmatory or in-use compliance testing of such vehicles,

4.4.5. As specified in section II.B.4.4.2.

4.4.6. If applicable, at the level approved under section II.B.4.4.2.1.

4.4.7. If applicable, at any level in-between the levels indicated by sections II.B.4.4.2. and II.B.4.4.2.1.

4.4.8. In lieu of performing the vehicle drivedown step specified in section II.B.4.4., a manufacturer may, with advance Executive Officer approval, optionally elect to bench purge the canister. Approval by the Executive Officer shall be based upon assurance that the canister will be bench purged by an equivalent volume of air corresponding to a consumption of 85%, or less as determined by the manufacturer, of the manufacturers' nominal fuel tank capacity, and that the characteristics of the purge flow through the canister, such as flow rates, shall be representative of flow that occurs under the specified vehicle drivedown UDDS cycles.

4.4.9. The canister shall be isolated from its system after completing the canister-purging procedures.

4.4.10. When the optional canister bench purge specified in section II.B.4.4.8. is elected, the 10-percent fuel tank volume specified in 40 CFR 86.153-98(e), may be established by using a measured drain of the fuel tank, within 60 minutes of completing the canister bench purge.

4.5. Subparagraph (e) [No change.]

5. §86.154-98 Measurement procedure; refueling test [August 23, 1995] ~~[No change].~~

5.1. Subparagraphs (a) through (d) [No change.]

5.2. Amend subparagraph (e) (6) to include: If using California certification fuel, the fuel shall be dispensed at a temperature of 79±1.5 ºF (26.1±0.8 ºC) and at a dispensing rate of 9.8±0.3 gal/min (37.1±1.1 liter/min).

6. §86.155-98 Records required; refueling test [April 6, 1994] [No change].

7. §86.156-98 Calculations [April 6, 1994] [No change.]

ATTACHMENT A-7

State of California
AIR RESOURCES BOARD

SPECIFICATIONS FOR FILL PIPES AND OPENINGS OF
1977 THROUGH 2014 MODEL MOTOR VEHICLE FUEL TANKS

Adopted:	March 19, 1976
Amended:	August 5, 1976
Amended:	June 8, 1977
Amended:	December 7, 1990
Amended:	January 22, 1990
Amended:	March 22, 2012

Note: Proposed amendments to this document are shown in underline to indicate additions and ~~strikeouts~~ to indicate deletions compared to the test procedures as last amended in January 22, 1990.

NOTE: This document is incorporated by reference in section 2235, title 13, California Code of Regulations (CCR). Additional requirements necessary to complete an application for certification of motor vehicles are contained in other documents that are designed to be used in conjunction with this document. These other documents include:

1. "California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2001 through 2016 Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles" (incorporated by reference in section 1961(d), title 13, CCR);

2. "California Exhaust Emission Standards and Test Procedures for 2009 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes" (incorporated by reference in section 1962.1(h), title 13, CCR);

3. "California Evaporative Emission Standards and Test Procedures For 2001 and Subsequent Model Motor Vehicles" (incorporated by reference in section 1976(c), title 13, CCR);

4. "Malfunction and Diagnostic System Requirements – 1994 and Subsequent Model-Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines" (incorporated by reference in section 1968.1, title 13, CCR);

5. "Malfunction and Diagnostic System Requirements – 2004 and Subsequent Model-Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines" (incorporated by reference in section 1968.2, title 13, CCR);

6. "California Refueling Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" (incorporated by reference in section 1978, title 13, CCR).

SPECIFICATIONS FOR FILL PIPES AND OPENINGS OF 1977 THROUGH 2014 MODEL MOTOR VEHICLE FUEL TANKS

I. General

A. No new 1977 ~~or later~~ through 2014 model year gasoline-powered motor vehicle may be sold, offered for sale, or registered in California unless such vehicle complies with the following specifications for fill pipes and openings of motor vehicles fuel tanks. In addition, these specifications shall apply to each new 1993 ~~and subsequent~~ through 2014 model methanol-fueled passenger car, light-duty truck, medium-duty vehicle, and heavy-duty vehicle. Any references made in these specifications to gasoline or gasoline-fueled vehicles shall be applicable also to methanol or methanol-fueled vehicles. The Executive Officer may exempt vehicles for which compliance with the specifications is found to be technologically infeasible, in accordance with Paragraph 9.

B. Evidence to show compliance with these specifications shall be submitted to the Executive Officer of the Air Resources Board with the application of certification of new vehicles required by Chapter 3, Subchapter 1, Article 2, of Title 13 of the California Code of Regulations.

C. Sections 4 through 8 shall apply to new 1984 ~~and later~~ through 2014 model year otto-cycle motor vehicles, except motorcycles.

II. Definitions

A. “Fill pipe face” means the surface of the open end of the fill pipe that seals against the fuel tank cap when the cap is in place.

B. “Test nozzle spout” means a rod with dimensions shown in Figure 4 (bottom left corner), used to establish the reference lines around which the fill pipe access zone is defined.

C. “Fill pipe access zone” means the spatial zone in the vicinity of the fill pipe, as described by Figures 3 and 4, which is used for nozzle insertion, and which must be free of obstructions.

D. “Reference plane” means the plane, chosen by the vehicle manufacturer, in which the vapor recovery nozzle should remain during vapor recovery nozzle insertion, and which contains the axial centerline of the fill pipe face.

E. “Normal resting position of the test nozzle spout” means the position of the test nozzle spout is in when all of the following conditions are met:

1. the test nozzle spout is inserted into the fill pipe such that the axial centerline of the test nozzle spout lies in the reference plane;

2. the locking ring of the test nozzle spout is located immediately on the inside (i.e., the vehicle tank side) of the locking lip;

3. either the locking ring of the test nozzle spout rests upon the fill pipe wall, or the test nozzle pout shaft rests upon the locking lip as shown in Figures 1 and 2 respectively; and

4. the fuel dispensing end of the test nozzle spout (which is indicated in Figures 1 and 2) is in contact with a restraining point.

The normal resting position of the test nozzle spout is illustrated in Figures 1 and 2.

F. “Unlatched position of the test nozzle spout” means the position of the test nozzle spout is in when all of the following conditions are met:

1. the test nozzle spout is inserted into the fill pipe with the axial centerline of the test nozzle spout contained in the reference plane;

2. the locking ring of the test nozzle spout is resting on the upper surface of the locking lip so as to raise the nozzle handle though the minimum angle required (from the normal resting position) to effect insertion of the test nozzle spout into the fill pipe; and

3. the fuel dispensing end of the test nozzle spout (which is indicated in Figures 1 and 2) is in contact with a restraining point.

The unlatched position of the test nozzle spout is illustrated in Figures 1a and 2a.

G. “Angle Alpha” means the angle between the axial centerline of the test nozzle spout when in its normal resting position, and the axial centerline of the fill pipe face. Alpha is considered a positive angle when the fuel dispensing end of the test nozzle spout (which is indicated in Figures 1 and 2) is pointing down relative to the axial centerline of the fill pipe face, as illustrated in Figures 1 and 2.

H. “Angle Beta” means the angle between the axial centerline of the test nozzle spout when in its unlatched position, and the axial centerline of the fill pipe face. Beta is considered a positive angle when the fuel dispensing end of the test nozzle spout (which is indicated in Figures 1a and 2a) is pointing down relative to the axial centerline of the fill pipe face, as illustrated in Figures 1a and 2a.

I. “Restriction device” means a fill pipe device installed by the vehicle manufacturer to prevent insertion by a leaded nozzle spout and to prevent fueling with leaded gasoline, pursuant to regulations of the United States Environmental Protection Agency.

J. “Vapor recovery nozzle”, for the purpose of these specifications, means a nozzle, unleaded or leaded as appropriate for fueling vehicles, certified by the state board, pursuant to the board’s “Certification procedures for Gasoline Vapor Recovery Systems at Service Stations” established in Section 94001 of Title 17, California Code of Regulations, at any time between January 1, 1981 and September 14, 1982, together with an appropriate vapor hose. An alternative vapor recovery nozzle means any nozzle certified subsequent to September 14, 1982.

K. “Premature nozzle shut-off” means any automatic shut-off of the vapor recovery nozzle before the vehicle fuel tank is filled to either 90 percent of the nominal fuel tank capacity or to within two gallons less than the nominal tank capacity, whichever corresponds to the smaller quantity of gasoline in the fuel tank.

L. “Liquid gasoline loss” means any liquid gasoline that leaves the fill pipe/nozzle interface during dispersing or after nozzle shut-off and includes any liquid gasoline on the ground, on the vehicle, or that enters the nozzle bellows, nozzle body vapor passage, or vapor hose, but does not include liquid gasoline in the nozzle spout.

III. General Design Specifications

A. The fill pipe face shall have a smooth surface which is flat within 0.025 centimeter TIR (total indicated reading) against which any vapor recovery nozzle as defined in Section 2.J can effect a vapor-tight seal. The fill pipe face shall be round in cross-section, and shall have an outside diameter of less than 5.75 centimeters.

An internal locking lip shall be provided around at least 100 degrees of the inside circumference of the fill pipe, with at least 35 degrees extending to either side of the reference plane.

The height of the lip, as measured from the inside wall of the fill pipe, shall not be less than 0.25 centimeters, or shall not be less than 0.85 centimeters as measured from the outside wall of the fill pipe if the outside diameter of the fill pipe is between 5.2 and 5.75 centimeters. The depth of the lip shall not be less than 0.4, nor more than 1.3 centimeters into the fill pipe as measured in the reference plane from the fill pipe face. If any portion of the locking lip has depth less than 0.4 centimeters, the depth transition shall not be greater than 0.006 centimeters per degree of arc throughout that portion of the locking lip.

B. The fill pipe and all surrounding bumpers, body parts, and factory installed accessories shall be designed and fabricated so that the fill pipe access zone as delineated by Figure 4 is not obstructed. Allowance must be made for production tolerances, as these are not included in this access zone. The access zone shall allow for insertion of any vapor recovery nozzle as defined in section 2.J in at least one orientation within ±90 degrees of the upright or vertical position.

The fill pipe access zone shall be determined by first locating reference lines A and B, and Point D, E, and P. Point P, as shown in Figures 3 and 4, is located by finding the intersection point of 30.6 centimeters radius arcs struck from points D and E. Point P shall be the point from which the 19, 24, and 30.6 centimeter radii of the handle access zone (as indicated in Figures 3 and 4) as constructed. The fill pipe access zone if defined relative to reference lines A and B, as shown in Figures 3 and 4. Reference line A is the axial centerline of the test nozzle spout when it is in its normal resting position. Reference line B is the axial centerline of the test nozzle spout when it is in its unlatched position.

The sealing zone as shown in Figure 4 shall be retained normal to the axial centerline of the fill pipe face. In between the handle access zone and the sealing zone, a smooth blend shall be provided as shown in Figure 4.

C. The internal portions of the fill pipe shall be configured such that test nozzle spout can be inserted far enough into the fill pipe to allow entrance of its locking ring beyond the fill pipe locking lip, and to allow deflection of the spout to the normal resting position and back to the unlatched position without binding. If the fill pipe contains a restriction device or other valve, it must be positioned so that the test nozzle spout in the normal resting position penetrates the restriction device or other valve by a minimum of 2.25 centimeters and allows free delivery of gasoline to the vehicle tank. The internal portions of the fill pipe shall also be configured to hold the test spout in its normal resting position such that the angle Alpha (α) falls within the range 20 degrees $\geq \alpha \geq$ -10 degrees as shown in Figures 1 and 2.

D. The fill pipe shall be oriented such that the axial centerline of the test nozzle spout in the normal resting position forms an angle of not less than 15 degrees with the horizontal plane, with the fuel dispensing end (which is indicated in Figures 1 and 2) pointing down. For 1980 and later model year vehicles, this angle shall not be less than 30 degrees.

IV. Fill Rate Specifications

A. Except as provided in Section 4.B below, the fill pipe shall accept a fill rate of 8 gallons per minute using the test procedures described in Section 6.

B. The fill pipe on 1987 and subsequent model year vehicles, except for those vehicles with fuel system designs carried over from the 1986 model year without change, shall accept a fill rate of 10 gallons per minute using the test procedure described in Section 6.

C. There shall be no premature nozzle shut-off in 90 percent of the test repetitions for any test nozzle using the test procedures described in Section 6.

V. Spillage and Spitback Specifications

A. There shall be no more than 1 millimeter of liquid gasoline loss per test in 90 percent of the tests using the test procedures described in Section 6.

B. There shall be no unlatching of the vapor recovery nozzle during dispensing or upon nozzle shut-off using the test procedure described in Section 6.

VI. Test Procedures

The following test procedures and test conditions shall be used for determining compliance with the specifications in Section 4 and 5.

A. Each different fill pipe/tank configuration, as appropriate to represent adequately the manufacturer's product line, shall be tested with two vapor recovery nozzles. Each nozzle must be from a different manufacturer. At least one of the two nozzles shall be a balance-type. Each nozzle shall include a hold-open clip for hands-off dispensing. Upon the request of a vehicle manufacturer, the Executive Officer or his designate may approve alternate vapor recovery nozzles and hoses for use with the test procedures.

B. The fill pipe shall be tested as installed in the vehicle. Fuel system mock-ups sufficiently complete to demonstrate production vehicle compliance with these specifications may be used.

C. The vehicle shall be parked in a level attitude and oriented such that normal vapor and liquid hose loads are applied to the nozzle. Normal vapor and liquid hose loads may be represented by applying a retractor cable tension of approximately ten pounds to a hose clamp attached to the liquid hose approximately three feet from the nozzle as measured along the hose.

D. Gasoline used as fuel during the tests shall have a Reid vapor pressure of at least 8.5 pounds per square inch (psi) and be at a temperature of 21º plus or minus 5º Centigrade.

E. The pressure drop from the nozzle/fill pipe interface through the vapor passage shall be nominally 0.5 inch of water (gauge) as measured with a nitrogen gas flow of 60 cubic feet per hour though the vapor passage.

F. Each test shall be conducted as follows:

At the start of the test the fuel tank shall be approximately 10 percent of the nominal tank capacity. The nozzle to be sued for dispensing gasoline shall be in the normal hands-off-latched position. The fill rate shall be the minimum rate necessary to demonstrate compliance with the applicable fill rate specification set forth in Section 4. The nozzle shall be allowed to dispense gasoline until automatic nozzle shut-off.

If a premature nozzle shut-off occurs, the nozzle shall be left in the fill pipe in the same position. Dispensing shall be resumed within 10 seconds at the fill rate specified in Section 4 and dispensing shall continue until the fuel tank is filled to within 90 percent of the nominal fuel tank capacity or to within two gallons of the nominal fuel tank capacity, whichever corresponds to the smaller quantity of gasoline in the vehicle fuel tank.

G. A minimum of five tests with each chose nozzle shall be completed to demonstrate compliance with the fill rate and spillage/spitback specifications. If there is any premature nozzle shut-off or instance of liquid gasoline loss greater than 1 millimeter during the first five test with any chosen nozzle, a minimum of ten tests with that nozzle shall be completed to demonstrate compliance with the fill rate and spillage/ spitback specifications.

H. At the request of a manufacturer, the Executive Officer may approve the use of an alternative test procedure by the manufacturer upon a determination that the alternative test procedure is equivalent to the adopted test procedure. The manufacturer shall be responsible for demonstrating the equivalency of the alternative test procedure.

I. For fill pipe/tank configurations with fuel system designs unchanged from a prior model year, and which have been tested using the adopted test procedure or by an equivalent test procedure acceptable to the Executive Officer as specified in Section 6.H, the test results from the prior model year may be used for determining compliance to these specifications.

VII. Specifications to Reduce Damage to Vapor Recovery Nozzles

To avoid damage to the bellows and faceplates of vapor recovery nozzles, there shall be no sharp projections or edges within the fill pipe access zone, along the surface of the fill pipe access zone, or along the surface of adjacent zones outside of the fill pipe access zone, which could foreseeably damage the bellows or faceplate of nozzles during nozzle insertion, latching, dispensing or removal. Fill pipe access doors, including license plate holders and license plates when used as access doors, and all associated door and license plate mounting brackets, screws, and other hardware shall stand free of the fill pipe access zone during nozzle insertion, latching, dispensing, and removal. This Section shall also apply to all factory installed accessories in the vicinity of the fill pipe and opening.

VIII. Fill Pipe Assembly and Restriction Device Durability and Other Specifications

A. The manufacturer of each motor vehicle shall warrant to the ultimate purchaser and each subsequent purchaser that he vehicle is: (1) designed, built, and equipped so as to conform, at the time of sale, with the specifications in Sections 4, 5, 7, 8.B, and 8.C herein, and (2) free from defects in materials and workmanship which cause the fill pipe assembly, including restriction device, to fail to conform to the specifications in Sections 4, 5, 7, 8.B, and 8.C herein for the useful life of the vehicle as defined in Section 2035 of Title 13, California Code of Regulations. The provision of Sections 2037 (d) – (k), 2038, 2039, 2040, and 2041 of Title 13, California Code of Regulations, shall be applicable to the warranty. The fill pipe assembly, including restriction device, shall be subject to vehicle emissions related defects report and vehicle or engine recall procedures in Title 13, Chapter 3, Subchapter 2, Article 2, California Code of Regulations.

B. Any restriction device in a motor vehicle shall be sufficiently durable to withstand simple tampering and to prevent expansion of the restriction device diameter to 2.4 centimeters or removal of the restriction device without extraordinary effort.

C. The fill pipe assembly including fuel tank cap shall not expel liquid gasoline during normal driving maneuvers or parking attitudes for which the vehicle is designed irrespective of ambient temperature or tank level up to nominal capacity.

D. The fill pipe assembly of all methanol-fueled vehicles shall be designed to resist the insertion of flexible tubing of a diameter that is feasible for use in siphoning fuel. Manufacturers of methanol-fueled heavy-duty vehicles in excess of 14,000 pounds gross vehicle weight may request an exemption from this requirement. The request shall be submitted to the Executive Officer and shall be granted if the manufacturer demonstrates that compliance with this requirement is technically infeasible.

IX. Exemption of Vehicles

A. A manufacturer may apply for an exemption from the fill pipe and fuel tank opening specifications in paragraphs 3 through 8 for any of its vehicles by applying in writing to the Executive Officer. Application should be submitted at lest 60 days prior to the manufacturer's date for final design commitment. The application shall set forth:

1. the specific models for which the exemption is sought;

2. for each such model all facts which demonstrate that compliance with the specifications is technologically infeasible; and

3. evidence showing what efforts have been and will be made by the manufacturer to overcome technological infeasibility, and what the state-of-art technology and problems consist of.

B. Upon receipt of an exemption application, together with sufficient supporting evidence, the Executive Officer may make a finding of technological infeasibility and grant an exemption. The exemption may be limited to specific models, specified body styles of any vehicle model, and/or specified model years. In determining whether to grant an exemption, the Executive Officer shall consider technologies available to the motor vehicle industry as a while. The Executive Officer may condition an exemption upon a commitment by the manufacturer to develop new technologies in accordance with a responsible compliance schedule approved by the Executive Officer. No exemption shall be granted unless the manufacturer has demonstrated a good faith effort to overcome technological infeasibility.

C. The manufacturer shall bear the responsibility for submitting evidence to the Executive Officer sufficient to justify the granting of an exemption.

Figure 1.

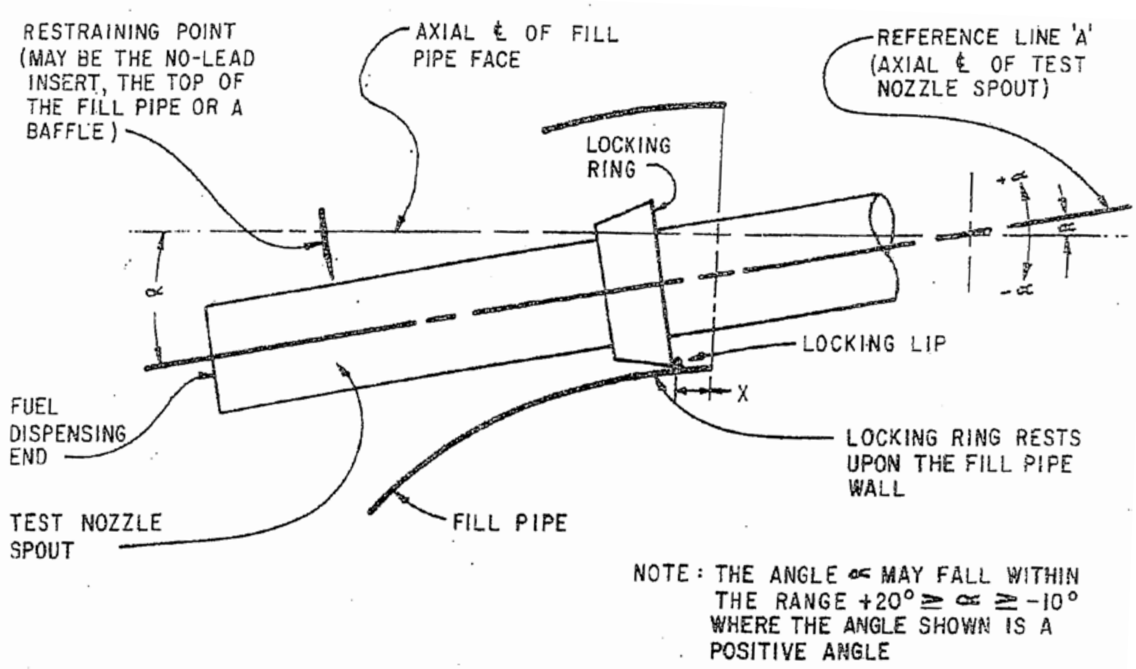


FIGURE 1 : SAE J1114 TYPE FILL PIPE (NORMAL RESTING POSITION)

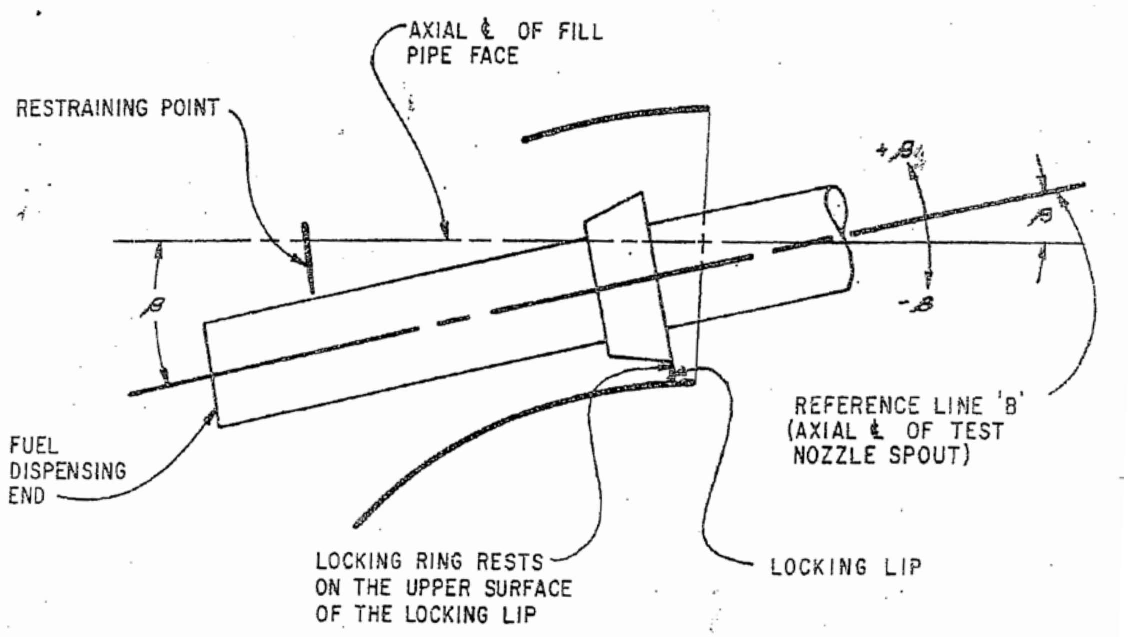


FIGURE 1a : SAE J1114 TYPE FILL PIPE (UNLATCHED POSITION)

Figure 2.

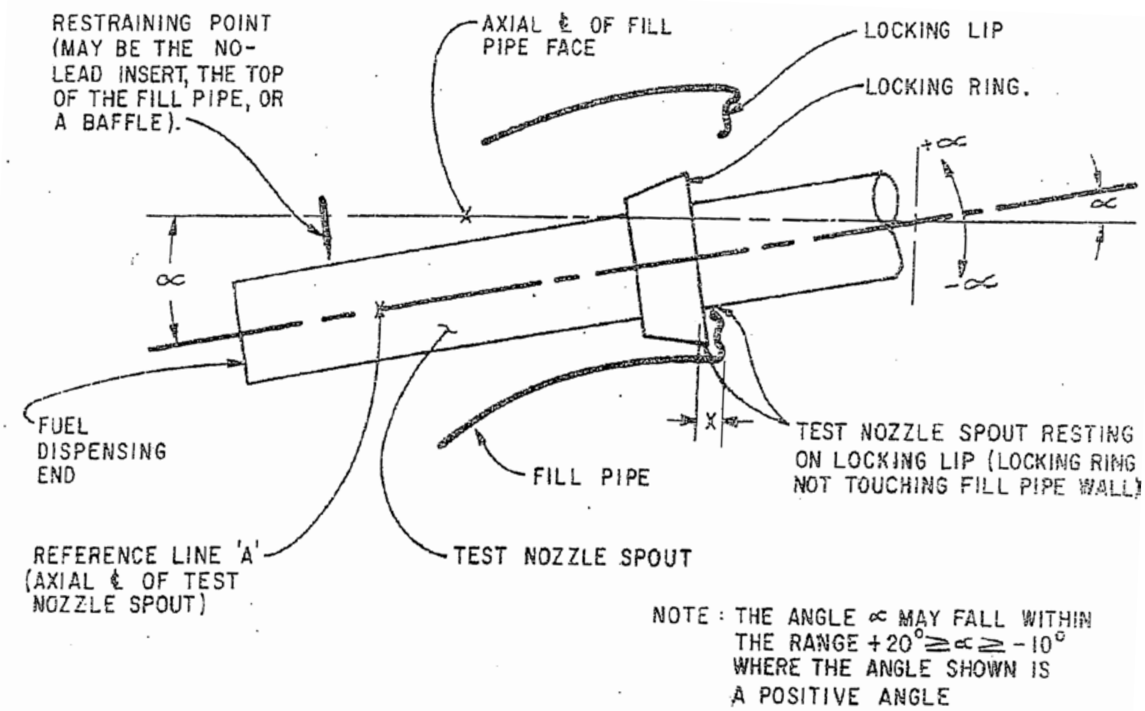


FIGURE 2 : SAE J829B TYPE FILL PIPE (NORMAL RESTING POSITION)

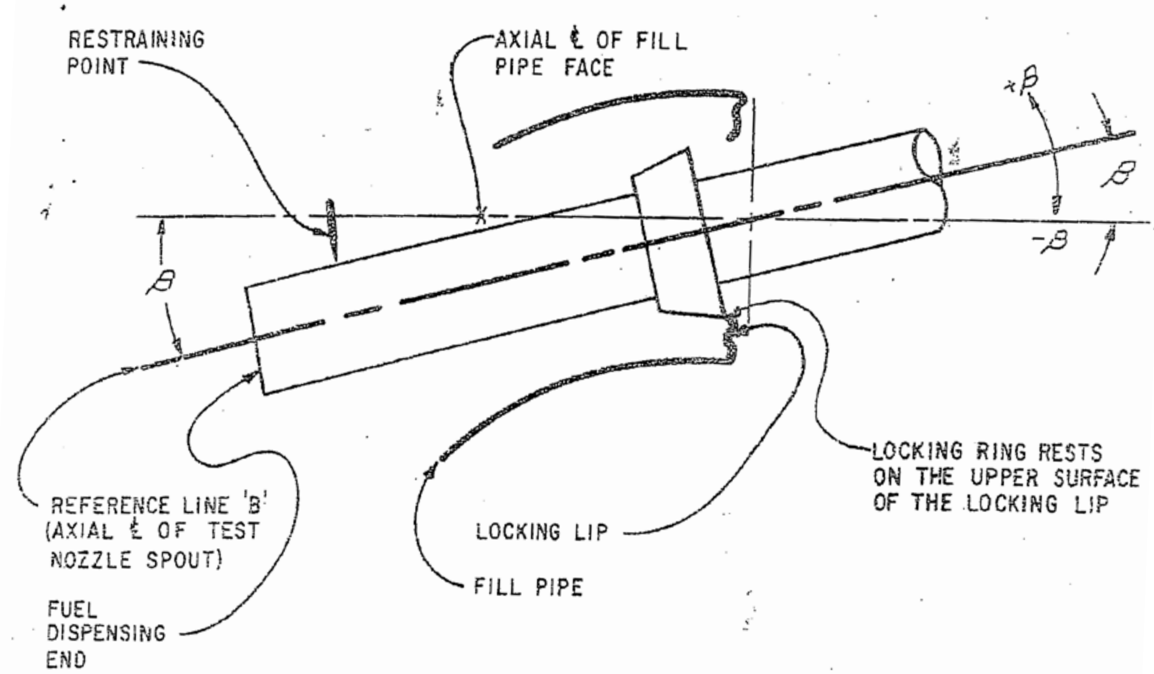


FIGURE 2a : SAE J829B TYPE FILL PIPE (UNLATCHED POSITION)

As Amended: March 22, 2012
Date of Hearing: January 26-27, 2012

Figure 3.

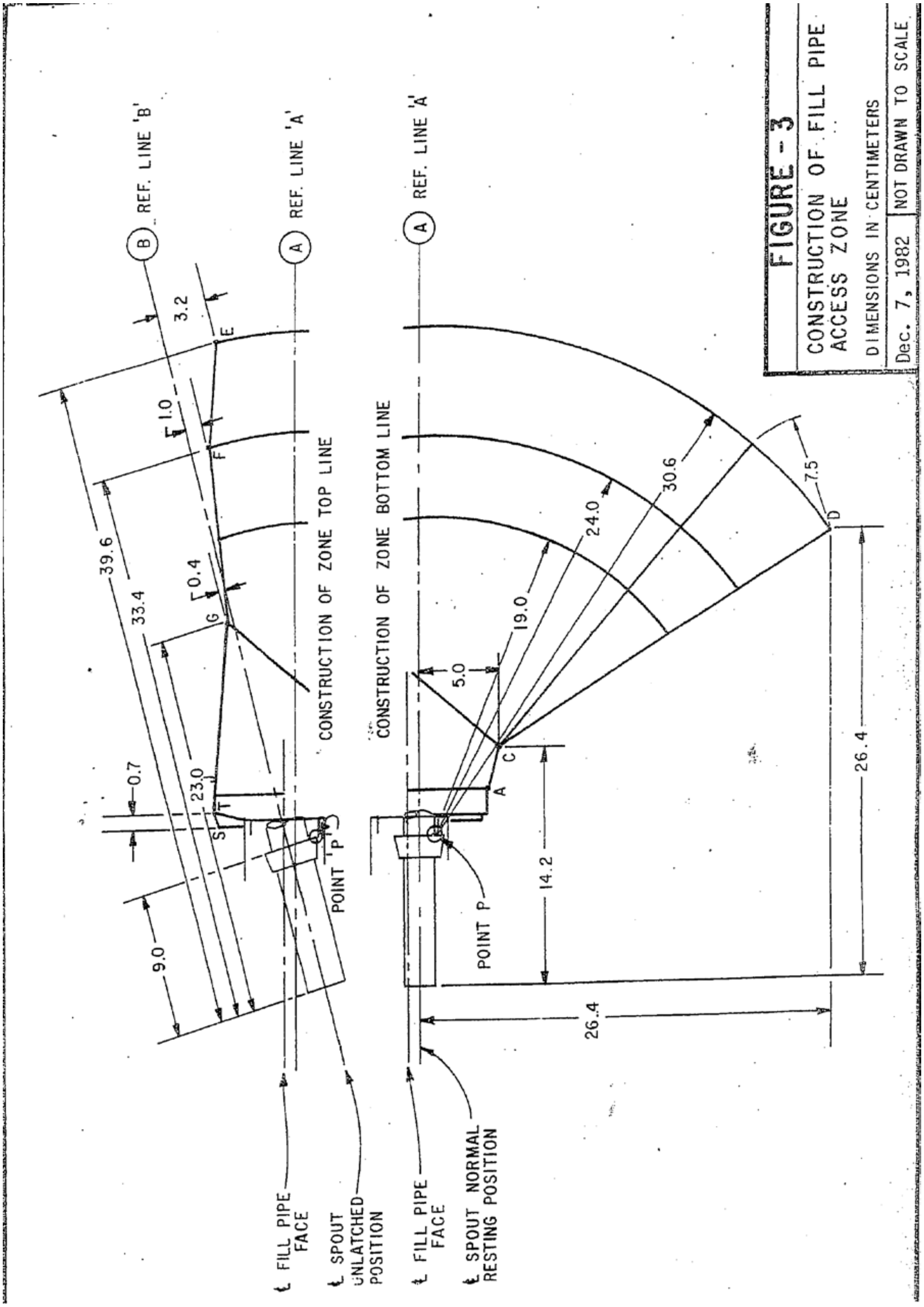
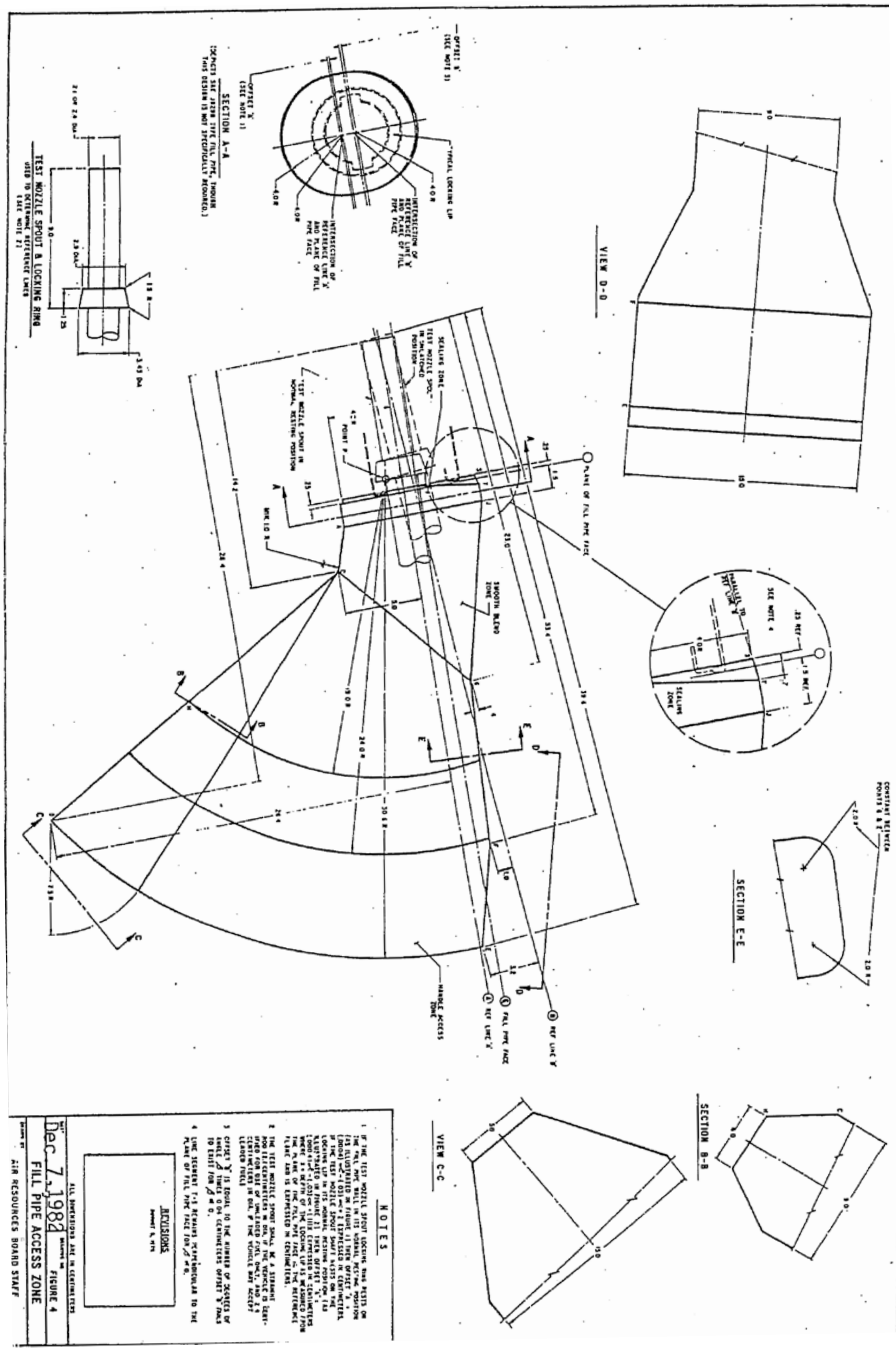


FIGURE - 3
CONSTRUCTION OF FILL PIPE ACCESS ZONE
DIMENSIONS IN CENTIMETERS
Dec. 7, 1982
NOT DRAWN TO SCALE
REF. LINE 'B'
REF. LINE 'A'
REF. LINE 'A'
CONSTRUCTION OF ZONE TOP LINE
CONSTRUCTION OF ZONE BOTTOM LINE
POINT 'P'
POINT P
FILL PIPE FACE
SPOUT UNLATCHED POSITION
FILL PIPE FACE
SPOUT NORMAL RESTING POSITION
3.2
1.0
0.4
0.7
39.6
33.4
23.0
9.0
5.0
19.0
24.0
30.6
7.5
14.2
26.4
26.4

Figure 3 continued.



ATTACHMENT A-8

State of California
AIR RESOURCES BOARD

SPECIFICATIONS FOR FILL PIPES AND OPENINGS OF 2015 AND SUBSEQUENT MODEL MOTOR VEHICLE FUEL TANKS

Adopted: March 22, 2012

As Adopted: March 22, 2012
Date of Hearing: January 26-27, 2012

NOTE: This document is incorporated by reference in section 2235, title 13, California Code of Regulations (CCR). Additional requirements necessary to complete an application for certification of motor vehicles are contained in other documents that are designed to be used in conjunction with this document. These other documents include:

1. “California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles” (incorporated by reference in section 1961.2 (d), title 13, CCR);

2. “California Exhaust Emission Standards and Test Procedures for 2009 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes” (incorporated by reference in section 1962.1(h), title 13, CCR);

3. “California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles” (incorporated by reference in section 1976(c), title 13, CCR);

4. “Malfunction and Diagnostic System Requirements – 1994 and Subsequent Model-Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines” (incorporated by reference in section 1968.1, title 13, CCR);

5. “Malfunction and Diagnostic System Requirements – 2004 and Subsequent Model-Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles and Engines” (incorporated by reference in section 1968.2, title 13, CCR);

6. “California Refueling Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles” (incorporated by reference in section 1978, title 13, CCR).

SPECIFICATIONS FOR FILL PIPES AND OPENINGS OF MOTOR VEHICLE FUEL TANKS

I. General

A. No new 2015 or later model year gasoline or alcohol fueled passenger car, light-duty truck, medium-duty vehicle, or heavy-duty vehicle may be sold, offered for sale, or registered in California unless such vehicle complies with the following specifications for fill pipes and openings of motor vehicles fuel tanks. The Executive Officer may exempt vehicles for which compliance with the specifications is found to be technologically infeasible, in accordance with Paragraph 9.

B. Evidence to show compliance with these specifications shall be submitted to the Executive Officer of the Air Resources Board with the application of certification of new vehicles required by Chapter 3, Subchapter 1, Article 2, of Title 13 of the California Code of Regulations.

C. Sections 4 through 8 shall apply to new 2015 and later model year otto-cycle motor vehicles, except motorcycles.

II. Definitions

These test procedures incorporate by reference the definitions set forth in the International Organization for Standardization standard (ISO) “Road vehicles – Filler pipes and openings of motor vehicle fuel tanks – Vapour recovery system” (ISO-13331-1995(E)), as adopted June 1, 1995; the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles;" and the “California Exhaust Emission Standards and Test Procedures for 2009 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck, and Medium-Duty Vehicle Classes,” including the incorporated definitions from the Code of Federal Regulations. In addition, the following definitions apply:

1. “Restriction device” means a fill pipe device installed by the vehicle manufacturer to prevent insertion by a leaded nozzle spout and to prevent fueling with leaded gasoline, pursuant to regulations of the United States Environmental Protection Agency.

2. “Vapor recovery nozzle”, for the purpose of these specifications, means a nozzle, unleaded or leaded as appropriate for fueling vehicles, certified by the state board, pursuant to the board’s “Certification procedures for Gasoline Vapor Recovery Systems at Service Stations” established in Section 94001 of Title 17, California Code of Regulations, at any time between January 1, 1981 and September 14, 1982, together

with an appropriate vapor hose. An alternative vapor recovery nozzle means any nozzle certified subsequent to September 14, 1982.

3. "Premature nozzle shut-off" means any automatic shut-off of the vapor recovery nozzle before the vehicle fuel tank is filled to either 90 percent of the nominal fuel tank capacity or to within two gallons less than the nominal tank capacity, whichever corresponds to the smaller quantity of gasoline in the fuel tank.

4. "Liquid gasoline loss" means any liquid gasoline that leaves the fill pipe/nozzle interface during dispersing or after nozzle shut-off and includes any liquid gasoline on the ground, on the vehicle, or that enters the nozzle bellows, nozzle body vapor passage, or vapor hose, but does not include liquid gasoline in the nozzle spout.

III. General Design Specifications

The fill pipe and opening of the vehicle fuel tank shall conform to all specifications in the ISO standard "Road vehicles – Filler pipes and openings of motor vehicle fuel tanks – Vapour recovery system" (ISO-13331-1995(E)), as adopted June 1, 1995 and incorporated by reference herein. For filler pipes with threaded-type caps, manufacturers may elect to use the alternate filler pipe sealing surface shape specified in the Society for Automotive Engineers (SAE) standard "Fuel Tank Filler Cap and Cap Retainer Threaded" (J1114), as amended August 4, 2005 and incorporated by reference herein. The alternate shape allowance would be used in lieu of section 3.1 of ISO-13331-1995(E); all other provisions of ISO-13331-1995(E) would need to be met by a manufacturer utilizing the SAE J1114 provision.

IV. Fill Rate Specifications

A. The fill pipe on 2015 and subsequent model year vehicles shall accept a fill rate of 10 gallons per minute using the test procedure described in Section 6.

B. There shall be no premature nozzle shut-off in 90 percent of the test repetitions for any test nozzle using the test procedures described in Section 6.

V. Spillage and Spitback Specifications

A. There shall be no more than 1 millimeter of liquid gasoline loss per test in 90 percent of the tests using the test procedures described in Section 6.

B. There shall be no unlatching of the vapor recovery nozzle during dispensing or upon nozzle shut-off using the test procedure described in Section 6.

VI. Test Procedures

The following test procedures and test conditions shall be used for determining compliance with the specifications in Section 4 and 5.

A. Each different fill pipe/tank configuration, as appropriate to represent adequately the manufacturer's product line, shall be tested with two vapor recovery nozzles. Each nozzle must be from a different manufacturer. At least one of the two nozzles shall be a balance-type. Each nozzle shall include a hold-open clip for hands-off dispensing. Upon the request of a vehicle manufacturer, the Executive Officer or his designate may approve alternate vapor recovery nozzles and hoses for use with the test procedures.

B. The fill pipe shall be tested as installed in the vehicle. Fuel system mock-ups sufficiently complete to demonstrate production vehicle compliance with these specifications may be used.

C. The vehicle shall be parked in a level attitude and oriented such that normal vapor and liquid hose loads are applied to the nozzle. Normal vapor and liquid hose loads may be represented by applying a retractor cable tension of approximately ten pounds to a hose clamp attached to the liquid hose approximately three feet from the nozzle as measured along the hose.

D. Gasoline used as fuel during the tests shall have a Reid vapor pressure of at least 8.5 pounds per square inch (psi) and be at a temperature of 21º plus or minus 5º Centigrade.

E. The pressure drop from the nozzle/fill pipe interface through the vapor passage shall be nominally 0.5 inch of water (gauge) as measured with a nitrogen gas flow of 60 cubic feet per hour though the vapor passage.

F. Each test shall be conducted as follows:

At the start of the test the fuel tank shall be approximately 10 percent of the nominal tank capacity. The nozzle to be sued for dispensing gasoline shall be in the normal hands-off-latched position. The fill rate shall be the minimum rate necessary to demonstrate compliance with the applicable fill rate specification set forth in Section 4. The nozzle shall be allowed to dispense gasoline until automatic nozzle shut-off.

If a premature nozzle shut-off occurs, the nozzle shall be left in the fill pipe in the same position. Dispensing shall be resumed within 10 seconds at the fill rate specified in Section 4 and dispensing shall continue until the fuel tank is filled to within 90 percent of the nominal fuel tank capacity or to within two gallons of the nominal fuel tank capacity, whichever corresponds to the smaller quantity of gasoline in the vehicle fuel tank.

G. A minimum of five tests with each chose nozzle shall be completed to demonstrate compliance with the fill rate and spillage/spitback specifications. If there is any premature nozzle shut-off or instance of liquid gasoline loss greater than 1 millimeter during the first five test with any chosen nozzle, a minimum of ten tests with that nozzle shall be completed to demonstrate compliance with the fill rate and spillage/ spitback specifications.

H. At the request of a manufacturer, the Executive Officer may approve the use of an alternative test procedure by the manufacturer upon a determination that the alternative test procedure is equivalent to the adopted test procedure. The manufacturer shall be responsible for demonstrating the equivalency of the alternative test procedure.

I. For fill pipe/tank configurations with fuel system designs unchanged from a prior model year, and which have been tested using the adopted test procedure or by an equivalent test procedure acceptable to the Executive Officer as specified in Section 6.H, the test results from the prior model year may be used for determining compliance to these specifications.

VII. Specifications to Reduce Damage to Vapor Recovery Nozzles

To avoid damage to the bellows and faceplates of vapor recovery nozzles, there shall be no sharp projections or edges within the fill pipe access zone, along the surface of the fill pipe access zone, or along the surface of adjacent zones outside of the fill pipe access zone, which could foreseeably damage the bellows or faceplate of nozzles during nozzle insertion, latching, dispensing or removal. Fill pipe access doors, including license plate holders and license plates when used as access doors, and all associated door and license plate mounting brackets, screws, and other hardware shall stand free of the fill pipe access zone during nozzle insertion, latching, dispensing, and removal. This Section shall also apply to all factory installed accessories in the vicinity of the fill pipe and opening.

VIII. Fill Pipe Assembly and Restriction Device Durability and Other Specifications

A. The manufacturer of each motor vehicle shall warrant to the ultimate purchaser and each subsequent purchaser that he vehicle is: (1) designed, built, and equipped so as to conform, at the time of sale, with the specifications in Sections 4, 5, 7, 8.B, and 8.C herein, and (2) free from defects in materials and workmanship which cause the fill pipe assembly, including restriction device, to fail to conform to the specifications in Sections 4, 5, 7, 8.B, and 8.C herein for the useful life of the vehicle as defined in Section 2035 of Title 13, California Code of Regulations. The provision of

Sections 2037 (d) – (k), 2038, 2039, 2040, and 2041 of Title 13, California Code of Regulations, shall be applicable to the warranty. The fill pipe assembly, including restriction device, shall be subject to vehicle emissions related defects report and vehicle or engine recall procedures in Title 13, Chapter 3, Subchapter 2, Article 2, California Code of Regulations.

B. Any restriction device in a motor vehicle shall be sufficiently durable to withstand simple tampering and to prevent expansion of the restriction device diameter to 2.4 centimeters or removal of the restriction device without extraordinary effort.

C. The fill pipe assembly including fuel tank cap shall not expel liquid gasoline during normal driving maneuvers or parking attitudes for which the vehicle is designed irrespective of ambient temperature or tank level up to nominal capacity.

D. The fill pipe assembly of all methanol-fueled vehicles shall be designed to resist the insertion of flexible tubing of a diameter that is feasible for use in siphoning fuel. Manufacturers of methanol-fueled heavy-duty vehicles in excess of 14,000 pounds gross vehicle weight may request an exemption from this requirement. The request shall be submitted to the Executive Officer and shall be granted if the manufacturer demonstrates that compliance with this requirement is technically infeasible.

IX. Exemption of Vehicles

A. A manufacturer may apply for an exemption from the fill pipe and fuel tank opening specifications in paragraphs 3 through 8 for any of its vehicles by applying in writing to the Executive Officer. Application should be submitted at lest 60 days prior to the manufacturer's date for final design commitment. The application shall set forth:

1. the specific models for which the exemption is sought;

2. for each such model all facts which demonstrate that compliance with the specifications is technologically infeasible; and

3. evidence showing what efforts have been and will be made by the manufacturer to overcome technological infeasibility, and what the state-of-art technology and problems consist of.

B. Upon receipt of an exemption application, together with sufficient supporting evidence, the Executive Officer may make a finding of technological infeasibility and grant an exemption. The exemption may be limited to specific models, specified body styles of any vehicle model, and/or specified model years. In determining whether to grant an exemption, the Executive Officer shall consider technologies available to the motor vehicle industry as a while. The Executive Officer may condition an exemption upon a commitment by the manufacturer to develop new technologies in accordance with a responsible compliance schedule approved by the

Executive Officer. No exemption shall be granted unless the manufacturer has demonstrated a good faith effort to overcome technological infeasibility.

C. The manufacturer shall bear the responsibility for submitting evidence to the Executive Officer sufficient to justify the granting of an exemption.

ATTACHMENT A-9

State of California
AIR RESOURCES BOARD

CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 2004 AND SUBSEQUENT MODEL HEAVY-DUTY OTTO-CYCLE ENGINES

Adopted:	December 27, 2000
Amended:	December 12, 2002
Amended:	July 26, 2007
Amended:	October 17, 2007
Amended:	September 27, 2010
Amended:	March 22, 2012

Note: The proposed amendments to this document are shown in underline to indicate additions and ~~strikeout~~ to indicate deletions compared to the test procedures as last amended September 27, 2010. [No change] indicates proposed federal provisions that are also proposed for incorporation herein without change. Existing intervening text that is not amended in this rulemaking is indicated by "* * * *".

NOTE: This document is incorporated by reference in section 1956.8(d), title 13, California Code of Regulations ("CCR") and also incorporates by reference various sections of Title 40, Part 86 of the Code of Federal Regulations, with some modifications. It contains the majority of the requirements necessary for certification of heavy-duty Otto-cycle engines for sale in California, in addition to containing the exhaust emissions standards and test procedures for these Otto-cycle engines.[1] The section numbering conventions for this document are set forth in subparagraph 4 on page 4. Reference is also made in this document to other California-specific requirements that are necessary to complete an application for certification. These other documents are designed to be used in conjunction with this document. They include:

1. "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" (incorporated by reference in section 1976, title 13, CCR;~~.~~

2. Warranty requirements (sections 2035, et seq., title 13, CCR);~~.~~

3. OBD II (section 1968, et seq., title 13, CCR, as applicable);~~.~~

4. "California Test Procedures for Evaluating Substitute Fuels and New Clean Fuels through 2014," (section 2317, title 13, CCR); and

5. "California Test Procedures for Evaluating Substitute Fuels and New Clean Fuels in 2015 and Subsequent Years," (section 2317, title 13, CCR).

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1 The requirements for Otto-cycle engines used in complete vehicles up to 14,000 pounds GVW are contained in the "California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and ~~for 2001~~ 2009 through 2016 ~~and Subsequent~~ Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles," incorporated by reference in §1961(d), title 13, CCR and the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles," incorporated by reference in section 1961.2, title 13, CCR .

CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 2004 AND SUBSEQUENT MODEL HEAVY-DUTY OTTO-CYCLE ENGINES

* * * *

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

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

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

A. Federal provisions.

* * * *

2. §86.005-1 October 6, 2000.

* * * *

2.2 Delete subparagraph (b) and replace with the following: A manufacturer must certify any complete heavy-duty vehicle of 14,000 pounds gross vehicle weight rating or less and any 2020 and subsequent model incomplete heavy-duty vehicle of 10,000 pounds gross vehicle weight rating or less in accordance with the medium-duty vehicle provisions contained in the "California 2001 through 2014 Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and ~~for 2001~~ ~~and Subsequent~~ 2009 through 2016 Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles," incorporated by reference in §1961(d), title 13, CCR or the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles," incorporated by reference in section 1961.2, title 13, CCR, as applicable. Heavy-duty engine or vehicle provisions of subpart A do not apply to such a vehicle.

* * * *

2. **Definitions.** [§86.xxx-2]

A. Federal provisions.

All of the definitions in previous CFR sections continue to apply, except as otherwise noted below. Definitions specific to other requirements such as evaporative emissions are contained in those separate documents.

1. §86.004-2. January 18, 2001.
2. §86.010-2. February 24, 2009.

B. California provisions.

* * * *

"Medium-Duty Vehicle" means any 1992 though 2006 model-year heavy-duty low-emission, ultra-low-emission, super-ultra-low-emission or zero-emission vehicle certified to the standards in section 1960.1(h)(2) having a manufacturer's gross vehicle weight rating of 14,000 pounds or less and any 2000 and subsequent model heavy-duty low-emission, ultra-low-emission, super-ultra-low-emission or zero-emission vehicle certified to the standards in section 1961(a)(1), 1961.2, or 1962 having a manufacturer's gross vehicle weight rating between 8,500 and 14,000 pounds.

* * * *

10. **Emission standards for Otto-cycle heavy-duty engines and vehicles.** [§86.xxx-10]

A. Federal provisions.

1. **§86.098-10.** ~~October 6, 2000~~ April 30, 2010. Amend as follows:

* * * *

2. **§86.099-10**. [n/a; See evap TPs.]
3. **§86.005-10**. ~~January 18, 2001~~ December 8, 2005. Amend as follows:

* * * *

4. **§86.008-10**. ~~January 18, 2001~~ April 30, 2010. Amend as follows:

* * * *

B. California provisions.

1. Exhaust emissions from new 2004 and later model year Otto-cycle medium- and heavy-duty engines, except for Otto-cycle medium- and heavy-duty engines subject to the alternative standards in 40 CFR §86.005-10(f), shall not exceed:

California Emission Standards for 2004 and Subsequent Model Heavy-Duty Otto-Cycle Engines[A]
(in g/bhp-hr)

Model Year	Emission Category	NMHC + NOx	NMHC	NOx	CO[~~F~~H]	HCHO	PM
Standards for Heavy-Duty Otto-Cycle Engines Used In 2004 through 2019 Model Medium-Duty Vehicles 8,501 to 10,000 pounds GVW[B] **and 2004 and Subsequent Model Medium-Duty Vehicles 10,001 to 14,000 pounds GVW**[~~B~~C]							
2004	ULEV	2.4 **or** 2.5 with 0.5 NMHC cap[~~C~~D]	n/a	n/a	14.4	0.05	n/a
	SULEV	2.0	n/a	n/a	7.2	0.025	n/a
2005 through 2007[~~E~~F]	ULEV	1.0[~~C,E~~D,F]	n/a	n/a	14.4	0.05	n/a
	SULEV	0.5[~~C,E~~D,F]	n/a	n/a	7.2	0.025	n/a
2008 and subsequent[~~F~~G]	ULEV	n/a	0.14[~~E~~F]	0.20[~~E~~F]	14.4	0.01	0.01
	SULEV	n/a	0.07[~~E~~F]	0.10[~~E~~F]	7.2	0.005	0.005
Standards for Heavy-Duty Otto-Cycle Engines Used In Heavy-Duty Vehicles Over 14,000 pounds GVW							
2004	n/a	2.4 **or** 2.5 with 0.5 NMHC cap[~~C~~D]	n/a	n/a	37.1	0.05[~~D~~E]	n/a
2005 through 2007[~~E~~F]	n/a	1.0[C,E]	n/a	n/a	37.1	0.05[~~D~~E]	n/a
2008 and subsequent[~~F~~G]	n/a	n/a	0.14[~~E~~F]	0.20 [E]	14.4	0.01	0.01

[A] These standards apply to petroleum-fueled, alcohol-fueled, liquefied petroleum gas-fueled and natural gas-fueled Otto-cycle engines. Alcohol-fueled engines have the option of certifying to the organic material hydrocarbon equivalent ("OMHCE") or organic material non-methane hydrocarbon equivalent ("OMNMHCE") standard.

[B] For the 2020 and subsequent model years, medium-duty vehicles 8,501 to 10,000 pounds GVW must certify to the primary emission standards and test procedures for complete vehicles specified in section 1961.2, title 13, CCR.

[~~B~~C] A manufacturer of engines used in incomplete medium-duty vehicles may choose to comply with these standards as an alternative to the primary emission standards and test procedures for complete vehicles specified in section 1961 or 1961.2, title 13, CCR. A manufacturer that chooses to comply with these optional heavy-duty engine standards and test procedures shall specify, in the Part I application for certification, an in-use compliance test procedure, as provided in section 2139(c), title 13 CCR.

[~~C~~D] A manufacturer may request to certify to the Option 1 or Option 2 federal NMHC + NOx standards as set forth in 40 CFR §86.005-10(f). However, for engines used in medium-duty vehicles the formaldehyde level must meet the standard specified above.

[~~D~~E] This standard only applies to methanol-fueled Otto-cycle engines.

[~~E~~F] A manufacturer may elect to include any or all of its medium- and heavy-duty Otto-cycle engine families in any or all of the emissions ABT programs for HDEs, within the restrictions described in section I.15 of these test procedures. For engine families certified to the Option 1 or 2 federal standards the FEL must not exceed 1.5 g/bhp-hr. If a manufacturer elects to include engine families certified to the 2005 and subsequent model year standards, the NOx plus NMHC FEL must not exceed 1.0 g/bhp-hr. For engine families certified to the 2008 and subsequent model year standards, the FEL is the same as set forth in 40 CFR 86.008-10(a)(1).

[~~F~~G] A manufacturer may elect to include any or all of its medium- and heavy-duty Otto-cycle engine families in any or all of the emissions ABT programs for HDEs, within the restrictions described in section I.15 of these test procedures.

[~~G~~H] Idle carbon monoxide: For all Otto-cycle heavy-duty engines utilizing aftertreatment technology, and not certified to the on-board diagnostics requirements of title 13, CCR, §1968, et seq, as applicable, the CO emissions shall not exceed 0.50 percent of exhaust gas flow at curb idle.

2. **Optional Standards for Complete Heavy-Duty Vehicles.**

Manufacturers may request to group complete heavy-duty vehicles into the same test group as vehicles certifying to the LEV III exhaust emission standards and test procedures specified in title 13, CCR, §1961.2, so long as those complete heavy-duty Otto-cycle vehicles meet the most stringent LEV III standards to which any vehicle within that test group certifies.

* * * *

14. **Small-volume manufacturers certification procedures.** [§86.xxx-14]. [Note: A small volume manufacturer shall mean a California small volume manufacturer as defined in Section I.1.A., above. Any reference to 10,000 units shall mean 4,500 units in California based on a three year running average as defined in I.1.A., above.]

1. §86.094-14. ~~January 3, 1996~~ April 30, 2010. Amend as follows:

* * * *

~~2. §86.096-14. March 24, 1993. [n/a; pertains to evaporative requirements.]~~
2. §86.095-14. April 30, 2010. [No change.]
3. §86.098-14. April 6, 1994. [No change.]

* * * *

16. **Prohibition of defeat devices.** §86.004-16. ~~October 6, 2000~~ July 13, 2005. [No change.]

17. **Emission control diagnostic system for light-duty vehicles and trucks.** [§86.099-17; §86.005-17; §86.007-17] Delete; replace with: All heavy-duty Otto-cycle engines up to 14,000 pounds GVW must have an on-board diagnostic system as required in section 1968, et seq., title 13, CCR, as applicable.

* * * *

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

A. Federal provisions.

1. §86.004-21. October 6, 2000. [No change.]
2. §86.007-21. ~~October 6, 2000~~ August 30, 2006. [No change - diesel only.]

* * * *

26. **Mileage and service accumulation; emission measurements.** [§86.004-26] ~~October 6, 2000~~ July 13, 2005.

* * * *

28. **Compliance with emission standards.** [§86.xxx-28]

A. Federal provisions.

1. §86.004-28. ~~January 18, 2001~~ August 30, 2006. [No change.]

B. California provisions.

1. All dedicated methanol-fueled and fuel-flexible vehicles and engines shall comply with the requirements which are applicable to heavy-duty gasoline-fueled Otto-cycle vehicles and engines, except where otherwise noted. In particular, for fuel-flexible vehicles and engines, a manufacturer's proposed durability demonstration program, as required in sections ~~86.094-21~~ 86.004-21(b)(5)(i)(A), 86.007-21(b)(5)(i)(A), 86.001-23(b)(1)(ii), and ~~86.098-23~~ 86.007-23(b)(1)(ii), shall provide for the assessment of the durability of the engine in operation with methanol and gasoline, as well as intermediate mixtures of both fuels. A manufacturer's proposed mileage and service accumulation, as required in section ~~86.096-24~~ 86.001-24(c), shall be conducted on methanol.

* * * *

30. **Certification.** [§86.xxx-30].

1. ~~[~~§86.004-30~~]~~. October 6, 2000. [No change.]
2. §86.007-30. February 24, 2009. [No change.]

* * * *

38. **Maintenance instructions.** [§86.xxx-38]

1. §86.004-38. ~~October 21, 1997~~ June 27, 2003.

* * * *

2. §86.007-38. ~~January 18, 2001~~ June 29. 2004. [No change, except as noted above for §86.004-38 subparagraph (g)(1).]

3. §86.010-38. April 30, 2010. [No change, except as noted above for §86.004-38 subparagraph (g)(1).]

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Part II. OTHER REQUIREMENTS; TEST PROCEDURES

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

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86.1304~~-90~~ Section numbering; construction. ~~October 6, 2000~~ July 13, 2005.
86.1305-2004 Introduction; structure of subpart. October 6, 2000.
86.1305-2010 Introduction; structure of subpart. September 15, 2011.

* * * *

86.1313-94 Fuel specifications. September 5, 1997.
86.1313-98 Fuel specifications. February 18, 2000. [n/a diesel fuel specifications.]
86.1313-2004 Fuel specifications. January 18, 2001.
86.1313-2007 Fuel specifications. January 18, 2001 [n/a diesel fuel specifications.]

A. Federal Provisions.

Amend the federal fuel specifications as follows:

1. California Certification Gasoline Specification.

1.1 Certification Gasoline Fuel Specifications for the 2004 through 2019 Model Years.

Add the following subparagraph which reads: For 2004 through 2019 model engines certifying in accordance with these test procedures, g~~G~~asoline having the specifications listed below may be used in exhaust and evaporative emission testing as an option to the specifications referred to in 86.1313-94(a)(1) and in 86.1313-2004(a)(1). If a manufacturer elects to utilize this option, both exhaust and evaporative emission testing shall be conducted by the manufacturer with gasoline having the specifications listed below, and the Executive Officer shall conduct exhaust and evaporative emission testing with gasoline having the specifications listed below. For the 2015 through 2019 model years, gasoline having the specifications listed in Part II, Section A.1.2 may be used in exhaust and evaporative emission testing as an option to the specifications referred to in §86.113-94(a)(1), §86.113-04(a)(1), and this section A.1.1. If a manufacturer elects to certify a 2015 through 2019 model year engine using gasoline having the specifications listed in Part II, Section A.1.2, both exhaust and evaporative emission testing shall be conducted by the manufacturer with gasoline having the specifications listed in Part II, Section A.1.2, and the Executive Officer shall conduct exhaust and evaporative emission testing with gasoline having the specifications listed in Part II, Section A.1.2.

California Certification Gasoline Specifications **<u>for the 2004 through 2019 Model Years</u>**		
Fuel Property[a]	**Limit**	**Test Method [b]**
Octane (R+M)/2	91 (min)	D 2699-88, D 2700-88
Sensitivity	7.5 (min)	D 2699-88, D 2700-88
Lead	0-0.01g/gal (max); no lead added	§2253.4(c), title 13 CCR
Distillation Range:		§2263, title 13 CCR[c]
10% point	130-150 ^{o}F	
50% point [d]	200-210 ^{o}F	
90% point [e]	290-300 ^{o}F	
EP, maximum	390 ^{o}F	
Residue	2.0 vol. % (max)	
Sulfur	30-40 ppm by wt.	§2263, title 13 CCR
Phosphorous	0.005 g/gal (max)	§2253.4(c), title 13 CCR
RVP	6.7-7.0 psi	§2263, title 13 CCR
Olefins	4.0-6.0 vol. %	§2263, title 13 CCR
Total Aromatic Hydrocarbons	22-25 vol. %	§2263, title 13 CCR
Benzene	0.8-1.0 vol. %[f]	§2263, title 13 CCR
Multi-substituted Alkyl Aromatic Hydrocarbons	12-14 vol. %[g]	
MTBE	10.8-11.2 vol. %	§2263, title 13 CCR
Additives	Sufficient to meet requirements of §2257, title 13 CCR	
Copper Corrosion	No. 1	D 130-88
Gum, washed	3.0 mg/100 mL (max)	D 381-86
Oxidation Stability	1000 minutes (min)	D 525-88
Specific Gravity	Report [h]	
Heat of Combustion	Report [h]	
Carbon	Report wt. % [h]	
Hydrogen	Report wt. % [h]	

[a] The gasoline must be blended from typical refinery feedstocks.
[b] ASTM specification unless otherwise noted. A test method other than that specified may be used following a determination by the Executive Officer that the other method produces results equivalent to the results with the specified method.

(c) Although §2263, title 13, CCR refers to the temperatures of the 50 and 90 percent points, this procedure can be extended to the 10 percent and end point temperatures, and to the determination of the residue content.

(d) The range for interlaboratory testing is 195-215^o F.

(e) The range for interlaboratory testing is 285-305^o F.

(f) The range for interlaboratory testing is 0.7-1.1 percent by volume.

(g) "Detailed Hydrocarbon Analysis of Petroleum Hydrocarbon Distillates, Reformates, and Gasoline by Single Column High Efficiency (Capillary) Column Gas Chromatography," by Neil Johansen, 1992, Boulder, CO.

(h) The fuel producer should report this fuel property to the fuel purchaser. Any generally accepted test method may be used and shall be identified in the report.

1.2 Certification Gasoline Fuel Specifications for the 2020 and Subsequent Model Years.

Add the following subparagraph which reads: For 2020 and subsequent model engines, gasoline having the specifications listed below shall be used in exhaust and evaporative emission testing and the Executive Officer shall conduct exhaust and evaporative emission testing with gasoline having the specifications listed below.

California Certification Gasoline Specifications for the 2020 and Subsequent Model Years

Fuel Property[a]	**Limit**	**Test Method [b]**
Octane (R+M)/2[i]	87-88.4; 91 (min)	D 2699-88, D 2700-88
Sensitivity	7.5 (min)	D 2699-88, D 2700-88
Lead	0-0.01g/gal (max); no lead added	§2253.4(c), title 13 CCR
Distillation Range:		§2263, title 13 CCR[c]
10% point	130-150 ^{o}F	
50% point [d]	205-215 ^{o}F	
90% point [e]	310-320 ^{o}F	
EP, maximum	390 ^{o}F	
Residue	2.0 vol. % (max)	
Sulfur	8-11 ppm by wt.	§2263, title 13 CCR
Phosphorous	0.005 g/gal (max)	§2253.4(c), title 13 CCR
RVP	6.9-7.2 psi	§2263, title 13 CCR
Olefins	4.0-6.0 vol. %	§2263, title 13 CCR
Total Aromatic Hydrocarbons	19.5-22.5 vol. %	§2263, title 13 CCR
Benzene	0.6-0.8 vol. %[f]	§2263, title 13 CCR
Multi-substituted Alkyl Aromatic Hydrocarbons	13-15 vol. %[g]	

MTBE	0.05 vol. %	§2263, title 13 CCR
Ethanol	9.8-10.2 vol. %	
Total Oxygen	3.3-3.7 wt. %	§2263, title 13 CCR
Additives	Sufficient to meet requirements of §2257, title 13 CCR	
Copper Corrosion	No. 1	D 130-88
Gum, washed	3.0 mg/100 mL (max)	D 381-86
Oxidation Stability	1000 minutes (min)	D 525-88
Specific Gravity	Report [(h)]	
Heat of Combustion	Report [(h)]	
Carbon	Report wt. % [(h)]	
Hydrogen	Report wt. % [(h)]	

[(a)] The gasoline must be blended from typical refinery feedstocks.

[(b)] ASTM specification unless otherwise noted. A test method other than that specified may be used following a determination by the Executive Officer that the other method produces results equivalent to the results with the specified method.

[(c)] Although §2263, title 13, CCR refers to the temperatures of the 50 and 90 percent points, this procedure can be extended to the 10 percent and end point temperatures, and to the determination of the residue content.

[(d)] The range for interlaboratory testing is 195-215^{o} F.

[(e)] The range for interlaboratory testing is 285-305^{o} F.

[(f)] The range for interlaboratory testing is 0.7-1.1 percent by volume.

[(g)] "Detailed Hydrocarbon Analysis of Petroleum Hydrocarbon Distillates, Reformates, and Gasoline by Single Column High Efficiency (Capillary) Column Gas Chromatography," by Neil Johansen, 1992, Boulder, CO.

[(h)] The fuel producer should report this fuel property to the fuel purchaser. Any generally accepted test method may be used and shall be identified in the report.

[(i)] For vehicles/engines that require the use of premium gasoline as part of their warranty, the Octane ((R+M)/2) shall be a 91 minimum. All other certification gasoline specifications, as shown in this table, must be met. For all other vehicles/engines, the Octane ((R+M)/2) shall be 87-88.4.

* * * *

B. California Provisions.

1. Identification of New Clean Fuels to be Used in Certification Testing. Any person may petition the state board to establish by regulation certification testing specifications for a new clean fuel for which specifications for a new clean fuel are not specifically set forth in paragraph 86.1313-94 as amended herein. Prior to adopting such specifications, the state board shall consider the relative cost-effectiveness of use of the fuel in reducing emissions compared to the use of other fuels. Whenever the state board adopts specifications for a new clean fuel for certification testing, it shall also establish by regulation specifications for the fuel as it is sold commercially to the public.

(a) If the proposed new clean fuel may be used to fuel existing motor vehicles, the state board shall not establish certification specifications for the fuel unless the petitioner has demonstrated that:

(1) Use of the new clean fuel in such existing motor vehicles would not increase emissions of NMOG (on a reactivity-adjusted basis), NOx, CO, and the potential risk associated with toxic air contaminants, as determined pursuant to the procedures set forth in "California Test Procedures for Evaluating Substitute Fuels and New Clean Fuels through 2014~~,~~" ~~as adopted September 17, 1993~~ or the "California Test Procedures for Evaluating Substitute Fuels and New Clean Fuels in 2015 and Subsequent Years," as applicable. In the case of fuel-flexible vehicles or dual-fuel vehicles which were not certified on the new clean fuel but are capable of being operated on it, emissions during operation with the new clean fuel shall not increase compared to emissions during vehicle operation on gasoline.

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86.1321-94 Hydrocarbon analyzer calibration. ~~September 5, 1997~~ July 13, 2005.

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86.1333-2010 Transient test cycle generation. June 30, 2008.

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86.1342-94 Calculations; exhaust emissions. September 5, 1997.

* * * *

B. California Provisions.

1. Non-methane hydrocarbon emissions shall be measured in accordance with the "California Non-Methane Organic Gas Test Procedures~~,~~" ~~as last amended July 30, 2002,~~ which is incorporated by reference in section 1956.8(d), title 13, CCR.

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Subpart P - Emission Regulations for New Gasoline-Fueled and Methanol-Fueled Otto-Cycle Heavy-Duty Engines and New Gasoline-Fueled and Methanol-Fueled Otto-Cycle Light-Duty Trucks; Idle Test Procedures.

86.1501~~-94~~ Scope~~,~~; applicability. ~~October 6, 2000~~ June 30, 2008.
86.1502~~-84~~ Definitions. ~~May 4, 1999~~ June 30, 2008.
86.1503~~-84~~ Abbreviations. ~~May 4, 1999~~ June 30, 2008.
~~86.1504-94 Section numbering; construction. June 30, 1995.~~
86.1505~~-94~~ Introduction; structure of subpart. ~~June 30, 1995~~ June 30, 2008.
86.1506~~-94~~ Equipment required and specifications; overview. ~~September 21, 1994~~ June 30, 2008.
86.1509~~-84~~ Exhaust gas sampling system. June 30, ~~1995~~ 2008.
86.1511~~-84~~ Exhaust gas analysis system. June 30, ~~1995~~ 2008.
86.1513~~-94~~ Fuel specifications. ~~September 21, 1994~~ June 30, 2008.
86.1514~~-84~~ Analytical gases. June 30, ~~1995~~ 2008.
86.1516~~-84~~ Calibration; frequency and overview. ~~November 16, 1983~~ June 30, 2008.
86.1519~~-84~~ CVS calibration. ~~November 16, 1983~~ June 30, 2008.
86.1522~~-84~~ Carbon monoxide analyzer calibration. ~~November 16, 1983~~ June 30, 2008.
86.1524~~-84~~ Carbon dioxide analyzer calibration. ~~November 16, 1983~~ June 30, 2008.
86.1526~~-84~~ Calibration of other equipment. ~~November 16, 1983~~ June 30, 2008.
86.1527~~-84~~ Idle test procedure; overview. ~~November 16, 1983~~ June 30, 2008.
86.1530~~-84~~ Test sequence; general requirements. ~~November 16, 1983~~ June 30, 2008.
86.1537~~-84~~ Idle test run. June 30, ~~1995~~ 2008.
86.1540~~-84~~ Idle exhaust sample analysis. ~~November 16, 1983~~ June 30, 2008.
86.1542~~-84~~ Information required. ~~December 10, 1984~~ June 30, 2008.
86.1544~~-84~~ Calculation; idle exhaust emissions. July 7, 1986 June 30, 2008.

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PART 1065 – ENGINE-TESTING PROCEDURES.

Subpart A – Applicability and General Provisions.

1065.1 Applicability. September 15, 2011.

1. Amend subparagraph (a) as follows:
   1.1. Introductory paragraph. [No change.]
   1.2. Subparagraphs (a)(1). [n/a]
   1.3. Amend subparagraph (a)(2) as follows: Model year 2010 and later heavy-duty highway engines we regulate under title 13, CCR, §1956.8. For earlier model years, manufacturers may use the test procedures in this part or those specified in 40 CFR part 86, subpart N, according to §1065.10, as modified by these test procedures.
   1.4. Subparagraphs (a)(3) through (a)(8). [n/a]
2. Subparagraph (b). [n/a]
3. Subparagraph (c) through (g). [No change.]

1065.2 Submitting information to EPA under this part. April 30, 2010.

1. Subparagraphs (a) through (d). [No change.]
2. Amend subparagraph (e) as follows: See title 13, CCR, section 91011 for provisions related to confidential information. Note that according to this section, emission data shall not be identified as confidential.
3. Subparagraph (f). [No change.]

1065.5 Overview of this part 1065 and its relationship to the standard-setting part. October 30, 2009.

1065.10 Other procedures. April 30, 2010.

1065.12 Approval of alternate procedures. June 30, 2008.

1065.15 Overview of procedures for laboratory and field testing. September 15, 2011.

1065.20 Units of measure and overview of calculations. September 15, 2011.

1065.25 Recordkeeping. July 13, 2005.

Subpart B – Equipment Specifications.

1065.101 Overview. June 30, 2008.

1065.110 Work inputs and outputs, accessory work, and operator demand. June 30, 2008.

1065.120 Fuel properties and fuel temperature and pressure. June 30, 2008.

1065.122 Engine cooling and lubrication. June 30, 2008.

1065.125 Engine intake air. September 15, 2011.

1065.127 Exhaust gas recirculation. July 13, 2005.

1065.130 Engine exhaust. June 30, 2008.

1065.140 Dilution for gaseous and PM constituents. September 15, 2011.

1065.145 Gaseous and PM probes, transfer lines, and sampling system components. April 30, 2010.

1065.150 Continuous sampling. July 13, 2005.

1065.170 Batch sampling for gaseous and PM constituents. September 15, 2011.

1065.190 PM-stabilization and weighing environments for gravimetric analysis. September 15, 2011.
1065.195 PM-stabilization environment for in-situ analyzers. June 30, 2008.

Subpart C – Measurement Instruments.

1065.201 Overview and general provisions. April 30, 2010.
1065.202 Data updating, recording, and control. July 13, 2005.
1065.205 Performance specifications for measurement instruments. September 15, 2011.

Measurement of Engine Parameters and Ambient Conditions

1065.210 Work input and output sensors. June 30, 2008.
1065.215 Pressure transducers, temperature sensors, and dewpoint sensors. June 30, 2008.

Flow-Related Measurements

1065.220 Fuel flow meter. June 30, 2008.
1065.225 Intake-air flow meter. September 15, 2011.
1065.230 Raw exhaust flow meter. July 13, 2005.
1065.240 Dilution air and diluted exhaust flow meters. April 30, 2010.
1065.245 Sample flow meter for batch sampling. July 13, 2005.
1065.248 Gas divider. July 13, 2005.

CO and CO_2 Measurements

1065.250 Nondispersive infra-red analyzer. September 15, 2011.

Hydrocarbon Measurements

1065.260 Flame ionization detector. September 15, 2011.
1065.265 Nonmethane cutter. September 15, 2011.
1065.267 Gas chromatograph. September 15, 2011.

NOx Measurements

1065.270 Chemiluminescent detector. September 15, 2011.
1065.272 Nondispersive ultraviolet analyzer. September 15, 2011.
1065.275 N_2O measurement devices. September 15, 2011.

O_2 Measurements

1065.280 Paramagnetic and magnetopneumatic O_2 detection analyzers. September 15, 2011.

Air-to Fuel Ratio Measurements

1065.284 Zirconia (ZrO_2) analyzer. September 15, 2011.

PM Measurements

1065.290 PM gravimetric balance. November 8, 2010.
1065.295 PM inertial balance for field-testing analysis. September 15, 2011.

Subpart D – Calibrations and Verifications.

1065.301 Overview and general provisions. July 13, 2005.
1065.303 Summary of required calibration and verifications. September 15, 2011.
1065.305 Verifications for accuracy, repeatability, and noise. April 30, 2010.
1065.307 Linearity verification. September 15, 2011.
1065.308 Continuous gas analyzer system-response and updating-recording verification. October 8, 2008.
1065.309 Continuous gas analyzer uniform response verification. April 30, 2010.

Measurement of Engine Parameters and Ambient Conditions

1065.310 Torque calibration. June 30, 2008.
1065.315 Pressure, temperature, and dewpoint calibration. April 30, 2010.

Flow-Related Measurements

1065.320 Fuel-flow calibration. July 13, 2005.
1065.325 Intake-flow calibration. July 13, 2005.
1065.330 Exhaust-flow calibration. July 13, 2005.
1065.340 Diluted exhaust flow (CVS) calibration. September 15, 2011.
1065.341 CVS and batch sampler verification (propane check). September 15, 2011.
1065.342 Sample dryer verification. April 30, 2010.
1065.345 Vacuum-side leak verification. April 30, 2010.

CO and CO_2 Measurements

1065.350 H_2O interference verification for CO_2 NDIR analyzers. September 15, 2011.
1065.355 H_2O and CO_2 interference verification for CO NDIR analyzers. April 30, 2010.

Hydrocarbon Measurements

1065.360 FID optimization and verification. September 15, 2011.
1065.362 Non-stoichiometric raw exhaust FID O2 interference verification. June 30, 2008.
1065.365 Nonmethane cutter penetration fractions. October 30, 2009.

NOx Measurements

1065.370 CLD CO_2 and H_2O quench verification. September 15, 2011.
1065.372 NDUV analyzer HC and H_2O interference verification. September 15, 2011.
1065.376 Chiller NO_2 penetration. June 30, 2008.
1065.378 NO_2-to-NO converter conversion verification. September 15, 2011.

PM Measurements

1065.390 PM balance verifications and weighing process verification. November 8, 2010.
1065.395 Inertial PM balance verifications. July 13, 2005.

Subpart E – Engine Selection, Preparation, and Maintenance.

1065.401 Test engine selection. July 13, 2005.
1065.405 Test engine preparation and maintenance. June 30, 2008.
1065.410 Maintenance limits for stabilized test engines. June 30, 2008.
1065.415 Durability demonstration. June 30, 2008.

Subpart F – Performing an Emission Test in the Laboratory.

1065.501 Overview. April 30, 2010.
1065.510 Engine mapping. September 15, 2011.
1065.512 Duty cycle generation. October 8, 2008.
1065.514 Cycle-validation criteria. September 15, 2011.
1065.520 Pre-test verification procedures and pre-test data collection. September 15, 2011.
1065.525 Engine starting, restarting, and shutdown. September 15, 2011.
1065.526 Repeating void modes or test intervals. November 8, 2010.
1065.530 Emission test sequence. September 15, 2011.
1065.545 Validation of proportional flow control for batch sampling. April 30, 2010.

1065.546 Validation of minimum dilution ratio for PM batch sampling and drift correction. September 15, 2011.
1065.550 Gas analyzer range validation, drift validation, and drift correction. September 15, 2011.
1065.590 PM sample preconditioning and tare weighing. June 30, 2008.
1065.595 PM sample post-conditioning and total weighing. June 30, 2008.

Subpart G – Calculations and Data Requirements.

1065.601 Overview. April 30, 2010.
1065.602 Statistics. September 15, 2011.
1065.610 Duty cycle generation. September 15, 2011.
1065.630 1980 international gravity formula. July 13, 2005.
1065.640 Flow meter calibration calculations. September 15, 2011.
1065.642 SSV, CFV, and PDP molar flow rate calculations. September 15, 2011.
1065.645 Amount of water in an ideal gas. September 15, 2011.
1065.650 Emission calculations. September 15, 2011.
1065.655 Chemical balances of fuel, intake air, and exhaust. September 15, 2011.
1065.659 Removed water correction. September 15, 2011.
1065.660 THC and NMHC determination. September 15, 2011.
1065.665 THCE and NMHCE determination. June 30, 2008.
1065.667 Dilution air background emission correction. September 15, 2011.
1065.670 NOx intake-air humidity and temperature corrections. September 15, 2011.
1065.672 Drift correction. April 30, 2010.
1065.675 CLD quench verification calculations. September 15, 2011.
1065.690 Buoyancy correction for PM sample media. April 30, 2010.
1065.695 Data requirements. June 30, 2008.

Subpart H – Engine Fluids, Test Fuels, Analytical Gases and Other Calibration Standards.

1065.701 General requirements for test fuels. April 30, 2010.

A. Federal provisions.

1. Subparagraph (a). [No change.]

2. Amend subparagraph (b) as follows: *Fuels meeting alternative specifications.* We may allow you to use a different test fuel if you show us and we find that using it does not affect your ability to comply with all applicable emission standards using commercially available fuels.

3. Subparagraph (c). [No change.]

4. Amend subparagraph (d) as follows: *Fuel specifications*. The fuel parameters specified in this subpart depend on measurement procedures that are incorporated by reference.

5. Subparagraph (e). [No change.]

6. Subparagraph (f). [No change.]

B. California provisions.

* * * *

3. **Identification of New Clean Fuels to be Used in Certification Testing.** Any person may petition the state board to establish by regulation certification testing specifications for a new clean fuel for which specifications for the new clean fuel are not specifically set forth in paragraph §86.1313-98 as amended herein. Prior to adopting such specifications, the state board shall consider the relative cost-effectiveness of use of the fuel in reducing emissions compared to the use of other fuels. Whenever the state board adopts specifications for a new clean fuel for certification testing, it shall also establish by regulation specifications for the fuel as it is sold commercially to the public.

(a) If the proposed new clean fuel may be used to fuel existing motor vehicles, the state board shall not establish certification specifications for the fuel unless the petitioner has demonstrated that:

(1) Use of the new clean fuel in such existing motor vehicles would not increase emissions of NMHC, NOx, and CO, and the potential risk associated with toxic air contaminants, as determined pursuant to the procedures set forth in the "California Test Procedures for Evaluating Substitute Fuels and New Clean Fuels <u>through 2014</u>~~,~~" ~~as adopted September 17, 1993~~ <u>or the "California Test Procedures for Evaluating Substitute Fuels and New Clean Fuels in 2015 and Subsequent Years," as applicable</u>. In the case of fuel-flexible vehicles or dual-fuel vehicles that were not certified on the new clean fuel but are capable of being operated on it, exhaust and evaporative emissions from the use of the new clean fuel shall not increase compared to exhaust and evaporative emissions from the use of gasoline that complies with Title 13, Division 3, Chapter 5, Article 1, California Code of Regulations.

(2) Use of the new clean fuel in such existing motor vehicles would not result in increased deterioration of the vehicle and would not void the warranties of any such vehicles.

(b) Whenever the state board designates a new clean fuel pursuant to this section, the state board shall also establish by regulation required specifications for the new clean fuel sold commercially in California.

<u>1065.703 Distillate diesel fuel. April 30, 2010. [n/a]</u>
<u>1065.705 Residual fuel. June 30, 2008.</u>
<u>1065.710 Gasoline. June 30, 2008.</u>

<u>1. Subparagraph (a). [No change.]</u>

<u>2. Delete subparagraph (b) and replace with the following:</u>

<u>(b)(1) **Certification Gasoline Fuel Specifications for the 2004 through 2019 Model Years**.</u>

For 2004 through 2019 model engines certifying in accordance with these test procedures, gasoline having the specifications listed below may be used in exhaust and evaporative emission testing as an option to the specifications referred to in §1065.710. If a manufacturer elects to utilize this option, both exhaust and evaporative emission testing shall be conducted by the manufacturer with gasoline having the specifications listed below, and the Executive Officer shall conduct exhaust and evaporative emission testing with gasoline having the specifications listed below. For the 2015 through 2019 model years, gasoline having the specifications listed in the following section (b)(2), may be used in exhaust and evaporative emission testing as an option to the specifications referred to in §1065.710 and this section (b)(1). If a manufacturer elects to certify a 2015 through 2019 model year engine using gasoline having the specifications listed in the following section (b)(2), both exhaust and evaporative emission testing shall be conducted by the manufacturer with gasoline having the specifications listed in the following section (b)(2), and the Executive Officer shall conduct exhaust and evaporative emission testing with gasoline having the specifications listed in the following section (b)(2).

California Certification Gasoline Specifications for the 2004 through 2019 Model Years		
Fuel Property[(a)]	**Limit**	**Test Method [(b)]**
Octane (R+M)/2	91 (min)	D 2699-88, D 2700-88
Sensitivity	7.5 (min)	D 2699-88, D 2700-88
Lead	0-0.01g/gal (max); no lead added	§2253.4(c), title 13 CCR
Distillation Range:		§2263, title 13 CCR[(c)]
10% point	130-150 °F	
50% point [(d)]	200-210 °F	
90% point [(e)]	290-300 °F	
EP, maximum	390 °F	
Residue	2.0 vol. % (max)	
Sulfur	30-40 ppm by wt.	§2263, title 13 CCR
Phosphorous	0.005 g/gal (max)	§2253.4(c), title 13 CCR
RVP	6.7-7.0 psi	§2263, title 13 CCR
Olefins	4.0-6.0 vol. %	§2263, title 13 CCR
Total Aromatic Hydrocarbons	22-25 vol. %	§2263, title 13 CCR
Benzene	0.8-1.0 vol. %[(f)]	§2263, title 13 CCR
Multi-substituted Alkyl Aromatic Hydrocarbons	12-14 vol. %[(g)]	

MTBE	10.8-11.2 vol. %	§2263, title 13 CCR
Additives	Sufficient to meet requirements of §2257, title 13 CCR	
Copper Corrosion	No. 1	D 130-88
Gum, washed	3.0 mg/100 mL (max)	D 381-86
Oxidation Stability	1000 minutes (min)	D 525-88
Specific Gravity	Report [h]	
Heat of Combustion	Report [h]	
Carbon	Report wt. % [h]	
Hydrogen	Report wt. % [h]	

[a] The gasoline must be blended from typical refinery feedstocks.

[b] ASTM specification unless otherwise noted. A test method other than that specified may be used following a determination by the Executive Officer that the other method produces results equivalent to the results with the specified method.

[c] Although §2263, title 13, CCR refers to the temperatures of the 50 and 90 percent points, this procedure can be extended to the 10 percent and end point temperatures, and to the determination of the residue content.

[d] The range for interlaboratory testing is 195-215^o F.

[e] The range for interlaboratory testing is 285-305^o F.

[f] The range for interlaboratory testing is 0.7-1.1 percent by volume.

[g] "Detailed Hydrocarbon Analysis of Petroleum Hydrocarbon Distillates, Reformates, and Gasoline by Single Column High Efficiency (Capillary) Column Gas Chromatography," by Neil Johansen, 1992, Boulder, CO.

[h] The fuel producer should report this fuel property to the fuel purchaser. Any generally accepted test method may be used and shall be identified in the report.

(b)(2) **Certification Gasoline Fuel Specifications for the 2020 and Subsequent Model Years**.

For 2020 and subsequent model engines, gasoline having the specifications listed below shall be used in exhaust and evaporative emission testing and the Executive Officer shall conduct exhaust and evaporative emission testing with gasoline having the specifications listed below.

California Certification Gasoline Specifications for the 2020 and Subsequent Model Years		
Fuel Property[a]	**Limit**	**Test Method [b]**
Octane (R+M)/2[i]	87-88.4; 91 (min)	D 2699-88, D 2700-88
Sensitivity	7.5 (min)	D 2699-88, D 2700-88
Lead	0-0.01g/gal (max); no lead added	§2253.4(c), title 13 CCR
Distillation Range:		§2263, title 13 CCR[c]
10% point	130-150 ^{o}F	

50% point [(d)]	205-215 ^{o}F	
90% point [(e)]	310-320 ^{o}F	
EP, maximum	390 ^{o}F	
Residue	2.0 vol. % (max)	
Sulfur	8-11 ppm by wt.	§2263, title 13 CCR
Phosphorous	0.005 g/gal (max)	§2253.4(c), title 13 CCR
RVP	6.9-7.2 psi	§2263, title 13 CCR
Olefins	4.0-6.0 vol. %	§2263, title 13 CCR
Total Aromatic Hydrocarbons	19.5-22.5 vol. %	§2263, title 13 CCR
Benzene	0.6-0.8 vol. %[(f)]	§2263, title 13 CCR
Multi-substituted Alkyl Aromatic Hydrocarbons	13-15 vol. %[(g)]	
MTBE	0.05 vol. %	§2263, title 13 CCR
Ethanol	9.8-10.2 vol. %	
Total Oxygen	3.3-3.7 wt. %	§2263, title 13 CCR
Additives	Sufficient to meet requirements of §2257, title 13 CCR	
Copper Corrosion	No. 1	D 130-88
Gum, washed	3.0 mg/100 mL (max)	D 381-86
Oxidation Stability	1000 minutes (min)	D 525-88
Specific Gravity	Report [(h)]	
Heat of Combustion	Report [(h)]	
Carbon	Report wt. % [(h)]	
Hydrogen	Report wt. % [(h)]	

[(a)] The gasoline must be blended from typical refinery feedstocks.

[(b)] ASTM specification unless otherwise noted. A test method other than that specified may be used following a determination by the Executive Officer that the other method produces results equivalent to the results with the specified method.

[(c)] Although §2263, title 13, CCR refers to the temperatures of the 50 and 90 percent points, this procedure can be extended to the 10 percent and end point temperatures, and to the determination of the residue content.

[(d)] The range for interlaboratory testing is 195-215^{o} F.

[(e)] The range for interlaboratory testing is 285-305^{o} F.

[(f)] The range for interlaboratory testing is 0.7-1.1 percent by volume.

[(g)] "Detailed Hydrocarbon Analysis of Petroleum Hydrocarbon Distillates, Reformates, and Gasoline by Single Column High Efficiency (Capillary) Column Gas Chromatography," by Neil Johansen, 1992, Boulder, CO.

[(h)] The fuel producer should report this fuel property to the fuel purchaser. Any generally accepted test method may be used and shall be identified in the report.

(i) For vehicles/engines that require the use of premium gasoline as part of their warranty, the Octane ((R+M)/2) shall be a 91 minimum. All other certification gasoline specifications, as shown in this table, must be met. For all other vehicles/engines, the Octane ((R+M)/2) shall be 87-88.4.

1065.715 Natural gas. June 30, 2008.

1. Delete subparagraph (a) and replace with the following:

(a)(1) **Exhaust emission test fuel.** For dedicated, dual-fueled or hybrid electric vehicles which use natural gas, fuel used for exhaust and evaporative emission testing shall meet the specifications listed in section 2292.5, title 13, CCR, (Specifications for Compressed Natural Gas) as modified by the following:

Compressed Natural Gas Certification Test Fuel	
Specification	Limit
Methane	90.0 ± 1.0 mole percent
Ethane	4.0 ± 0.5 mole percent
C_3 and higher hydrocarbon content	2.0 ± 0.3 mole percent
Oxygen	0.5 mole percent maximum
Inert gases (CO_2 + N_2)	3.5 ± 0.5 vol. percent

(a)(2) **Mileage accumulation fuel.** For dedicated, dual-fueled or hybrid electric vehicles which use natural gas, fuel used for service accumulation shall meet the specifications listed in section 2292.5, title 13, CCR (Specifications for Compressed Natural Gas).

2. Subparagraphs (b) through (d). [No change.]

1065.720 Liquefied petroleum gas. July 13, 2005.

1. Delete subparagraph (a) and replace with the following:

(a)(1) **Evaporative and exhaust emission test fuel.** For dedicated, dual-fueled or hybrid electric vehicles which use liquefied petroleum gas, fuel used for exhaust and evaporative emission testing shall meet the specifications listed in title 13, CCR, section 2292.6 (Specifications for Liquefied Petroleum Gas) as modified by the following:

Liquefied Petroleum Gas Certification Test Fuel	
Specification	Limit
Propane	93.5 ± 1.0 volume percent
Propene	3.8 ± 0.5 volume percent
Butane and heavier components	1.9 ± 0.3 volume percent

(a)(2) Mileage accumulation fuel. For dedicated, dual-fueled or hybrid electric vehicles which use liquefied petroleum gas, fuel used for service accumulation shall meet the specifications listed in title 13, CCR, section 2292.6 (Specifications for Liquefied Petroleum Gas).

(a)(3) The specification range of the fuels to be used in this section (a) shall be measured in accordance with ASTM D2163-91 and reported in accordance with §86.094-21.

2. Subparagraphs (b) through (d). [No change.]

1065.740 Lubricants. July 13, 2005.
1065.745 Coolants. July 13, 2005.
1065.750 Analytical gases. September 15, 2011.
1065.790 Mass standards. September 15, 2011.

Subpart I –Testing with Oxygenated Fuels.

1065.801 Applicability. July 13, 2005.
1065.805 Sampling system. June 30, 2008.
1065.845 Response factor determination. April 30, 2010.
1065.850 Calculations. July 13, 2005.

Subpart K – Definitions and Other Reference Information.

1065.1001 Definitions. September 15, 2011.
1. Amend the definition of "Designated Compliance Officer" as follows: *Designated Compliance Officer* means the Executive Officer of the Air Resources Board or a designee of the Executive Officer.
1065.1005 Symbols, abbreviations, acronyms, and units of measure. September 15, 2011.
1065.1010 Reference materials. September 15, 2011.

Attachment B-1

FINAL REGULATION ORDER

Zero Emission Vehicle Regulation: 2009 through 2017 Model Years

Title 13, California Code of Regulations

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Attachment B-1
FINAL REGULATION ORDER

Amend section 1962.1, title 13, California Code of Regulation (CCR), to read as follows:

[Note: Set forth below are the 2012 amendments to the California zero emission vehicle (ZEV) regulation. The text of the amendments is shown in <u>underline</u> to indicate additions and ~~strikeout~~ to indicate deletions, compared to the preexisting regulatory language.]

§ 1962.1 Zero-Emission Vehicle Standards for 2009 ~~and Subsequent~~<u>through 2017</u> Model Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles.

(a) ***ZEV Emission Standard.*** The Executive Officer shall certify new 2009 ~~and subsequent~~<u>through 2017</u> model <u>year</u> 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~~<u>subdivision</u> (b)(1)(C), produced by the manufacturer and delivered for sale in California that must be ZEVs, subject to the conditions in this ~~section~~<u>subdivision</u> 1962.1(b). <u>The ZEV requirement will be based on the annual NMOG production report for the appropriate model year.</u>

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***. <u>For purposes of calculating a manufacturer's requirement in subdivision 1962.1(b)(1) for model years 2009 through 2017, a manufacturer may use a three year average method or same model year method, as described below in sections 1. and 2. A manufacturer may switch methods on an annual basis. This production averaging is used to determine ZEV requirements specified in subdivision 1962.1 (b)(1)(A) only, and has no effect on a manufacturer's size determination, specified in section 1900. In applying the ZEV requirement, a PC, LDT1, or LDT2, that is produced by one manufacturer (e.g., Manufacturer A), but is marketed in California by another</u>

manufacturer (e.g., Manufacturer B) under the other manufacturer's (Manufacturer B) nameplate, shall be treated as having been produced by the marketing manufacturer (Manufacturer B).

1. For the 2009 through 2011 model years, a manufacturer's production volume of PCs and LDT1s, and LDT2s as applicable, produced and delivered for sale in California will be based on the 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 2003 through 2005 model years. 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, as applicable, produced by the manufacturer and delivered for sale in California that same model year.

2. For 2012 ~~and subsequent~~through 2017 model years, a manufacturer's production volume for the given model year will be based on the three-year average of the manufacturer's volume of PCs and LDT~~1~~s, ~~and LDT2s, as applicable,~~ produced and delivered for sale in California in the prior fourth, fifth and sixth model year (for example, 2013 model year ZEV requirements will be based on California production volume of PCs and LDT~~1~~s, ~~and LDT2s as applicable,~~ for the 2007 to 2009 model years, and 2014 model year ZEV requirements will be based on California production volume of PCs and LDTs, for the 2008 to 2010 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 LDT~~1~~s, ~~and LDT2s, as applicable,~~ produced by the manufacturer and delivered for sale in California that same model year. ~~For 2012 and subsequent model years, a manufacturer may, on an annual basis, select either the three-year average or the same model-year calculation method. In applying the ZEV requirement, a PC, LDT1, or LDT2 as applicable, that is produced by one manufacturer (e.g., Manufacturer A), but is marketed in California by another manufacturer (e.g., Manufacturer B) under the other manufacturer's (Manufacturer B) nameplate, shall be treated as having been produced by the marketing manufacturer (Manufacturer B).~~

(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~~subdivision (b)(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 ~~sections~~subdivisions 1962.1(b)(1)(B) and 1962.1(b)(1)(C), the volume of PCs, LDT1s, and LDT2s that 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 that ~~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 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, AT PZEVs, or credits generated by such vehicles. The remainder of the 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 manufacturer electing the alternative compliance requirements during model years 2009 through 2011 must produce ZEV credits equal to 0.82 percent of the manufacturer's average annual California sales of PCs and LDT1s, and LDT2s, as applicable, over the three year period from model years 2003 through 2005, ~~though~~through production, delivery for sale, and placement in service of ZEVs, other than NEVs and Type 0 ZEVs, using the credit substitution ratios for each ZEV Type compared to a Type III prescribed in the table below, or submit an equivalent number of credits generated by such vehicles.

ZEV Types	Credit Substitution Ratio Compared To A Type III ZEV
Type I	2
Type I.5	1.6
Type II	1.33
Type IV	0.8
Type V	0.57

i. Manufacturers may use credits generated by 1997-2003 model year ZEVs that qualify for an extended service multiplier under ~~section~~subdivision 1962.1(f) for a year during calendar years 2009-2011, provided that 33 years of such a multiplier will equal 4 ZEV credits.

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~~subdivision 1962.1(g)(5) shall not be counted towards compliance with this ~~section~~subdivision 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 ~~section~~subdivision 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 with the 2012 model year, these credits may no longer be used to meet the ZEV requirement specified in subdivision 1962.1(b)(2)(B)1.b.; they may be used as ~~Enhanced AT PZEV~~TZEV, AT PZEV, or PZEV credits. ZEV credits earned in model year 2009 ~~and subsequent~~through 2011 would be allowed to be carried forward for two years for application to the ZEV requirement. For example, ZEV credit earned in the 2010 model year would retain full flexibility through the 2012 model year. Starting 2013 model year, ~~at which time~~ that credit could only be used as ~~Enhanced AT PZEV~~TZEV, 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 ZEVs***. A manufacturer that, after electing the alternative requirements in ~~section~~subdivision 1962.1(b)(2)(B) for any model year from 2009 through 2011, fails to meet the requirement in ~~section~~subdivision 1962.1(b)(2)(B)1.b. by the end of the 2011 model year, shall be treated as subject to the primary requirements in ~~section~~subdivision 1962.1(b)(2)(A) for the 2009 through 2011 model years.

i. ***Rounding Convention.*** The number of ZEVs needed for a manufacturer under ~~section~~subdivision 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 manufacturer electing 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, AT PZEVs, or ~~Enhanced AT PZEVs~~TZEVs, or credits generated from such vehicles. ZEV credits generated for compliance with the alternative requirements during any given model year will be applied to the 45 percent which may be met with ZEVs, AT PZEVs, ~~Enhanced AT PZEVs~~TZEVs, or credits generated from such vehicles, but not PZEVs. The remainder of the 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~~subdivision 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 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 manufacturer that has previously elected the primary ZEV requirements for one or more of the 2009 through 2011 model years may prior to the end of the 2011 model year elect the alternative compliance requirements for the 2009 through 2011 model years upon a demonstration that it has complied with all of the applicable requirements for that period in ~~section~~subdivision 1962.1(b)(2)(B)1.b.

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

1. ***2012 through 2014 Requirements.*** On an annual basis, a~~A~~ manufacturer must meet the total ZEV obligation with ~~ZEVs or~~ ZEV credits generated by such vehicles, excluding credits generated by NEV~~s~~ and Type 0 ZEV~~s~~ equal to at least 0.79% of its annual sales, using either production volume determination method described in ~~section~~subdivision 1962.1(b)(1)(B). No more than 50% of the total obligation may be met with credits generated from PZEVs. No more than 75% of the total obligation may be met with credits generated from AT PZEVs. No more than 93.4% may be met with ~~Enhanced AT PZEVs~~ credits generated from TZEVs, Type 0 ZEVs, and NEVs, as limited in ~~section~~subdivision 1962.1(g)(6). The entire ~~requirement~~ obligation may be met solely with credits generated from ZEVs.

2. ***2015 through 2017 Requirements.*** On an annual basis, a~~A~~ manufacturer must meet the total ZEV obligation with ~~ZEVs or~~ ZEV credits generated by such vehicles, excluding credits generated by NEV~~s~~ and Type 0 ZEV~~s~~, equal to at least 3% of its annual sales, using either production volume determination method described in ~~section~~subdivision 1962.1(b)(1)(B). No more than 42.8% of the total obligation may be met with credits generated from PZEVs. No more than 57.1% of the total obligation may be met with credits generated from AT PZEVs. No more than 78.5% may be met with ~~Enhanced AT PZEVs~~ credits generated from TZEVs, Type 0 ZEVs, and NEVs, as limited in ~~section~~subdivision 1962.1(g)(6). The entire ~~requirement~~ obligation may be met solely with credits generated from ZEVs.

3. The following table enumerates a manufacturer's annual percentage obligation for the 2012 though 2017 model years if the manufacturer produces the minimum number of credits required to meet its ZEV obligation and the maximum percentage for the ~~Enhanced AT PZEV~~TZEV, AT PZEV, and PZEV categories.

Model Years	*Total ZEV Percent Requirement*	*Minimum ZEV floor*	*~~Enhanced AT PZEVs~~ TZEVs, Type 0s, or NEVs*	*AT PZEVs*	*PZEVs*
2012 – 2014	12	0.79	2.21	3.0	6.0
2015 – 2017	14	3.0	3.0	2.0	6.0

4. ***Use of Additional Credits for Transportation Systems.*** Any additional credits for transportation systems generated from ZEVs in accordance with ~~section~~subdivision 1962.1(g)(5) may be used to meet up to one tenth of the portion of the ZEV obligation which must be met with ZEVs, specified in ~~section~~subdivision 1962.1(b)(2)(D).

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

~~In the 2018 and subsequent model years, a manufacturer must meet a ZEV total percent requirement of 16 percent. The maximum portion of a manufacturer's percentage ZEV requirement that may be satisfied by PZEVs that are not Enhanced AT PZEVs or AT PZEVs, or credits generated by such vehicles, is limited to 6 percent of the manufacturer's applicable California PC, LDT1, and LDT2 production volume; Enhanced AT PZEVs and AT PZEVs or credits generated by such vehicles may be used either alone or in combination, to meet up to one-half of the manufacturer's remaining ZEV requirement.~~

(3) ***Requirements for Intermediate Volume Manufacturers*****.** ~~In~~ For 2009 ~~and~~ through 2017~~subsequent~~ model years, an intermediate volume manufacturer may meet its ZEV requirement with up to 100 percent PZEVs or credits generated by such vehicles. For 2015 through 2017 model years, the overall credit percentage requirement for an intermediate volume manufacturer will be 12% instead of 14%.

(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, TZEVs, AT PZEVs, 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 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.~~ ***[Reserved].***

(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~~ through 2017 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 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 (i.e., total production volume exceeds 180,000 vehicles in a three-year period), 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, or in model year 2018 (whichever occurs first), comply with all ZEV requirements for LVMs.

~~Requirements will begin in the fourth model year rather than the sixth model year when 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.~~ Requirements will begin in the sixth model year, or in model year 2018 (whichever occurs first) rather than the sixth model year when a manufacturer ceases to be an intermediate volume manufacturer in 2003 through 2017 due to the aggregation requirements in majority ownership situation.

(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

As Amended: March 22, 2012
Date of Hearing: January 26-27, 2012

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. When a manufacturer is simultaneously producing two model years of vehicles at the time of a change of ownership, the basis of determining next model year must be the earlier model year. The manufacturer's small, independent low, 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 calendar year occurs and the manufacturer is producing both 2010 and 2011 model year vehicles 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~~subdivisions 1962.1(b)(7)(A) and (B) will apply.

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

(1) ***Introduction.*** This ~~section~~subdivision 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.*** For 2009 through 2013 model years, ~~C~~certify the vehicle to the 150,000-mile SULEV exhaust emission standards for PCs and LDTs in ~~section~~subdivision 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. For 2014 through 2017 model years, certify the vehicle to the 150,000-mile SULEV 20 or 30 exhaust emission standards for PCs and LDTs in subdivision 1961.2(a)(1) , or to the 150,000-mile SULEV exhaust emission standards for PCs and

LDTs in subdivision 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.*** For 2009 through 2013 model years, ~~C~~certify the vehicle to the evaporative emission standards in ~~section~~subdivision 1976(b)(1)(E) (zero-fuel evaporative emissions standards). For 2014 through 2017 model years, certify the vehicle to the evaporative emission standards in subdivision 1976(b)(1)(G) or subdivision 1976(b)(1)(E);

(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 ~~section~~subdivision 2037(b)(2) and 2038(b)(2) 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~~subdivision 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:

Range	*Zero-emission VMT Allowance*
$EAER_u$ < 10 miles	0.0
$EAER_u$ ≥10 ~~miles~~ to 40 miles ~~and~~ ~~R_{cda} = 10 miles to 40 miles~~	$EAER_u$ x (1 – UF_{Rcda})/11.028
~~R_{cda}~~ $EAER_u$ > 40 miles	~~$EAER_{u40}$/ 29.63~~ ($EAER_{u40}$) x [1 – (UF_{40}*R_{cda}/$EAER_u$)]/ 11.028 Where, UF_{40}= utility factor at 40 miles $EAER_{u40}$= 40 miles

A vehicle cannot generate more than 1.39 zero-emission VMT PZEV allowances.

The urban equivalent all-electric range ($EAER_u$) and urban charge depletion range actual (R_{cda}) shall be determined in accordance with section ~~F.12~~G.5.4 and ~~F.5.5~~G.11.9, respectively, of the "California Exhaust Emission Standards and Test Procedures for 2009 ~~and Subsequent~~through 2017 Model Zero-Emission Vehicles, and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium Duty Vehicle Classes," incorporated by reference in section 1962.1(h). The utility factor (UF) based on the charge depletion range actual (urban cycle) (R_{cda}) shall be determined according to Section 4.5.2 Equation 6 and the "Fleet UF" Utility Factor Equation Coefficients in Section 4.5.2, Table 3 of SAE J2841 March 2009.

(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~~subdivision 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 5000 pounds per square inch or more, stored in nongaseous form, or at cryogenic temperatures, 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 ~~five~~four types of HEVs based on the criteria in the following table.

Characteristics	~~*Type C*~~	*Type D*	*Type E*	*Type F*	*Type G*
Electric Drive System Peak Power Output	~~≥ 10 kW~~	≥ 10 kW	≥ 50 kW	Zero-Emission VMT allowance; ≥ 10 mile all-electric ~~range (~~UDDS ~~drive cycle)~~range	Zero-Emission VMT allowance; ≥ 10 mile all-electric ~~range (~~US06 ~~drive cycle)~~ range
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. ***[Reserved]***

3. ***[Reserved]***

4. ***[Reserved]******~~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~~through 2017 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~~through 2017 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, including achieving 10 miles or more of all-electric UDDS range, qualifies for an additional advanced componentry allowance of 0.72 in the 2009 through 2011 model years, 0.67 in the 2012 through 2014 model years, and 0.57 in the 2015 ~~and subsequent~~through 2017 model years.

8. ***Type G HEVs.*** A PZEV that the manufacturer demonstrates to the reasonable satisfaction of the Executive Officer meets all of the criteria for a Type G HEV, including achieving 10 miles or more of all-electric US06 range, qualifies for an additional advanced componentry allowance of 0.95 in the 2009 through 2011 model years, 0.9 in the 2012 through 2014 model years, and 0.8 in the 2015 ~~and subsequent~~through 2017 model years.

9. ***Severability.*** In the event that all or part of ~~section~~subdivision 1962.1(c)(4)(B)1. - 8. is found invalid, the remainder of section 1962.1~~, including the remainder of section 1962.1(c)(4)(B)1.- 8. 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~~subdivision 1962.1(c)(6), multiplied by any PZEV introduction phase-in multiplier listed in ~~section~~subdivision 1962.1(c)(7), subject to the caps in ~~section~~subdivision 1962.1(c)(6)(B).

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

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

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

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

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

1. ***Cap for 2009 ~~and Subsequent~~through 2017 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 sold to a California motorist or is leased for three or more years to a California 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, qualifies for a phase-in multiplier of 1.25. This subdivision 1962.1 (c)(7)(B) multiplier will no longer be available after model year 2011.

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

(1) ***[Reserved].***

(2) ***[Reserved].***

(3) ***[Reserved].***

(4) ***[Reserved].***

(5) ***~~ZEV~~ Credits for 2009 ~~and Subsequent~~through 2017 Model Year~~s~~ ZEVs.***

(A) ***ZEV Tiers for Credit Calculations*.** ~~ZEV c~~Credits from a particular ZEV are based on the assignment of a given ZEV into one of the following eight 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)
	≥ 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)
Type V	≥ 300	Must be capable of replacing 285 miles (UDDS ZEV range) in ≤ 15 minutes per section 1962.1(d)(5)(B)

Type I.5x and Type IIx vehicles are defined in subdivision 1962.1(d)(5)(G) and (i)(10).

(B) ***Fast Refueling.*** The "fast refueling capability" requirement for a 2009 ~~and subsequent~~through 2017 model year Type III, IV, or V ZEV in ~~section~~subdivision 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 or V ZEV has the capability to accumulate at least 190 or 285 miles, respectively, in 15 minutes or less. For ZEVs that utilize more than one ZEV fuel, such as plug-in fuel cell vehicles, the Executive Officer may choose to waive these ~~section~~subdivision 1962.1(d)(5)(B) fast refueling requirements and base the amount of credit earned on UDDS ZEV range, as specified in ~~section~~subdivision 1962.1(d)(5)(A).

(C) ***~~ZEV~~ Credits for 2009 ~~and Subsequent~~through 2017 Model Year ZEVs.*** A 2009 ~~and subsequent~~through 2017 model-year ZEV, including a Type I.5x and Type IIx, 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~~through 2017 model-year ZEV earns additional credits based on the earliest year in which the ZEV is placed in service in California (not earlier than the ZEV's model year). The vehicle must be delivered for sale and placed in service in a Section 177 state or in California in order to earn the total credit amount. The Total credit amount will be earned in the state (i.e. California or a Section 177 state) in which the vehicle was delivered for sale. The following table identifies the total credits that a ZEV in each of the eight ZEV tiers will earn, including the credit not contingent on placement in service, if it is placed in service in the specified calendar year or by June 30 after the end of the specified calendar year. A vehicle is not eligible to receive credits if it is placed in service after December 31, five calendar years after the model year. For example, if a vehicle is produced in 2012, but does not get placed until January 1, 2018, the vehicle would no longer be eligible for ZEV credits.

Total Credit Earned by ZEV Type and Model Year for Production and Delivery for Sale and for Placement		
Tier	*Calendar Year in Which ZEV is Placed in Service*	
	2009-20~~7~~1	2012 - 2017~~2018+~~
NEV	0.30	0.30
Type 0	1	1
Type I	2	2
Type I.5	2.5	2.5
Type I.5x	n/a	2.5
Type II	3	3
Type IIx	n/a	3
Type III	4	~~3~~4
Type IV	5	~~3~~5
Type V	7	~~3~~2012-2014: 7 2015-2017: 9

(D) ***Multiplier for Certain ZEVs.*** 2009 through 2011 model-year ZEVs, excluding NEVs or Type 0 ZEVs, 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. This subdivision 1962.1 (d)(5)(D) multiplier will no longer be available after model year 2011.

(E) ***Counting Specified ZEVs Placed in a Section 177 State and in California.***

1. Provisions for 2009 Model Year.

a. Large volume manufacturers and intermediate volume manufacturers with credits earned from ZEVs, excluding NEVs and Type 0 ZEVs, that are either certified to the California ZEV standards or approved as part of an advanced technology demonstration program and are placed in service in a section 177 state, may be counted towards compliance with the California percentage ZEV requirements in ~~section~~subdivision 1962.1(b), including the requirements in ~~section~~subdivision 1962.1(b)(2)(B), as if they were delivered for sale and placed in service in California.

b. Large volume manufacturers and intermediate volume manufacturers with credits earned from ZEVs, excluding NEVs and Type 0 ZEVs, that are certified to the California ZEV standards or approved as part of an advanced technology demonstration program and are placed in service in California may be counted towards the percentage ZEV requirements of ~~any~~all section 177 states, including requirements based on ~~section~~subdivision 1962.1(b)(2)(B).

2. ***Provisions for 2010 through 2017 Model Years.*** Large volume manufacturers and intermediate volume manufacturers with credits earned from ~~Specified model year~~ ZEVs, including Type I.5x and Type IIx vehicles, and excluding NEVs and Type 0 ZEVs, that are either certified to the California ZEV standards applicable for the ZEV's model year or approved as part of an advanced technology demonstration program and are placed in service in California or in a section 177 state may be counted towards compliance in California and in all section 177 states, with the percentage ZEV requirements in ~~section~~subdivision 1962.1(b), provided that the credits are multiplied by the ratio of a~~n LVM's~~ manufacturer's applicable production volume for a model year, as specified in ~~section~~subdivision 1962.1(b)(1)(B), in the state receiving credit to the ~~LVM's~~manufacturer's applicable production volume (hereafter, "proportional value"), as specified in section 1962.1(b)(1)(B), for the same model year in California. Credits generated in a section 177 state will be earned at the proportional value in the section 177 state, and earned in California at the full value specified in ~~section~~subdivision 1962.1(d)(5)(C). However, credits generated by 2010 and 2011 model-year vehicles produced, delivered for sale, and placed in service or as part of an advanced technology demonstration program in California to meet ~~the~~ any section 177 state's requirements that implement ~~section~~subdivision 1962.1(b)(2)(B) are exempt from proportional value, with the number of credits exempted from proportional value allowed being limited to the number of credits needed to satisfy a manufacturer's section 177 state's requirements that implement ~~section~~subdivision 1962.1(b)(2)(B)1.b. The table below specifies the qualifying model years for each ZEV type that may be counted towards compliance in all section 177 states.

Vehicle Type	*Model Years:*
Type I, I.5, or II ZEV	2009 – ~~2014~~2017
Type III, IV, or V ZEV	2009 – 2017
Type I.5x or Type IIx	2012 – 2017

3. ***Optional Section 177 State Compliance Path.*** Large volume manufacturers and intermediate volume manufacturers that choose to elect the optional section 177 state compliance path must notify the Executive Officer and each section 177 state in writing no later than September 1, 2014.

a. ***Additional 2016 and 2017 Model Year ZEV Requirements.*** Large volume manufacturers and intermediate volume manufacturers that elect the optional section 177 state compliance path must generate additional 2012 through 2017 model year ZEV credits, including no more than 50% Type 1.5x and Type IIx vehicle credits and excluding all NEV and Type 0 ZEV credits, in each section 177 state equal to the following percentages of their sales volume determined under subdivision 1962.1(b)(1)(B):

Model Years	Additional Section 177 State ZEV Requirements
2016	0.75%
2017	1.50%

Subdivision 1962.1(d)(5)(E)2. shall not apply to any ZEV credits used to meet a manufacturer's additional 2016 and 2017 model year ZEV requirements under this subdivision 1962.1(d)(5)(E)3.a. ZEVs produced to meet a manufacturer's additional 2016 and 2017 model year ZEV requirements under this subdivision 1962.1(d)(5)(E)3.a. must be placed in service in the section 177 states no later than June 30, 2018.

i. Trading and Transferring ZEV Credits within the West Region Pool and East Region Pool. Manufacturers may trade or transfer ~~*specified model year*~~ ZEV credits, used to meet ~~*the same model year*~~ requirements in subdivision 1962.1(d)(5)(E)3.c, within the West Region pool, and will incur no premium on their credit values. For example, for a manufacturer to make up a ~~*2016 model year*~~ shortfall of 100 credits in State X, the manufacturer may transfer 100 ~~*(2016 model year)*~~ ZEV credits from State Y, within the West Region pool. Manufacturers may trade or ~~*transfer specific model year*~~ ZEV credits, used to meet ~~*the same model year requirements*~~ in subdivision 1962.1(d)(5)(E)3.c., within the East Region pool, and will incur no premium on their credit values. For example, for a manufacturer to make up a ~~*2016 model year*~~ shortfall of 100 credits in State W, the manufacturer may transfer 100 ~~*(2016 model year)*~~ ZEV credits from State Z, within the East Region pool.

ii. Trading and Transferring ZEV Credits between the West Region Pool and East Region Pool. Manufacturers may trade or transfer ~~specified model year~~ ZEV credits used to meet ~~the same model year~~ requirements in subdivision 1962.1(d)(5)(E)3.c. between the West Region pool and the East Region pool; however, any credits traded or transferred will incur a premium of 30% of their value. For example, in order for a manufacturer to make up a ~~2016 model year~~ shortfall of 100 credits in the West Region Pool, the manufacturer may transfer 130 ~~(2016 model year)~~ ZEV credits from the East Region Pool. No credits may be traded or transferred to the East Region pool or West Region pool from a manufacturer's California ZEV bank, or from the East Region pool or West Region pool to a manufacturer's California ZEV bank.

b. *Reduced TZEV Percentages.* Large volume manufacturers and intermediate volume manufacturers that elect the optional section 177 state compliance path and that fully comply with the additional 2016 and 2017 model year ZEV requirements in this subdivision 1962.1(d)(5)(E)3.a. are allowed to meet TZEV percentages reduced from the allowed TZEV percentages in subdivision 1962.1(b)(2)(D)2. and 3. in 2015 through 2017 model year in each section 177 state as enumerated below:

Model Year	2015	2016	2017
Existing TZEV Percentage	3.00%	3.00%	3.00%
Section 177 State Adjustment for Optional Compliance Path for TZEVs	75.00%	80.00%	85.00%
New Section 177 State Optional Compliance Path TZEV Percentage	2.25%	2.40%	2.55%

Manufacturers may meet the reduced TZEV percentages above with credits from ZEVs or credits from TZEVs. These reduced TZEV percentages also reduce the total ZEV percent requirement, as illustrated in subdivision 1962.1(d)(5)(E)3.c.

i. Trading and Transferring TZEV Credits within the West Region Pool and the East Region Pool. *Starting in model year 2015,* Manufacturers may trade or transfer ~~specified~~ TZEV credits used to meet ~~the same model year~~ subdivision 1962.1(d)(5)(E)3.c. requirements within the West Region pool, and will incur no premium on their credit values. For example, for a manufacturer to make up a ~~2016~~ shortfall of 100 credits in State X, the manufacturer may transfer 100 ~~(2016 model year)~~ TZEV credits from State Y, within the West Region pool. Manufacturers may trade or transfer TZEV credits to meet the same model year subdivision

1962.1(d)(5)(E)3.c. within the East Region pool, and will incur no premium on their credit values. For example, for a manufacturer to make up a ~~2016 model year~~ shortfall of 100 credits in State W, the manufacturer may transfer 100 ~~*(2016 model year)*~~ TZEV credits from State Z, within the East Region pool.

ii. Trading and Transferring TZEV Credits between the West Region Pool and the East Region Pool. Manufacturers may trade or transfer specified TZEV credits used to meet the same model year percentages in subdivision 1962.1(d)(5)(E)3.c. between the West Region pool and the East Region pool; however, any credits traded or transferred will incur a premium of 30% of their value. For example, in order for a manufacturer to make up a 2016 model year shortfall of 100 credits in the West Region Pool, the manufacturer may transfer 130 (2016 model year) TZEV credits from the East Region Pool. No credits may be traded or transferred to the East Region pool or West Region pool from a manufacturer's California ZEV bank, or from the East Region pool or West Region pool to a manufacturer's California ZEV bank.

c. ***Total Requirement Percentages.*** Requirements for the minimum ZEV floor, and allowed percentages for AT PZEVs and PZEVs in subdivision 1962.1(b) remain in effect for large and intermediate volume manufacturers choosing the optional section 177 state compliance path in each section 177 state. However, the optional section 177 compliance path requires manufacturers to meet additional ZEV requirements and allows manufacturers to meet reduced TZEV percentages as described above in subdivision 1962.1(d)(5)(E)3.a. and b. The table below enumerates the total annual percentage obligation in each section 177 state for the 2015 through 2017 model years if the manufacturer elects the optional section 177 state compliance path and produces the minimum number of credits required to meet its minimum ZEV floor and the maximum percentage allowed to be met with credits from TZEVs, AT PZEVs and PZEVs.

Years	Total ZEV Percent Requirement for Optional Compliance Path	Minimum ZEV Floor for Optional Compliance Path	TZEVs for Optional Compliance Path	AT PZEVs (no change)	PZEVs (no change)
2015	13.25%	3.00%	2.25%	2.00%	6.00%
2016	14.15%	3.75%	2.40%	2.00%	6.00%
2017	15.05%	4.50%	2.55%	2.00%	6.00%

d*. **Reporting Requirements.*** On an annual basis, by May 1st of the calendar year following the close of a model year, each manufacturer that elects the optional section 177 state compliance path shall submit, in writing, to the Executive

Officer and each section 177 state a report, including an itemized list, that demonstrates the manufacturer has met the requirements of this subdivision 1962.1(d)(5)(E)3. in each section 177 state as well as in the East Region pool and in the West Region pool. The itemized list shall include the following:

i. The manufacturer's total applicable volume of PCs and LDTs delivered for sale in each section 177 state within the pool, as determined under subdivision 1962.1(b)(1)(B).

ii. Make, model, vehicle identification number, credit earned, and section 177 state where delivery for sale and placement in service for ZEV occurred to meet the manufacturer's additional ZEV obligation under subdivision 1962.1(d)(5)(E)3.a.

iii. Make, model, vehicle identification number, credit earned, and section 177 state where delivery for sale of each TZEV occurred and section 177 state where delivery for sale and placement in service of each ZEV occurred to meet manufacturer's requirements under subdivision 1962.1(d)(5)(E)3.c.

e. ***Failure to Meet Optional Section 177 State Compliance Path Requirements.*** A manufacturer that elects the optional section 177 state compliance path and does not meet the requirements in subdivision 1962.1(d)(5)(E)3.a. by June 30, 2018 in all section 177 states within an applicable pool shall be treated as subject to the total ZEV percentage requirements in section 1962.1(b) for the 2015 through 2017 model years in each section 177 state and the pooling provisions in subdivision 1962.1(d)(5)(E)3.a. shall not apply. Any transfers of ZEV credits between section 177 states will be null and void, and ZEV credits will return to the section 177 state in which the credits were earned. A manufacturer that elects the optional section 177 state compliance path and does not meet the percentages in subdivision 1962.1(d)(5)(E)3.b. in a model year or make up their deficit within the specified time and with the specified credits allowed by subdivision 1962.1(g)(7)(A) in all section 177 states within an applicable pool shall be treated as subject to the total ZEV percentage requirements in section 1962.1(b) for the 2015 through 2017 model years and the pooling provisions in subdivision 1962.1(d)(5)(E)3.b. shall not apply. Any transfers of TZEV credits between section 177 states will be null and void if a manufacturer fails to comply, and TZEV credits will return to the section 177 state in which the credits were earned. Penalties shall be calculated separately by each section 177 state where a manufacturer fails to make up the ZEV deficits by the end of the 2018 model year.

f. The provisions in section 1962.1 shall apply to a manufacturer electing the optional section 177 state compliance path, except as specifically modified by this subdivision 1962.1(d)(5)(E)3.

(F) ***NEVs.*** Beginning in 2010 model year, to be eligible for the credit amount in ~~section~~subdivision 1962.1(d)(5)(C), NEVs must meet the following specifications and requirements in this ~~section~~subdivision 1962.1(d)(5)(F):

1. ***Specifications***. A 2010 through 2017 ~~and subsequent~~ model year NEV earns credit when it meets all the following specifications:

a. ***Acceleration.*** The vehicle has a 0-20 mph acceleration of 6.0 seconds or less when operating with a payload of 332 pounds and starting with the battery at a 50% state of charge.

b. ***Top Speed.*** The vehicle has a minimum top speed of 20 mph when operating with a payload of 332 pounds and starting with the battery at a 50% state of charge. The vehicle's top speed shall not exceed 25 mph when tested in accordance with 49 CFR 571.500 (68 FR 43972, July 25, 2003).

c. ***Constant Speed Range.*** The vehicle has a minimum 25-mile range when operating at constant top speed with a payload of 332 pounds and starting with the battery at 100% state of charge.

2. ***Battery Requirement*.** A 2010 through 2017 ~~and subsequent~~ model year NEV must be equipped with one or more sealed, maintenance-free batteries.

3. ***Warranty Requirement*.** A 2010 through 2017 ~~and subsequent~~ model year NEV drive train, including battery packs, must be covered for a period of at least 24 months. ~~At least~~ The first 6 months ~~of the first 12 months~~ of the NEV warranty period must be covered by a full warranty; the ~~remainder of the first 12 months and all of the second 12 months of the~~ remaining warranty period may be optional extended warranties (available for purchase) and may be prorated. If the extended warranty is prorated, the percentage of the battery pack's original value to be covered or refunded must be at least as high as the percentage of the prorated coverage period still remaining. For the purpose of this computation, the age of the battery pack must be expressed in intervals no larger than three months. Alternatively, a manufacturer may cover 50 percent of the original value of the battery pack for the full period of the extended warranty.

4. Prior to allowance approval, the Executive Officer may request that the manufacturer provide copies of representative vehicle and battery warranties.

5. ***NEV Charging Requirements.*** Model year 2014 through 2017 NEVs must meet charging connection standard portion of the requirements specified in subdivision 1962.3(c)(2).

(G) ***Type I.5x and Type IIx Vehicles.*** Beginning in 2012 model year, to be eligible for the credit amount in subdivision 1962.1(d)(5)(C), Type I.5x and Type IIx vehicles must meet the following specifications and requirements:

1. ***PZEV Requirements.*** Type I.5x and Type IIx vehicles must meet all PZEV requirements, specified in subdivision 1962.1(c)(2)(A) through (D).

2. ***Type G Requirements.*** Type I.5x and Type IIx vehicles must meet the requirements for Type G advanced componentry allowance, specified in subdivision 1962.1(c)(4)(B).

3. ***APU Operation.*** The vehicle's UDDS range after the APU first starts and enters "charge sustaining hybrid operation" must be less than or equal to the vehicle's UDDS all-electric test range prior to APU start. The vehicle's APU cannot start under any user-selectable driving mode unless the energy storage system used for traction power is fully depleted.

4. ***Minimum Zero Emission Range Requirements.***

Vehicle Category	Zero Emission UDDS Range
Type I.5x	≥ 75 miles, < 100 miles
Type IIx	≥ 100 miles

(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, in the 2009 through 2011 calendar years. 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. Additional credit cannot be earned after model year 2011.

(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~~subdivision 1962.1(b) shall earn ~~ZEV~~ credits in accordance with this ~~section~~subdivision 1962.1(g).

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

(A) ***Credits from ZEVs.*** For model years 2009 through 2014, ~~T~~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, or LDT2s as applicable, for 2009 through 2011 model years, and for PCs and LDT1s for 2012 through 2014 ~~that~~ model years.

For model years 2015 through 2017, the amount of credits earned by a manufacturer in a given model year from ZEVs shall be expressed in units of credits 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, or, if applicable, requirements specified under subdivision 1962.1(d)(5)(E)3., for the model year subtracted from the number of ZEV credits produced and delivered for sale in California by the manufacturer in the model year or model years.

(B) ***Credits from PZEVs.*** For model years 2009 through 2014, ~~T~~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, or LDT2s as applicable, for 2009 through 2011 model years, and for PCs and LDT1s for 2012 through 2014 ~~that~~ model years.

For model years 2015 through 2017, the amount of credits earned by a manufacturer in a given model year from PZEVs shall be expressed in units of credits, and shall be equal to the number of credits from PZEVs produced and delivered for sale in California that the manufacturer applies towards meeting the ZEV requirements, or, if applicable, requirements specified under subdivision 1962.1(d)(5)(E)3., for the model year subtracted from the number of PZEV credits produced and delivered for sale in California by the manufacturer in the model year or model years.

(C) ***Separate Credit Accounts.*** The number of credits from a manufacturer's [i] ZEVs, [ii] Type I.5x and Type IIx vehicles, [~~ii~~iii] ~~Enhanced AT PZEVs~~TZEVs, [~~iii~~iv] AT PZEVs, [~~i~~v] all other PZEVs, and [vi] NEVs shall each be maintained separately.

(D) Rounding Credits. For model year 2012 through 2014, ZEV credits and debits shall be rounded to the nearest 1/1000th only on the final credit and debit totals using the conventional rounding method. For model year 2015 through 2017, ZEV credits and debits shall be rounded to the nearest 1/100th only on the final credit and debit totals using the conventional rounding method.

(E) *Converting g/mi NMOG ZEV Credits to ZEV Credits.* After model year 2014 compliance, all manufacturer ZEV, Type I.5x and Type IIx, TZEV, AT PZEV, PZEV, and NEV accounts will be converted from g/mi NMOG to credits. Each g/mi NMOG account balance will be divided by 0.035. Starting in model year 2015, credits will no longer be expressed in terms of g/mi credits, but only as credits.

(F) *Converting PZEV and AT PZEV Credits after Model Year 2017.* After model year 2017 compliance, a manufacturer's PZEV and AT PZEV credit accounts will be converted to be used for compliance with requirements specified in subdivision 1962.2(b). For LVMs, PZEV accounts will be discounted 93.25%, and AT PZEV accounts will be discounted 75%. For IVMs, PZEV accounts and AT PZEV accounts will be discounted 75%. This will be a one time calculation after model year 2017 compliance is complete.

(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~~subdivision 1962.1(g) if the manufacturer so designates.

(4) *ZEV Credits for Advanced Technology Demonstration Programs.*

(A) *TZEVs.* ~~In model years~~ For 2009 through 2014 model years, ~~ZEVs and Enhanced AT PZEVs, excluding NEVs,~~ TZEVs 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 operated 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 25 vehicles per model, per ZEV state, per year under this ~~section~~subdivision 1962.1(g)(4). A manufacturer's vehicles in excess of the 25-vehicle cap will not be eligible for advanced technology demonstration program credits.

(B) ***ZEVs.*** In model years 2009 through 2017, ZEVs, including Type I.5x and IIx vehicles, excluding NEVs and Type 0 ZEVs, 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 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 operated 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 25 vehicles per model, per ZEV state, per year under this subdivision 1962.1(g)(4). A manufacturer's vehicles in excess of the 25-vehicle cap will not be eligible for advanced technology demonstration program credits.

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

(A) ***General.*** In model years 2009 through 2011, a ZEV placed, for two or more years, 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 subdivision (g)(5)(C) below. In model years 2012~~09 and subsequent~~ through 2017, a ZEV, Type I.5x and Type IIx vehicles, or TZEV placed, for two or more years, 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 subdivision (d)(5)(E)2. and as provided in ~~section~~subdivision (g)(5)(C) below . In model years 2009 through 2011, an ~~Enhanced AT PZEV,~~ AT 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~~subdivision (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 p art of a project that uses an innovative transportation system as described in ~~section~~subdivision (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, Type I.5x and Type IIx vehicles, ~~Enhanced AT PZEVs~~TZEV, 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
~~Enhanced AT PZEV~~ TZEV	2009 through 2011	4	2
ZEV	2009 through 2011	6	3
~~Enhanced AT PZEV~~ TZEV	2012 ~~and subsequent~~through 2017	~~1~~0.5	~~1~~0.5
ZEV and Type I.5x and Type IIx vehicles	2012 ~~and subsequent~~through 2017	~~2~~0.75	~~1~~0.75

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

1. ***ZEVs*.** Credits earned or allocated by ZEVs or Type I.5x and Type IIx vehicles pursuant to this ~~section~~subdivision (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, and may be used to satisfy up to one-tenth of a manufacturer's ZEV obligation which must be met with ZEVs, as specified in ~~section~~subdivision 1962.1(b)(2)(D)3.

2. ***~~Enhanced AT PZEVs~~TZEVs*.** Credits earned or allocated by ~~Enhanced AT PZEVs~~TZEVs pursuant to this ~~section~~subdivision (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, or, if applicable, up to one-tenth of the total ZEV percentages specified under subdivision 1962.1(d)(5)(E)3., but may only be used in the same manner as other credits earned by vehicles of that category.

3. ***AT PZEVs*.** Credits earned or allocated by AT PZEVs pursuant to this ~~section~~subdivision (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.

4. ***PZEVs*.** Credits earned or allocated by PZEVs pursuant to this ~~section~~subdivision (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 Transportation System 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 for the time specified in subdivision 1962.1(g)(5)(A). 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. Credits will no longer be allocated for vehicles placed in transportation systems after 2017 model year.

(6) ***Use of ZEV Credits*****.** For model years 2009 through 2014, ~~A~~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~~subdivision 1962.1(b). For model years 2015 through 2017, a manufacturer may meet the ZEV requirements in any given model year by submitting to the Executive Officer a commensurate amount of ZEV credits, consistent with subdivision 1962.1(b). Credits in each of the categories may be used to meet the requirement for that category as well as the requirements for lesser credit earning ZEV categories, but shall not be used to meet the requirement for a greater credit earning ZEV category. For example, credits produced from ~~Enhanced AT PZEVs~~TZEVs may be used to comply with AT PZEV requirements, but not with the portion that must be satisfied with ZEVs. These credits may be earned previously by the manufacturer or acquired from another party.

(A) ***NEVs.*** 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 percentage limits described in the following table:

Model Years	***ZEV Obligation that:***	***Percentage limit for NEVs allowed to meet each Obligation[1]:***
2009 – 2011	Must be met with ZEVs	50%
2009	May be met with AT PZEVs but not PZEVs	75%
2010 – 2011		50%
2009 – 2011	May be met with PZEVs	No Limit
2012 –	Must be met with ZEVs	0%

~~2014~~2017	May be met with ~~Enhanced AT PZEVs~~TZEVs and AT PZEVs	50%
	May be met with PZEVs	No Limit

[1] If applicable, obligation in this table means requirements specified under subdivision 1962.1(d)(5)(E)3..

Additionally, credits earned from NEVs ~~offered for sale or~~ placed in service in model years 2006 through 2017 ~~or later~~ can be used to meet the percentage limits described in the following table:

Model Years	***ZEV Obligation that:***	***Percentage Limit for NEVs allowed to meet each Obligation[1]:***
2009 - 2011	May be met through compliance with Primary Requirements	No Limit
	May be met through compliance with Alternative Requirements, and must be met with ZEVs	0%
	May be met through compliance Alternative Requirements, and may be met with AT PZEVs or PZEVs	No Limit
2012 – ~~2014~~2017	Must be met with ZEVs	0%
	May be met with ~~Enhanced AT PZEVs~~TZEVs, AT PZEVs, or PZEVs	No Limit

[1] If applicable, obligation in this table means requirements specified under subdivision 1962.1(d)(5)(E)3..

This limitation applies to NEV credits earned by the same manufacturer or earned by another manufacturer and acquired.

(B) ***Carry forward provisions for LVMs for 2009-2011 Model Years***. ~~ZEV c~~Credits from ZEVs, excluding credits generated from NEVs generated from excess production in ~~model years~~ 2009 through 2011 model years~~and subsequent~~, including those acquired from another party, may be carried forward and applied to the ZEV minimum floor requirement specified in ~~section~~subdivisions 1962.1(b)(2)(B)1.b. and (b)(2)(D) 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~~TZEVs, AT PZEVs, or PZEVs. For example, ZEV credit earned in 2010 would retain full flexibility through 2012, after which time that credit could only be used as ~~Enhanced AT PZEV~~TZEV, AT PZEV, or PZEV credits.

(C) ***Carry forward provisions for manufacturers other than LVMs for 2009-2011 Model Years***. ~~ZEV c~~Credits generated from ZEVs, excluding credits generated from NEVs, from 2009 through 2011~~and subsequent~~ model year production by manufacturers that are not LVMs may be carried forward by the manufacturer producing the ~~ZEV~~ credit until the manufacturer becomes subject to the LVM requirements, after the transition period permitted in ~~section~~subdivision 1962.1(b)(7)(A). When subject to the LVM requirements, a manufacturer must comply with the provisions of ~~section~~subdivision 1962.1(g)(6)(B).

~~ZEV c~~Credits traded by a manufacturer other than a LVM to any other manufacturer, including a LVM, are subject to ~~section~~subdivision 1962.1(g)(6)(B), beginning in the model year in which they were produced (e.g., a 2009 model year ~~ZEV~~ credit traded in calendar year 2010 can only be applied towards the portion of the manufacturer's requirement that must be met with ZEVs through model year 2011; beginning in model year 2012, the credit can only be applied to the portion of the manufacturer's requirement that may be met with ~~Enhanced AT PZEVs~~TZEVs, AT PZEVs, or PZEVs).

(D) ***Type I.5x and Type IIx Vehicles.*** Credits earned from Type I.5x and Type IIx vehicles offered for sale or placed in service may meet up to 50% of the portion of a manufacturer's requirement that must be met with credits from ZEVs.

(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 generated by ZEVs, for model year 2009 through 2014, and the commensurate amount of credits generated by ZEVs for model year 2015 through 2017. The amount of ~~g/mi ZEV~~ credits required to be submitted shall be calculated by [i] adding the number of credits from ZEVs produced and delivered for sale in California by the manufacturer for the model year to the number of allowances from partial ZEV allowance vehicles produced and delivered for sale in California by the manufacturer for the model year (for a LVM, not to exceed that permitted under ~~section~~subdivision 1962.1(b)(2)), [ii] subtracting that total from the number of ZEV~~s~~ credits required to be produced and delivered for sale in California by the manufacturer for the model year, and, for model year 2009 through 2014 compliance, [iii] multiplying the resulting value by the fleet average requirements for PCs and LDT1s for the model year in which the deficit is incurred. Credits earned by delivery for sale of Type I.5x and Type IIx vehicles, TZEV, NEV, AT PZEV, and PZEV are not allowed to be used to fulfill a manufacturer's ZEV deficit; only credits from ZEVs may be used to fulfill a manufacturer's ZEV deficit.

(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, for model years 2009 through 2014, and credits for model years 2015 through 2017, and does not make up ZEV deficits within the specified time allowed by ~~section~~subdivision 1962.1(g)(7)(A) 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 allowed by ~~section~~subdivision 1962.1(g)(7)(A). For the purposes of Health and Safety Code section 43211, the number of vehicles not meeting the state board's standards shall be equal to the manufacturer's credit deficit, rounded to the to the nearest 1/1000th for model years 2009 through 2014 and rounded to the nearest 1/100th for model years 2015 through 2017, calculated according to the following equations, provided that the percentage of a ~~LVM's~~ manufacturer's ZEV requirement for a given model year that may be satisfied with PZEV allowance vehicles or credit from such vehicles may not exceed the percentages permitted under ~~section~~subdivision ~~1962.1(b)(2)(A)~~1962.1(b)(2):

For 2009 through 2014 model years:

(No. of ~~ZEVs~~ credits required to be ~~produced and delivered for sale in California~~ generated 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 compliance for the model year) / (the fleet average requirement for PCs and LDT1s for the model year)~~]~~

For 2015 through 2017 model years:

(No. of credits required to be generated for the model year) – (Amount of credits submitted for compliance for the model year)

(h) ***Test Procedures.***

(1) ***Determining Compliance***. 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~~through 2017 Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," adopted by the state board on [insert date here], and last amended [insert date here], which is incorporated herein by reference.

(2) ***NEV Compliance.*** The test procedures for determining compliance with ~~section~~subdivision 1962.1(d)(5)(F)1. are set forth in ETA-NTP002 (revision 3) "Implementation of SAE Standard J1666 May 93: Electric Vehicle Acceleration, Gradeability, and Deceleration Test Procedure" adopted on December 1, 2004, and ETA-NTP004 (revision 2) "Electric Vehicle Constant Speed Range Tests" adopted on December 1,2004.

(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) "Auxiliary power unit" or "APU" means any device that provides electrical or mechanical energy, meeting the requirements of subdivision 1962.1(c)(2), to a Type I.5x or Type IIx vehicle, after the zero emission range has been fully depleted. A fuel fired heater does not qualify under this definition for an APU.

(~~2~~3) "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~~4) "Charge depletion range actual" or "R_{cda}" means the distance achieved by a hybrid electric vehicle on the urban driving cycle at the point when the zero-emission energy storage device is depleted of off-vehicle charge and regenerative braking derived energy.

(5) "Conventional rounding method" means to increase the last digit to be retained when the following digit is five or greater. Retain the last digit as is when the following digit is four or less.

(6) "East Region pool" means the combination Section 177 states east of the Mississippi River.

(4~~7~~) "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~~8) "Enhanced AT PZEV" means any model year 2009 through 2011 PZEV that has an allowance of 1.0 or greater per vehicle without multipliers and makes use of a ZEV fuel. Enhanced AT PZEV means Transitional Zero Emission Vehicle.

(~~6~~9) "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.

(~~7~~10) "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~~DMV.

(11) "Proportional value" means the ratio of a manufacturer's California applicable sales volume to the manufacturer's Section 177 state applicable sales volume. In any given model year, the same applicable sale volume calculation method must be used to calculate proportional value.

(12) "Range Extended Battery Electric Vehicle" means a vehicle powered predominantly by a zero emission energy storage device, able to drive the vehicle for more than 75 all-electric miles, and also equipped with a backup APU, which does not operate until the energy storage device is fully depleted, and meeting requirements in subdivision 1962.1(d)(5)(G),

(~~8~~13) "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.

(~~9~~14) "Section 177 state" means a state that is administering the California ZEV requirements pursuant to section 177 of the federal Clean Air Act (42 U.S.C. § 7507).

(15) "Transitional Zero Emission Vehicle" means a PZEV that has an allowance of 1.0 or greater, and makes use of a ZEV fuel.

(~~10~~16) "Type 0, I, I.5, II, III, IV, and V ZEV" all have the meanings set forth in section 1962.1(d)(5)(A).

(17) "West Region pool" means the combination of Section 177 states west of the Mississippi River.

(~~11~~18) "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.
"APU" means auxiliary power unit.
"AT PZEV" means advanced technology partial zero-emission vehicle.
"CFR" means Code of Federal Regulations.
"DMV" means the California Department of Motor Vehicles.
"EAER" means equivalent all-electric range.
"$EAER_{u40}$" means the equivalent all-electric range that a 40 mile R_{cda} plug-in hybrid electric vehicle achieves.

"FR" means Federal Register.
"HEV" means hybrid-electric vehicle.
"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.
"LVM" means large volume manufacturer.
"MDV" means medium-duty vehicle.
"Non-Methane Organic Gases" or "NMOG" means the total mass of oxygenated and non-oxygenated hydrocarbon emissions.
"NEV" means neighborhood electric vehicle.
"NOx" means oxides of nitrogen.
"PC" means passenger car.
"PZEV" means partial allowance zero-emission vehicle, any vehicle that is delivered for sale in California and that qualifies for a partial ZEV allowance of at least 0.2.
"R_{cda}" means charge depletion actual range (urban Cycle).
"SAE" means Society of Automotive Engineers.
"SULEV" means super-ultra-low-emission-vehicle.
"TZEV" means transitional zero emission vehicle.
"Type I.5x" means range extended 75 mile to 100 mile all electric range battery electric vehicle.
"Type IIx" means range extended 100 mile or greater all electric range battery electric vehicle.
"UDDS" means urban dynamometer driving cycle.
"UF" means utility factor.
"US06" means the US06 Supplemental Federal Test Procedure
"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~~ TZEVs, AT PZEVs, and PZEVs for the 2009 through 2017~~and subsequent~~ model years; and

(2) Each manufacturer's annual credit balances for 2010 through 2017 ~~and subsequent~~ years for:

(A) Each type of vehicle: ZEVs (minus NEVs), Type I.5x, and Type IIx vehicles, NEVs, ~~Enhanced AT PZEVs~~TZEVs, AT PZEVs, and PZEVs; and

(B) Advanced technology demonstration programs; and

(C) Transportation systems; and

(D) Credits earned under ~~section~~subdivision 1962.1(d)(5)(C), including credits acquired from, or transferred to another party.

Note: Authority cited: Sections 39600, 39601, 43013, 43018, 43101, 43104 and 43105, Health and Safety Code. Reference: Sections 38562, 39002, 39003, 39667, 43000, 43009.5, 43013, 43018, 43018.5, 43100, 43101, 43101.5, 43102, 43104, 43105, 43106, 43204, 43205, 43206, and 43205.5, Health and Safety Code.

Attachment B-2

California Environmental Protection Agency
AIR RESOURCES BOARD

FINAL

CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 2009 THROUGH 2017 MODEL ZERO-EMISSION VEHICLES AND HYBRID ELECTRIC VEHICLES, IN THE PASSENGER CAR, LIGHT-DUTY TRUCK AND MEDIUM-DUTY VEHICLE CLASSES

Adopted: December 17, 2008
Amended: December 2, 2009
Amended: [insert date]

[Note: Set forth below are the 2012 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.]

NOTE: This document is incorporated by reference in section 1962.1, title 13, California Code of Regulations (CCR). Additional requirements necessary to complete an application for certification of zero-emission vehicles and hybrid electric vehicles are contained in other documents that are designed to be used in conjunction with this document. These other documents include:

1. "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);

2. "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" (incorporated by reference in section 1976(c), title 13, CCR);

3. "California Refueling Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" (incorporated by reference in section 1978(b), title 13, CCR);

4. OBD II (section 1968, et seq. title 13, CCR, as applicable);

5. "California Environmental Performance Label Specifications for 2009 and Subsequent Model Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles" (incorporated by reference in 1965, title 13, CCR);

6. Warranty Requirements (sections 2037 and 2038, title 13, CCR);

7. "Specifications for Fill Pipes and Openings of Motor Vehicle Fuel Tanks" (incorporated by reference in section 2235, title 13, CCR);

8. Guidelines for Certification of Federally Certified Light-Duty Motor Vehicles for Sale in California (incorporated by section 1960.5, title 13, CCR); and

9. "California Non-Methane Organic Gas Test Procedures," (incorporated by reference in section 1961(d), title 13, CCR).

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CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 2009 THROUGH 2017~~AND SUBSEQUENT~~ MODEL ZERO-EMISSION VEHICLES AND 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 through 2017 ~~and subsequent~~ model-year zero-emission passenger cars, light-duty trucks, and medium-duty vehicles, and 2009 through 2017 ~~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.

B. Definitions and Terminology.

1. 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 (CFR) §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" means the total miles driven electrically (with the engine off) before the engine turns on for the first time, after the battery has been fully charged. ~~For a blended off-vehicle charge capable hybrid electric vehicle, the equivalent all-electric range shall be considered the "all-electric range" of the vehicle.~~

"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).

"Alternate Continuous Urban Test Schedule" means a series of the following sequence: UDDS, 10 minute key-off hot soak, UDDS, and 10-20 minute key-off hot soak. This alternate procedure may be substituted for the Continuous Urban Test Schedule when the Continuous Urban Test Schedule cannot be performed.

"Alternate Continuous Highway Test Schedule" means a series of the following sequence: HFEDS, 15 second key-on pause, HFEDS, and 10-20 minute key-off hot soak or a 15 second key-on pause. This alternate procedure may be substituted for the Continuous Highway Test Schedule when the Continuous Highway Test Schedule cannot be performed.

"Auxiliary power unit" <u>or "APU"</u> 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. <u>For the purposes of range extended battery electric vehicles, auxiliary power unit means any device that provides electrical or mechanical energy, meeting the requirements of subdivision C.3.2, to a Type I.5x or Type IIx vehicle, after the zero emission range has been fully depleted. A fuel fired heater does not qualify under this definition for an APU.</u>

"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.

"Blended off-vehicle charge capable hybrid electric vehicle" means an off-vehicle charge capable hybrid electric vehicle that uses the engine to supplement battery/electric motor power during charge depleting operation.

"Blended operation mode" means an operating mode in which the energy storage state-of-charge decreases, on average, while the vehicle is driven and the engine is used occasionally to support power requests.

"Charge-depleting net energy consumption" means the net electrical energy, E_{cd}, measured in watt-hours consumed by vehicle over the charge depleting cycle range, R_{cdc}. E_{cd} can be expressed as AC or DC watt hours, where appropriate.

"Charge-depleting (CD) mode" means an operating mode in which the energy storage state-of-charge (SOC) may fluctuate but, on average, decreases while the vehicle is driven. 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 depleting actual range or R_{cda}" means the distance traveled on the Urban Charge Depleting Test Procedure at which the state-of-charge is first equal to the average state-of-charge of the two consecutive UDDS used to end the Urban Charge Depleting Test Procedure. This range must be reported to the nearest 0.1 miles. (See section F.11.9.)

"Charge depleting actual range, highway or R_{cdah}" means the distance traveled on the Highway Charge Depleting Test Procedure at which the state-of-charge is first equal to the average state-of-charge of the HFEDS used to end the Highway Charge Depleting Test Procedure. This range must be reported to the nearest 0.1 miles.

"Charge depleting cycle range or R_{cdc}" means the distance traveled on the Urban or Highway Charge Depleting Procedure up to the test cycle prior to where the state-of-charge is above the lower bound state-of-charge tolerance for one test cycle. This range will appear as the sum of a discrete number of test cycle distances. This range shall be reported to the nearest 0.1 miles. (See section F.11.8.)

"Charge-sustaining net energy consumption" means the net electrical energy, Ecs, measured in watt-hours consumed by vehicle during charge sustaining operation. For charge sustaining operation, this number should be ~ 0.

"Charge-sustaining (CS) mode" means an operating mode in which the energy storage SOC may fluctuate but, on average, is maintained at a certain level while the vehicle is driven. 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.

"Continuous Urban Test Schedule" means a repeated series comprised of an Urban Dynamometer Driving Schedules (UDDS), 40 CFR, Part 86, Appendix I, which is incorporated herein by reference; each test is followed by a 10 minute key-off soak period.

"Continuous Highway Test Schedule" means a repeated series comprised of four consecutive key-on Highway Fuel Economy Driving Schedules (HFEDS) with a 15 second key-on pause in-between each HFEDS. If this schedule cannot be performed continuously, a key-off soak up to 30 minutes is permitted after every fourth HFEDS.

"Continuous US06 Test Schedule" means a repeated series of US06 driving schedules (US06) with a key-on idle period of not less than one minute and not greater than two minutes between each US06.

"**Conventional rounding method**" means to increase the last digit to be retained when the following digit is five or greater. Retain the last digit as is when the following digit is four or less.

"**East Region pool**" means the combination Section 177 states east of the Mississippi River.

"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 model year 2009 through 2011 PZEV that has an allowance of 1.0 or greater per vehicle without multipliers and makes use of a ZEV fuel. Enhanced AT PZEV means Transitional Zero Emission Vehicle.

"Equivalent all-electric range" means the portion of the total charge depleting range attributable to the use of electricity from the battery over the charge depleting range test.

"Fuel cell vehicle" or "FCV" means any vehicle that receives propulsion solely from an onboard fuel cell power system.

"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.

"Grid-connected hybrid electric vehicle" means a hybrid electric vehicle that has the capacity for the battery to be recharged from an off-board source of electricity and has some all-electric range.

"Highway Fuel Economy Driving Schedule" or "HFEDS" means highway fuel economy driving schedule. See 40 CFR Part 600 §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.

"Hybrid fuel cell vehicle" or "HFCV" means any vehicle that receives propulsion energy from both an onboard fuel cell power system and either a battery or a capacitor.

"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 (July 1, 2000), and is certified to zero-emission vehicle standards.

“NIST” means the National Institute of Standards and Technology.

“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. A grid-connected hybrid electric vehicle is one example of an off-vehicle charge capable hybrid electric vehicle.

“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.

“Proportional value” means the ratio of a manufacturer’s California applicable sales volume to the manufacturer’s Section 177 state applicable sales volume. In any given model year, the same applicable sale volume calculation method must be used to calculate proportional value.

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

“Range Extended Battery Electric Vehicle” means a vehicle powered predominantly by a zero emission energy storage device, able to drive the vehicle for more than 75 all-electric miles, and also equipped with a backup APU, which does not operate until the energy storage device is fully depleted, and meeting requirements in subdivision C.4.5(g),

“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.

“SAE J2572” means the “Recommended Practice for Measuring Fuel Consumption and Range of Fuel Cell and Hybrid Fuel Cell Vehicles Fuelled by Compressed Gaseous Hydrogen,” as published by the Society of Automotive Engineers in October, 2008.

“Section 177 State” means a state that is administering the California ZEV requirements pursuant to section 177 of the federal Clean Air Act (42 U.S.C. § 7507).

“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 E.9 and F.10 of these procedures for tolerance specifications.

“SOC Criterion” means the state-of-charge criterion that is applied to a 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.

“Transitional Zero Emission Vehicle” means a PZEV that has an allowance of 1.0 or greater, and makes use of a ZEV fuel.

“Type 0, I, I.5, II, III, IV, and V ZEV” all have the meanings set forth in section C.4.4(a).

“Type I.5x” means range extended 75 mile to 100 mile all electric range battery electric vehicle.

"Type IIx" means range extended 100 mile or greater all electric range battery electric vehicle.

"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.

"**West Region pool**" means the combination of Section 177 states west of the Mississippi River.

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

"Zero-emission Vehicle Miles Traveled" or 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.

2. Terminology.

	Abbreviation	Units
Charge Depleting Actual Range (urban cycle)	R_{cda}	mi
Charge Depleting to Charge Sustaining Range	R_{cdcs}	mi
Charge Depleting Net Energy Consumption	E_{cd}	wh
Charge Depleting CO_2 Produced	M_{cd}	g/mi
Charge Sustaining CO_2 Produced	M_{cs}	g/mi
Highway Charge Depleting Actual Range	R_{cdah}	mi
Highway Charge Depleting Cycle Range	R_{cdch}	mi
Highway Electric Range Fraction	ERF_h	%
Highway Equivalent All-Electric Range	$EAER_h$	mi
Highway Equivalent All-Electric Range Energy Consumption	$EAEREC_h$	wh/mi
Urban Charge Depleting Cycle Range	R_{cdcu}	mi
Urban Electric Range Fraction	ERF_u	%
Urban Equivalent All-Electric Range	$EAER_u$	mi
Urban Equivalent All-Electric Range scaled to 40 mi limit	$EAER_{u40}$	mi
Urban Equivalent All-Electric Range Energy Consumption	$EAEREC_u$	wh/mi

C. Zero-Emission Vehicle Standards.

1. ZEV Emission Standard. The Executive Officer shall certify new 2009 ~~and subsequent~~through 2017 model year 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~~subdivision C.2.2(c), produced by the manufacturer and delivered for sale in California that must be ZEVs, subject to the conditions in ~~section~~subdivision C.2.2. The ZEV requirement will be based on the annual NMOG production report for the appropriate model year.

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.* For purposes of calculating a manufacturer's requirement in subdivision C.2.1 for model years 2009 through 2017, a manufacturer may use a three year average method or same model year method, as described below in sections 1. and 2. A manufacturer may switch methods on an annual basis. This production averaging is used to determine ZEV requirements specified in subdivision C.2.1(a) only, and has no effect on a manufacturer's size determination, specified in section 1900. For example, in applying the ZEV requirement, a PC, LDT1, or LDT2, that is produced by one manufacturer (e.g., Manufacturer A), but is marketed in California by another manufacturer (e.g., Manufacturer B) under the other manufacturer's (Manufacturer B) nameplate, shall be treated as having been produced by the marketing manufacturer (Manufacturer B).

(1) For the 2009 through 2011 model years, a manufacturer's production volume of PCs and LDT1s, and LDT2s as applicable, produced and delivered for sale in California will be based on the 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 2003 through 2005 model years. 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, as applicable, produced by

<u>the manufacturer and delivered for sale in California that same model year.</u>

<u>(2)</u> For 2012 ~~and subsequent~~<u>through 2017</u> model years, a manufacturer's production volume for the given model year will be based on the three-year average of the manufacturer's volume of PCs and LDT~~1s, and LDT2s, as applicable,~~ produced and delivered for sale in California in the prior fourth, fifth and sixth <u>model</u> year (for example, 2013 model year ZEV requirements will be based on California production volume of PCs and LDT~~1~~s, ~~and LDT2s as applicable,~~ for the 2007 to 2009 model years<u>, and 2014 model year ZEV requirements will be based on California production volume of PCs and LDTs, for the 2008 to 2010 model years</u>). ~~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 LDT~~1s, and LDT2s, as applicable,~~ produced by the manufacturer and delivered for sale in California that same model year. ~~For 2012 and subsequent model years, a manufacturer may, on an annual basis, select either the three-year average or the same model-year calculation method. In applying the ZEV requirement, a PC, LDT1, or LDT2 as applicable, that is produced by one manufacturer (e.g., Manufacturer A), but is marketed in California by another manufacturer (e.g., Manufacturer B) under the other manufacturer's (Manufacturer B) nameplate, shall be treated as having been produced by the marketing manufacturer (Manufacturer B).~~

(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~~<u>subdivision</u> 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~~<u>subdivision</u> C.2.1(b) and (c) the volume of PCs, LDT1s and LDT2s <u>that</u> 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 <u>that</u> ~~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 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, AT PZEVs, or credits generated by such vehicles. The remainder of the 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 manufacturer electing the alternative compliance requirements during model years 2009 through 2011 must produce ZEV credits equal to 0.82 percent of the manufacturer's average annual California sales of PCs and LDT1s, and LDT2s, as applicable, over the three year period from model years 2003 through 2005, ~~though~~through production, delivery for sale, and placement in service of ZEVs, other than NEVs and Type 0 ZEVs, using credit ratios for each ZEV Type compared to a Type III prescribed in the table below, or submit an equivalent number of credits generated by such vehicles.

ZEV Types	Credit Substitution Ratio
Type I	2
Type I.5	1.6
Type II	1.33
Type IV	0.8
Type V	0.57

(i) Manufacturers may use credits generated by 1997-2003 model-year ZEVs that qualify for an extended service multiplier under ~~section~~subdivision C.6 for a year primarily during calendar years 2009-2011, provided that 33 years of such a multiplier will equal 4 ZEV credits.

(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~~subdivision C.7.5 shall not be counted towards compliance with this ~~section~~subdivision 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 ~~section~~subdivision C.2.2(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 with the 2012 model year, these credits may no longer be used to meet the ZEV requirement, specified in subdivision

C.2.2(b)(1)(B); they may be used as Enhanced AT PZEV, AT PZEV, or PZEV credits. ZEV credits earned in model year 2009~~ and subsequent~~ through 2011 would be allowed to be carried forward for two years for application to the ZEV requirement. For example, ZEV credit earned in the 2010 model year would retain full flexibility through the 2012 model year. Starting 2013 model year, ~~at which time~~ that credit could only be used as ~~Enhanced AT PZEV~~TZEV, 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.

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(H) *Failure to Meet Requirement for Production of ZEVs.* A manufacturer that, after electing the alternative requirements in ~~section~~subdivision C.2.2(b) for any model year from 2009 through 2011, fails to meet the requirement in ~~section~~subdivision C.2.2(b)(1)(B) by the end of the 2011 model year, shall be treated as subject to the primary requirements in ~~section~~subdivision C.2.1(a) for the 2009 through 2011 model years.

(I) *Rounding Convention.* The number of ZEVs needed for a manufacturer under ~~section~~subdivision 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 manufacturer electing 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, AT PZEVs, or ~~Enhanced AT PZEVs~~TZEVs, or credits generated from such vehicles. ZEV credits generated for compliance with the alternative requirements during any given model year will be applied to the 45 percent which may be met with ZEVs, AT PZEVs, ~~Enhanced AT PZEVs~~TZEVs, or credits generated from such vehicles, but not PZEVs. The remainder of the 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~~subdivision 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 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 manufacturer that has previously elected the primary ZEV requirements for one or more of the 2009 through 2011 model years may prior to the end of the 2011 model year elect the alternative compliance requirements for the 2009 through 2011 model years upon a demonstration that it has complied with all of the applicable requirements for that period in ~~section~~subdivision C.2.2(b)(1)(B).

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

(1) *2012 through 2014 Requirements.* On an annual basis, a~~A~~ manufacturer must meet the total ZEV obligation with ZEVs or ZEV credits generated by such vehicles, excluding credits generated by NEV~~s~~ and Type 0 ZEVs, equal to at least 0.79% of its annual sales, using either production volume determination method described in ~~section~~subdivision C.2.1(b) No more than 50% of the total obligation may be met with credits generated from PZEVs, No more than 75% of the total obligation may be met with credits generated from AT PZEVs. No more than 93.4% may be met with Enhanced AT PZEVs, Type 0 ZEVs, and NEVs, other than limits described in ~~section~~subdivision C.7.6. The entire ~~requirement~~ obligation may be met solely with credits generated from ZEVs.

(2) *2015 through 2017 Requirements.* On an annual basis, a~~A~~ manufacturer must meet its ZEV obligation with ZEVs or ZEV credits generated by such vehicles, excluding credits generated by NEV~~s~~ and Type 0 ZEVs, equal to at least 3% of its annual sales, using either production volume determination method described in ~~section~~subdivision C.2.1(b). No more than 42.8% of the total obligation may be met with credits generated from PZEVs. No more than 57.1% of the total obligation may be met with credits generated from AT PZEVs. No more than 78.5% may be met with ~~Enhanced AT PZEVs~~ credits generated from TZEVs, Type 0 ZEVs, and NEVs, other than limits described in ~~section~~subdivision C.7.6. The entire ~~requirement~~ obligation may be met solely with credits generated from ZEVs.

(3) The following table enumerates a manufacturer's annual percentage obligation for the 2012 though 2017 model years if the manufacturer produces the minimum number of credits required to meet its ZEV obligation and the maximum percentage for the Enhanced AT PZEV, AT PZEV, and PZEV categories.

Years	Total ZEV Percent Requirement	Minimum ZEV floor	~~Enhanced AT PZEVs~~ TZEVs, Type 0s,or NEVs	AT PZEVs	PZEVs
2012 – 2014	12	0..79	2.21	3.0	6.0
2015 – 2017	14	3.0	3.0	2.0	6.0

(4) *Use of Additional Credits for Transportation Systems.* Any additional credits for transportation systems generated from ZEVs in accordance with ~~section~~subdivision C.7.5 may be used to meet up to one tenth of the portion of the ZEV obligation which must be met with ZEVs, specified in ~~section~~subdivision C.2.2(d)(1).

(e) *[Reserved]* ~~*Requirements for Large Volume Manufacturers in Model Year 2018 and Subsequent.* In the 2018 and subsequent model years, a manufacturer must meet a ZEV total percent requirement of 16 percent. The maximum portion of a manufacturer's percentage ZEV requirement that may be satisfied by PZEVs that are not Enhanced AT PZEVs or AT PZEVs, or credits generated by such vehicles, is limited to 6 percent of the manufacturer's applicable California PC, LDT1, and LDT2 production volume; Enhanced AT PZEVs and AT PZEVs or credits generated by such vehicles may be used either alone or in combination, to meet up to one-half of the manufacturer's remaining ZEV requirement.~~

2.3 Requirements for Intermediate Volume Manufacturers. ~~In~~ For 2009 ~~and~~ through 2017~~subsequent~~ model years, an intermediate volume manufacturer may meet its ZEV requirement with up to 100 percent PZEVs or credits generated by such vehicles. For 2015 through 2017 model years, the overall credit percentage requirement for an intermediate volume manufacturer will be 12% instead of 14%.

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, TZEVs, AT PZEVs, or PZEVs it produces and delivers for sale in California.

2.5 *[Reserved]* ~~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 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~~ through 2017 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 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 (i.e., total production volume exceeds 180,000 vehicles in a three year period), 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, or in model year 2018 (whichever occurs first), comply with all ZEV requirements for large volume manufacturers

Requirements will begin in the sixth model year, or in model year 2018 (whichever occurs first) when a manufacturer ceases to be an intermediate volume manufacturer in 2003 or subsequent years due to the aggregation requirements in majority ownership situation.

(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. When a manufacturer is simultaneously producing two model years of vehicles at the time of a change of ownership, the basis of determining next model year must be the earlier 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 calendar year occurs and the manufacturer is producing both 2010 and 2011 model year vehicles 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~~subdivisions C2.7(a) and (b) will apply.

3. Partial ZEV Allowance Vehicles (PZEVs).

3.1 Introduction*.* This ~~section~~subdivisions 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.* For 2009 through 2014 model years, ~~C~~certify the vehicle to the 150,000-mile SULEV exhaust emission standards for PCs and LDTs in ~~section~~subdivision 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. For 2015 through 2017 model years, certify the vehicle to the 150,000-mile SULEV 20 or 30 exhaust emission standards for PCs and LDTs in subdivision 1961.2(a)(1). Bi-fuel, fuel flexible and dual-fuel vehicles must certify to the applicable 150,000-mile SULEV 20 or 30 exhaust emission standards when operating on both fuels;

(b) *Evaporative Emissions.* For 2009 through 2014 model years, ~~C~~certify the vehicle to the evaporative emission standards in ~~section~~subdivision 1976(b)(1)(E), title 13, CCR (zero-fuel evaporative emissions standards). For 2014 through 2017 model years, certify the vehicle to the evaporative emission standards in subdivision 1976(b)(1)(G) or subdivision 1976(b)(1)(E);

(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~~subdivisions 2037(b)(2) and 2038(b)(2) 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~~subdivision C.3.2 and has zero-emission vehicle miles traveled ("VMT") capability will generate an additional zero emission VMT PZEV allowance, calculated as follows:

Range	*Zero-emission VMT Allowance*
$EAER_u$ < 10 miles	0.0
$EAER_u$ ≥10 ~~miles~~ to 40 miles ~~and~~ ~~R_{cda} = 10 miles to 40 miles~~	$EAER_u$ x (1 – UF_{Rcda})/11.028
~~R_{cda}~~ $EAER_u$ > 40 miles	~~$EAER_{u40}$/ 29.63~~ ($EAER_{u40}$) x [1 – (UF_{40}*R_{cda}/$EAER_u$)]/ 11.028 Where, UF_{40}= utility factor at 40 miles $EAER_{u40}$= 40 miles

A vehicle cannot generate more than 1.39 zero-emission VMT PZEV allowance.

The urban equivalent all-electric range ($EAER_u$) and charge depleting actual range (urban cycle) (R_{cda}) shall be determined in accordance with sections ~~F.11~~G.5.4 and ~~F.5.4~~G.11.9, respectively, of these test procedures. The utility Factor (UF) based on the charge depleting actual range (urban cycle) (R_{cda}) shall be determined according to Section 4.5.2 Equation 6 and the “Fleet UF” Utility Factor Equation Coefficients in Section 4.5.2, Table 3 of SAE J2841 March 2009.

(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~~subdivision 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 5000 pounds per square inch or more, stored in nongaseous form, or at cryogenic temperatures, 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 ~~five~~four types of HEVs based on the criteria in the following table.

Characteristics	~~*Type C*~~	*Type D*	*Type E*	*Type F*	*Type G*
Electric Drive System Peak Power Output	~~≥ 10 kW~~	≥ 10 kW	≥ 50 kW	Zero Emission VMT allowance; ≥ 10 mile all-electric ~~range (~~UDDS ~~drive cycle)~~range	Zero-Emission VMT allowance; ≥ 10 mile all-electric ~~range (~~US06 ~~drive cycle)~~ range
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) *[Reserved].*

(3) *[Reserved].*

(4) *[Reserved].*~~*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.~~

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(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~~through 2017 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~~through 2017 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, including achieving 10 miles or more of all-electric UDDS range, qualifies for an additional advanced componentry allowance of 0.72 in the 2009 through 2011 model years, 0.67 in the 2012 through 2014 model years, and 0.57 in the 2015 ~~and subsequent model years~~through 2017 model years.

(8) *Type G HEVs.* A PZEV that the manufacturer demonstrates to the reasonable satisfaction of the Executive Officer meets all of the criteria for a Type G HEV, including achieving 10 miles or more of all-electric US06 range, qualifies for an additional advanced componentry allowance of 0.95 in the 2009 through 2011 model years, 0.~~8~~9 in the 2012 through 2014 model years, and 0.~~7~~8 in the 2015 ~~and subsequent model years~~through 2017 model years.

(9) *Severability.* In the event that all or part of ~~section~~subdivision C.3.4(b)(1)-(8) is found invalid, the remainder of these standards and test procedures~~, including the remainder of section C.3.4(b)(1)-(8),~~ 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~~subdivision C.3.6, multiplied by any PZEV introduction phase-in multiplier listed in ~~section~~subdivision C.3.7, subject to the cap in ~~section~~subdivision C.3.6(b).

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

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

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

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

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

(1) *Cap for 2009 ~~and Subsequent~~ through 2017 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 sold to a California motorist or is leased for three or more years to a California 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, qualifies for a phase-in multiplier of 1.25. This subdivision C.3.7(b) multiplier will no longer be available after model year 2011.

4. Qualification for ZEV Multipliers and Credits.

4.1 [Reserved].

4.2 [Reserved].

4.3 [Reserved].

4.4 ~~ZEV~~ Credits for 2009 through 2017~~and Subsequent~~ Model Years ZEVs.

(a) *ZEV Tiers for Credit Calculations*. ~~ZEV c~~Credits from a particular ZEV are based on the assignment of a given ZEV into one of the following eight 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 C.4.4(b)
	≥ 200	N/A
Type IV	≥ 200	Must be capable of replacing 190 miles (UDDS ZEV range) in ≤ 15 minutes per section C.4.4(b)
Type V	≥ 300	Must be capable of replacing 285 miles (UDDS ZEV range) in ≤ 15 minutes per section C.4.4(b)

Type I.5x and Type IIx vehicles are defined in subdivision C.4.5(g) and C.9.10.

(b) *Fast Refueling*. The “fast refueling capability” requirement for a 2009 ~~and subsequent~~through 2017 model year Type III, IV, or V ZEV in ~~section~~subdivision C.4.4.(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 or V ZEV has the capability to accumulate at least 190 or 285 miles, respectively, in 15 minutes or less. For ZEVs that utilize more than one ZEV fuel, such as plug-in fuel cell vehicles, the Executive Officer may choose to waive these ~~section~~subdivision C.4.4.(b) fast fueling requirements and base the amount of credit earned on UDDS ZEV range, as specified in ~~section~~subdivision C.4.4.(a).

(c) *ZEV Credits for 2009 ~~and Subsequent~~ through 2017 Model-Year ZEVs.* A 2009 ~~and subsequent~~through 2017 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~~through 2017 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 vehicle must be delivered for sale and placed in service in a Section 177 state or in California in order to earn the total credit amount. The total credit amount will be earned in the state (i.e. California or a Section 177 state) in which the vehicle was delivered for sale. The following table identifies the total credits that a ZEV in each of the eight ZEV tiers will earn, including the credit not contingent on placement in service, if it is placed in service in the specified calendar year or by June 30 after the end of the specified calendar year. A vehicle is not eligible to receive credits if it is placed in service after December 31, five calendar years after the model year. For example, if a vehicle is produced in 2012, but does not get placed until January 1, 2018, the vehicle would no longer be eligible for ZEV credits.

Total Credit Earned by ZEV Type and Model Year for Production and Delivery for Sale and for Placement		
Tier	*Calendar Year in Which ZEV is Placed in Service*	
	2009-201~~7~~1	2012 - 2017~~2018+~~
NEV	0.30	0.30
Type 0	1	1
Type I	2	2
Type I.5	2.5	2.5
Type I.5x	n/a	2.5
Type II	3	3
Type IIx	n/a	3
Type III	4	~~3~~4
Type IV	5	~~3~~5
Type V	7	~~3~~2012-2014: 7 2015-2017: 9

(d) *Multiplier for Certain ZEVs.* 2009 through 2011 model-year ZEVs, excluding NEVs or Type 0 ZEVs, 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. This subdivision C.4.4(d) multiplier will no longer be available after model year 2011.

(e) *Counting Specified ZEVs Placed in a Section 177 State and in California.*

(1) *Provisions for 2009 Model Year.*

(A) Large volume manufacturers and intermediate volume manufacturers with credits earned from ZEVs, excluding NEVs and Type 0 ZEVs, that are either certified to the California ZEV standards or approved as part of an advanced technology demonstration program and are placed in service in a section 177 state, may be counted towards compliance with the California percentage ZEV requirements in ~~section~~subdivision C.2, including the requirements in ~~section~~subdivision C.2.2(b), as if they were delivered for sale and placed in service in California.

(B) Large volume manufacturers and intermediate volume manufacturers with credits earned from ZEVs, excluding NEVs and Type 0 ZEVs that are certified to the California ZEV standards or approved as part of an advanced technology demonstration program and are placed in service in California may be counted towards compliance with the percentage ZEV requirements of ~~any~~all section 177 state, including requirements based on ~~section~~subdivision C.2.2(B).

(2) *Provisions for 2010 and Subsequent Model Years.* Large volume manufacturers and intermediate volume manufacturers with credits earned from ~~Specified model year~~ ZEVs, including Type I.5xs and Type IIxs, and excluding NEVs and Type 0 ZEVs, that are either certified to the California ZEV standards applicable for the ZEV's model year or approved as part of an advanced technology demonstration program and are placed in service in California or in a section 177 state may be counted towards compliance in California and in all section 177 states, with the percentage ZEV requirements in ~~section~~subdivision C.2, provided that the credits are multiplied by the ratio of a~~n LVM's~~manufacturer's applicable production volume for a model year, as specified in ~~section~~subdivision C.2.1(b) in the state receiving credit to the ~~LVM's~~manufacturer's applicable production volume (hereafter, "proportional value"), as specified in ~~section~~subdivision C.2.1(b) for the same model year in California. Credits generated in a section 177 state will be earned at the proportional value in the section 177 state, and earned in California at the full value specified in ~~section~~subdivision C.4.5(d) However, credits generated by 2010 and 2011 model-year vehicles produced, delivered for sale, and placed in service, or as part of an advanced technology demonstration program in California to meet the any section 177 state's requirements that implement ~~section~~subdivision C.2.2(b) requirements are exempt from proportional value, with the maximum number of credits allowed to be counted towards compliance in a section 177 state being limited to the number of credits needed to satisfy a manufacturer's section 177 state's requirements to implement ~~section~~subdivision C.2.2(b)(1)(B). The table below specifies the qualifying model years for each ZEV type that may be counted towards compliance in all section 177 states.

Vehicle Type	Model Years:
Type I, I.5, or II ZEV	2009 – ~~2014~~2017
Type III, IV, or V ZEV	2009 – 2017
Type I.5x or Type IIx	2012 – 2017

(3) *Optional Section 177 State Compliance Path.* Large volume

manufacturers and intermediate volume manufacturers that choose to elect the optional section 177 state compliance path must notify the Executive Officer and each section 177 state in writing no later than September 1, 2014.

(A) *Additional 2016 and 2017 Model Year ZEV Requirements.* Large volume manufacturers and intermediate volume manufacturers that elect the optional section 177 state compliance path must generate additional 2012 through 2017 model year ZEV credits, including no more than 50% Type 1.5x and Type IIx vehicle credits and excluding all NEV and Type 0 ZEV credits, in each section 177 state equal to the following percentages of their sales volume determined under subdivision C.4.5(e)(3)(A)1.:

Model Years	Additional Section 177 State ZEV Requirements
2016	0.75%
2017	1.50%

Subdivision C.4.5(e)(2) shall not apply to any ZEV credits used to meet a manufacturer's additional 2016 and 2017 model year ZEV requirements under this subdivision C.4.5(e)(3)(A). ZEVs produced to meet a manufacturer's additional 2016 and 2017 model year ZEV requirements under this subdivision C.4.5(e)(3)(A) must be placed in service in the section 177 states no later than June 30, 2018.

1. *Trading and Transferring ZEV Credits within the West Region Pool and East Region Pool.* Manufacturers may trade or transfer specified model year ZEV credits used to meet the same model year requirements in subdivision C.4.5(e)(3)(C), within the West Region pool, and will incur no premium on their credit values. For example, for a manufacturer to make up a 2016 model year shortfall of 100 credits in State X, the manufacturer may transfer 100 (2016 model year) ZEV credits, from State Y, within the West Region pool. Manufacturers may trade or transfer specified model year ZEV credits, used to meet the same model year requirements in subdivision C.4.5(e)(3)(C), within the East Region pool, and will incur no premium on their credit values. For example, for a manufacturer to make up a 2016 model year shortfall of 100 credits in State W, the manufacturer may transfer 100 (2016 model year) ZEV credits from State Z, within the East Region pool.

2. *Trading and Transferring ZEV Credits between the West Region Pool and East Region Pool.* Manufacturers may trade or transfer specific model year ZEV credits used to meet the same model year requirements in subdivision C.4.5(e)(3)(C) between the West Region pool and the East Region pool; however, any credits traded or transferred will incur a premium of 30% of their value. For example, in order for a manufacturer to make up a 2016 model year

shortfall of 100 credits in the West Region Pool, the manufacturer may transfer 130 (2016 model year) ZEV credits from the East Region Pool. No credits may be traded or transferred to the East Region pool or West Region pool from a manufacturer's California ZEV bank, or from the East Region pool or West Region pool to a manufacturer's California ZEV bank.

(B) *Reduced TZEV Percentages.* Large volume manufacturers and intermediate volume manufacturers that elect the optional section 177 state compliance path and that fully comply with the additional 2016 and 2017 model year ZEV requirements in this subdivision C.4.5(e)(3)(A). are allowed to meet TZEV percentages reduced from the allowed TZEV percentages in subdivision C.2.2(d)(2) and (3) in 2015 through 2017 model year in each section 177 state as enumerated below:

Model Year	2015	2016	2017
Existing TZEV Percentage	3.00%	3.00%	3.00%
Section 177 State Adjustment for Optional Compliance Path for TZEVs	75.00%	80.00%	85.00%
New Section 177 State Optional Compliance Path TZEV Percentage	2.25%	2.40%	2.55%

Manufacturers may meet the reduced TZEV percentages above with credits from ZEVs or credits from TZEVs. These reduced TZEV percentages also reduce the total ZEV percent requirement, as illustrated in subdivision C.4.5(e)(3)(C).

1. *Trading and Transferring TZEV Credits within the West Region Pool and East Region Pool.* Manufacturers may trade or transfer specified TZEV credits to meet the same model year subdivision C.4.5(e)(3)(C) percentages within the West Region pool, and will incur no premium on their credit values. For example, for a manufacturer to make up a 2016 shortfall of 100 credits in State X, the manufacturer may transfer 100 (2016 model year) TZEV credits from State Y, within the West Region pool. Manufacturers may trade or transfer TZEV credits to meet the same model year subdivision C.4.5(e)(3)(C) within the East Region pool, and will incur no premium on their credit values. For example, for a manufacturer to make up a 2016 model year shortfall of 100 credits in State W, the manufacturer may transfer 100 (2016 model year) TZEV credits from State Z, within the East Region pool.

2. *Trading and Transferring TZEV Credit between the West Region Pool and East Region Pool.* Manufacturers may trade or transfer specified TZEV credits used to meet the same model year percentages in subdivision C.4.5(e)(3)(C) between the West

Region pool and the East Region pool; however, any credits transferred will incur a premium of 30% of their value. For example, in order for a manufacturer to make up a 2016 model year shortfall of 100 credits in the West Region Pool, the manufacturer may transfer 130 (2016 model year) TZEV credits from the East Region Pool. No credits may be traded or transferred to the East Region pool or West Region pool from a manufacturer's California ZEV bank, or from the East Region pool or West Region pool to a manufacturer's California ZEV bank.

(C) *Total Requirement Percentages.* Requirements for the minimum ZEV floor, and allowed percentages for AT PZEVs and PZEVs in subdivision C.2 remain in effect for large and intermediate volume manufacturers choosing the optional section 177 state compliance path in each section 177 state. However, the optional section 177 compliance path requires manufacturers to meet additional ZEV requirements and allows manufacturers to meet reduced TZEV percentages as described above in subdivision C.4.5(e)(3)(A) and (B). The table below enumerates the total annual percentage obligation in each section 177 state for the 2015 through 2017 model years if the manufacturer elects the optional section 177 state compliance path and produces the minimum number of credits required to meet its minimum ZEV floor and the maximum percentage allowed to be met with credits from TZEVs, AT PZEVs and PZEVs.

Years	Total ZEV Percent Requirement for Optional Compliance Path	Minimum ZEV Floor for Optional Compliance Path	TZEVs for Optional Compliance Path	AT PZEVs (no change)	PZEVs (no change)
2015	13.25%	3.00%	2.25%	2.00%	6.00%
2016	14.15%	3.75%	2.40%	2.00%	6.00%
2017	15.05%	4.50%	2.55%	2.00%	6.00%

d*. Reporting Requirements.* On an annual basis, by May 1st of the calendar year following the close of a model year, each manufacturer that elects the optional section 177 state compliance path shall submit, in writing, to the Executive Officer and each section 177 state a report, including an itemized list, that demonstrates the manufacturer has met the requirements of this subdivision C.4.5(e)(3)(C) in each section 177 state as well as in the East Region pool and in the West Region pool. The itemized list shall include the following:

i. The manufacturer's total applicable volume of PCs and LDTs delivered for sale in each section 177 state within the pool, as determined under subdivision C.2.1(b).

ii. Make, model, vehicle identification number, credit earned, and section 177 state where delivery for sale and placement in service for ZEV occurred to meet the manufacturer's additional ZEV obligation under subdivision C.4.5(e)(3)(A)

iii. Make, model, vehicle identification number, credit earned, and section 177 state where delivery for sale of each TZEV occurred and section 177 state where delivery for sale and placement in service of each ZEV occurred to meet manufacturer's requirements under subdivision C.4.5(e)(3)(C)

e. ***Failure to Meet Optional Section 177 State Compliance Path Requirements.*** A manufacturer that elects the optional section 177 state compliance path and does not meet the requirements in subdivision C.4.5(e)(3)(A) by June 30, 2018 in all section 177 states within an applicable pool shall be treated as subject to the total ZEV percentage requirements in section C.2 for the 2015 through 2017 model years in each section 177 state and the pooling provisions in subdivision C.4.5(e)(3)(A) shall not apply. Any transfers of ZEV credits between section 177 states will be null and void, and ZEV credits will return to the section 177 state in which the credits were earned. A manufacturer that elects the optional section 177 state compliance path and does not meet the percentages in subdivision C.4.5(e)(3)(B) in a model year or make up their deficit within the specified time and with the specified credits allowed by subdivision C.7.7(a) in all section 177 states within an applicable pool shall be treated as subject to the ZEV percentage requirements in section C.2 for the 2015 through 2017 model years and the pooling provisions in subdivision C.4.5(e)(3)(B) shall not apply. Any transfers of TZEV credits between section 177 states will be null and void if a manufacturer fails to comply, and TZEV credits will return to the section 177 state in which the credits were earned. Penalties shall be calculated separately by each section 177 state where a manufacturer fails to make up the ZEV deficits by the end of the 2018 model year.

f. The provisions in section C shall apply to a manufacturer electing the optional section 177 state compliance path, except as specifically modified by this subdivision C.4.5(e)(3).

(f) *NEV Test Procedures.* Beginning in 2010 model year, to be eligible for the credit amount in ~~section~~subdivision C.4.4.(c), NEVs must meet the following specifications and requirements in this ~~section~~subdivision C.4.4(f):

(1) *Specifications.* A 2010 through 2017 ~~and subsequent~~ model-year NEV, earns credit when it meets all the following specifications:

(A) *Acceleration.* The vehicle has a 0-20 mph acceleration of 6.0 seconds or less when operating with a payload of 332 pounds and starting with the battery at a 50% state of charge.

(B) *Top Speed.* The vehicle has a minimum top speed of 20 mph when operating with a payload of 332 pounds and starting with the battery at a 50% state of charge. The vehicle's top speed shall not exceed 25 mph when tested in accordance with 49 CFR 571.500 (68 FR 43972, July 25, 2003).

(C) *Constant Speed Range.* The vehicle has a minimum 25 mile range when operating at constant top speed with a payload of 332 pounds and starting with the battery at 100% state of charge.

(2) *Battery Requirement*. A qualifying NEV must be equipped with sealed, maintenance-free batteries.

(3) *Warranty Requirement*. A 2010 through 2017 ~~and subsequent~~ model year NEV drive train, including battery packs, must be covered for a period of at least 24 months. ~~At least~~ The first 6 months ~~of the first 12 months~~ of the NEV warranty period must be covered by a full warranty; the ~~remainder of the first 12 months and all of the second 12 months of the~~ remaining warranty period may be optional extended warranties (available for purchase) and may be prorated. If the extended warranty is prorated, the percentage of the battery pack's original value to be covered or refunded must be at least as high as the percentage of the prorated coverage period still remaining. For the purpose of this computation, the age of the battery pack must be expressed in intervals no larger than three months. Alternatively, a manufacturer may cover 50 percent of the original value of the battery pack for the full period of the extended warranty.

(4) Prior to allowance approval, the Executive Officer may request that the manufacturer provide copies of representative vehicle and battery warranties.

(5) *NEV Charging Requirements.* Model year 2014 through 2017 NEVs must meet charging connection standard portion of the requirements specified in subdivision 1962.3(c)(2).

(g) *Type I.5x and Type IIx Vehicles.* Beginning in 2012 model year, to be eligible for the credit amount in subdivision C.4.4(c), Type I.5x and Type IIx vehicles must meet the following specifications and requirements:

(1) *PZEV Requirements.* Type I.5x and Type IIx vehicles must meet all PZEV requirements, specified in subdivision C.3.2 (a) through (d).

(2) *Type G Requirements.* Type I.5x and Type IIx vehicles must meet the requirements for Type G advanced componentry allowance, specified in subdivision C.3.4(b).

(3) *APU Operation.* The vehicle's UDDS range after the APU first starts and enters "charge sustaining hybrid operation" must be less than or equal to the vehicle's UDDS all-electric test range prior to APU start. The vehicle's APU cannot start under any user-selectable driving mode unless the energy storage system used for traction power is fully depleted.

(4) *Minimum Zero Emission Range Requirements.*

Vehicle Category	Zero Emission UDDS Range
Type I.5x	≥ 75 miles, < 100 miles
Type IIx	≥ 100 miles

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, in the 2009 through 2011 calendar years. 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. Additional credit cannot be earned after model year 2011.

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~~subdivision C.2 shall earn ZEV credits in accordance with this ~~section~~subdivision C.7.

7.2 ZEV Credit Calculations.

(a) *Credits from ZEVs*. For model years 2009 through 2014, ~~T~~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, or LDT2s as applicable, for 2009 through 2011 model years , and for PCs and LDT1s for 2012 through 2014 ~~that~~ model years.

For model years 2015 through 2017, the amount of credits earned by a manufacturer in a given model year from ZEVs shall be expressed in units of credits, 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, or, if applicable, requirements specified under subdivision C.4.5(e)(3) for the model year subtracted from the number of ZEV credits produced and delivered for sale in California by the manufacturer in the model year or model years.

(b) *Credits from PZEVs.* For model years 2009 through 2014, ~~T~~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, or LDT2s as applicable, for 2009 through 2011 model years , and for PCs and LDT1s for 2012 through 2014 ~~that~~ model years.

For model years 2015 through 2017, the amount of credits earned by a manufacturer in a given model year from PZEVs shall be expressed in units of credits, and shall be equal to the number of credits from PZEVs produced and delivered for sale in California that the manufacturer applies towards meeting the ZEV requirements, or, if applicable, requirements specified under subdivision C.4.5(e)(3), for the model year subtracted from the number of PZEV credits produced and delivered for sale in California by the manufacturer in the model year or model years.

(c) *Separate Credit Accounts.* The number of credits from a manufacturer's [i] ZEVs, [ii] Type I.5x and Type IIx vehicles, [~~ii~~iii] ~~Enhanced AT PZEVs~~TZEVs, [~~iii~~iv] AT PZEVs, [~~i~~v] all other PZEVs, and [vi] NEVs shall each be maintained separately.

(d) *Rounding Credits.* For model year 2012 through 2014, ZEV credits and debits shall be rounded to the nearest 1/1000th only on the final credit and debit totals using the conventional rounding method. For model year 2015 through 2017, ZEV credits and debits shall be rounded to the nearest 1/100th only on the final credit and debit totals using the conventional rounding method.

(e) *Converting g/mi NMOG ZEV Credit to ZEV Credits.* After model year 2014 compliance, all manufacturer ZEV, Type I.5x and Type IIx, TZEV, AT PZEV, PZEV, and NEV accounts will be converted from g/mi NMOG to credits. Each g/mi NMOG account balance will be divided by 0.035. Starting in model year 2015, credits will no longer be expressed in terms of g/mi credits, but only as credits.

(f) *Converting PZEV and AT PZEV Credits after Model Year 2017.* After model year 2017 compliance, a manufacturer's PZEV and AT PZEV credit accounts will be converted to be used for compliance with requirements specified in subdivision C.2. For LVMs, PZEV accounts will be discounted 93.25%, and AT PZEV accounts will be discounted 75%. For IVMs, PZEV accounts and AT PZEV accounts will be discounted

75%. This will be a one time calculation after model year 2017 compliance is complete.

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, LDT1s and LDT2s as applicable, and included in the calculation of ZEV credits as specified in this ~~section~~subdivision C.4 if the manufacturer so designates.

7.4 ZEV Credits for Advanced Technology Demonstration Programs.

(a) *TZEVs.* ~~In model years~~ For 2009 through 2014 model years, ~~ZEVs and Enhanced AT PZEVs, excluding NEVs,~~ TZEVs 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 operated 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 25~~-~~vehicles per model, per ZEV state, per year under this section C.7.4. A manufacturer's vehicles in excess of the 25-vehicle cap will not be eligible for advanced technology demonstration program credits.

(b) *ZEVs.* In model years 2009 through 2017, ZEVs, including Type I.5x and IIx vehicles, excluding NEVs and Type 0 ZEVs, 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 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 operated 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 25 vehicles per model, per ZEV state, per year under this subdivision C.7.4. A manufacturer's vehicles in excess of the 25-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 through 2011, a ZEV placed, for two or more years, 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 subdivision C.7.5(c) below. In model years 2012~~09~~ ~~and subsequent~~ through 2017, a ZEV or TZEV placed, for two or more years, 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 subdivision C.4.5(e)(2) and as provided in ~~section~~subdivision C.7.5(c) below. In model years 2009 through 2011, an ~~Enhanced AT PZEV,~~ AT 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~~subdivision 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~~subdivision 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 Type I.5x and Type IIx vehicles, ~~Enhanced AT PZEVs~~TZEV, 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
Enhanced AT PZEV	2009 through 2011	4	2
ZEV	2009 through 2011	6	3
~~Enhanced AT PZEV~~ TZEV	2012 ~~and subsequent~~through 2017	~~1~~0.5	~~1~~0.5
ZEV and Type I.5x and Type IIx vehicles	2012 ~~and subsequent~~through 2017	~~2~~0.75	~~1~~0.75

(c) *Cap on Use of Credits.*

(1) *ZEVs.* Credits earned or allocated by ZEVs ZEVs or Type I.5x and Type IIx vehicles pursuant to this ~~section~~subdivision 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, and may be used to satisfy up to one-tenth of a manufacturer's ZEV obligation which must be met with ZEVs, as specified in ~~section~~subdivision C.2.2(d)(3).

(2) *~~Enhanced AT PZEVs~~TZEVs*. Credits earned or allocated by ~~Enhanced AT PZEVs~~TZEVs pursuant to this ~~section~~subdivision 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, or, if applicable, requirements specified under subdivision 4.5(e)(3), but may only be used in the same manner as other credits earned by vehicles of that category.

(3) *AT PZEVs.* Credits earned or allocated by AT PZEVs pursuant to this ~~section~~subdivision 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.

(4) *PZEVs.* Credits earned or allocated by PZEVs pursuant to this ~~section~~subdivision 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 Transportation System 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 for the time specified in subdivision C.7.5(a). 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. Credits will no longer be allocated for vehicles placed in transportation systems after 2017 model year.

7.6 Use of ZEV Credits. For model years 2009 through 2014, ~~A~~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~~subdivision C.2. For model years 2015 through 2017, a manufacturer may meet the ZEV requirements in any given model year by submitting to the Executive Officer a commensurate amount of ZEV credits, consistent with subdivision C.2. Credits in each of the categories may be used to meet the requirement for that category as well as the requirements for lesser credit earning ZEV categories, but shall not be used to meet the requirement for a greater credit earning ZEV category. For example, credits produced from ~~Enhanced AT PZEVs~~TZEVs may be used to comply with AT PZEV requirements, but not with the portion that must be satisfied by ZEVs. These credits may be earned previously by the manufacturer or acquired from another party.

(a) *NEVs.* 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 percentage limits described in the following table:

Model Years	ZEV Obligation that:	Percent limit for NEVs allowed to meet each Obligation[1]:
2009 – 2011	Must be met with ZEVs	50%
2009	May be met with AT PZEVs but not PZEVs	75%
2010 – 2011		50%
2009 – 2011	May be met with PZEVs	No Limit
2012 – ~~2014~~2017	Must be met with ZEVs	0%
	May be met with ~~Enhanced AT PZEVs~~TZEVs and AT PZEVs	50%
	May be met with PZEVs	No Limit

[1] If applicable, obligation in this table means requirements specified under subdivision 4.5(e)(3).

Additionally, credits earned from NEVs ~~offered for sale or~~ placed in service in model years 2006 through 2017 ~~or later~~ can be used to meet the percentage limits described in the following table:

Model Years	ZEV Obligation that:	Percent Limit for NEVs allowed to meet each Obligation[1]:
2009 - 2011	May be met through compliance with Primary Requirements	No Limit
	May be met through compliance with Alternative Requirements, and must be met with ZEVs	0%
	May be met through compliance Alternative Requirements, and may be met with AT PZEVs or PZEVs	No Limit
2012 – ~~2014~~2017	Must be met with ZEVs	0%
	May be met with ~~Enhanced AT PZEVs~~TZEVs, AT PZEVs, or PZEVs	No Limit

[1] If applicable, obligation in this table means requirements specified under subdivision 4.5(e)(3).

This limitation applies to credits earned by the same manufacturer or earned by another manufacturer and acquired.

(b) *Carry forward provisions for Large Volume Manufacturers for 2009-2011 Model Years.* ~~ZEV c~~Credits from ZEVs, excluding credits generated from NEVs generated from excess production in ~~model years~~ 2009 through 2011 model years~~and subsequent~~, including those acquired from another party, may be carried forward and applied to the ZEV minimum floor requirement specified in ~~section~~subdivisions C.2.2(b)(1)(B) and (d) 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~~TZEVs, AT PZEVs, or PZEVs. For example, ZEV credit earned in 2010 would retain full flexibility through 2012, after which time that credit could only be used as ~~Enhanced AT PZEVs~~TZEVs, AT PZEV, or PZEV credits.

(c) *Carry forward provisions for manufacturers other than Large Volume Manufacturers for 2009-2011 Model Years.* ~~ZEV c~~Credits generated from ZEVs, excluding credits generated from NEVs, from 2009 through 2011~~and subsequent~~ model year production by manufacturers that are not large volume manufacturers may be carried forward by the manufacturer producing the ~~ZEV~~ credit until the manufacturer becomes subject to the large volume manufacturer requirements, after the transition period permitted in ~~section~~subdivision C.2.7(a). When subject to the large volume manufacturer requirements, a manufacturer must comply with the provisions of ~~section~~subdivision C.7.6(b).

~~ZEV c~~Credits traded by a manufacturer other than a large volume manufacturer to any other manufacturer, including a large volume manufacturer, are subject to ~~section~~subdivision C.7.6(b), beginning in the model year in which they were produced (e.g., a 2009 model year ZEV credit traded in calendar year 2010 can only be applied towards the portion of the manufacturer's requirement that must be met with ZEVs through model year 2011; beginning in model year 2012, the credit can only be applied to the portion of the manufacturer's requirement that may be met with ~~Enhanced AT PZEVs~~TZEVs, AT PZEVs, or PZEVs).

(d) *Type I.5x and Type IIx vehicles.* Credits earned from Type I.5x and Type IIx vehicles offered for sale or placed in service may meet up to 50% of the portion of a manufacturer's requirement that must be met with credits from ZEVs.

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 generated by ZEVs, for model year 2009 through 2014, and the commensurate amount of credits generated by ZEVs for model year 2015 through 2017. The amount of ~~g/mi ZEV~~ credits required to be submitted shall be calculated by [i] adding the number of credits from 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~~subdivision C.2.1), [ii] subtracting that total from the number of ZEVs credits required to be produced and delivered for sale in California by the manufacturer for the model year, and, for model year 2009 through 2014 compliance, [iii] multiplying the resulting value by the fleet average requirements for PCs and LDT1s for the model year in which the deficit is incurred. Credits earned by delivery for sale of Type I.5x and Type IIx vehicles, TZEV, NEV, AT PZEV, and PZEV are not allowed to be used to fulfill a manufacturer's ZEV deficit; only credits from ZEVs may be used to fulfill a manufacturer's ZEV deficit.

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, for model years 2009 through 2014, and credits for model years 2015 through 2017, and does not make up ZEV deficits within the specified time allowed by ~~section~~subdivision C.7.7(a) 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 allowed by ~~section~~subdivision

C.7.7(a). For the purposes of Health and Safety Code section 43211, the number of vehicles not meeting the state board's standards shall be the number of vehicles not meeting the state board's standards shall be equal to the manufacturer's credit deficit, rounded to the to the nearest 1/1000th for model years 2009 through 2014 and rounded to the nearest 1/100th for model years 2015 through 2017, 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 PZEV allowance vehicles or credits from such vehicles may not exceed the percentages permitted under ~~section~~subdivision C.2.1(a):

For 2009 through 2014 model years:

> (No. of ~~ZEVs~~ credits required to be ~~produced and delivered for sale in California~~ generated 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 compliance for the model year) / (the fleet average requirement for PCs and LDT1s for the model year)~~]~~

For 2015 through 2017 model years:

> (No. of credits required to be generated for the model year) – (Amount of credits submitted for compliance 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 C 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~~ TZEVs, AT PZEVs, and PZEVs for the 2009 through 2017~~and subsequent~~ model years; and

(b) Each manufacturer's annual credit balances for 2010 through 2017 ~~and subsequent~~ years for:

(1) Each type of vehicle: ZEVs (minus NEVs), Type I.5x, and Type IIx vehicles, NEVs, ~~Enhanced AT PZEVs~~TZEVs, AT PZEVs, and PZEVs; and

(2) Advanced technology demonstration programs; and

(3) Transportation systems; and

(4) Credits earned under section C.4.4(c), including credits acquired from, or transferred to another party.

D. Certification Requirements.

1. Durability and Emission Testing Requirements. All ZEVs, excluding Type I.5x and Type IIx vehicles, 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. For off-vehicle charge capable hybrid electric vehicles certifying to section F, the manufacturer shall provide the energy usage in kilowatt hours per mile from the Urban Equivalent All-Electric Range and the Highway Equivalent All-Electric Range.

2.7 For those vehicles 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, and the method used to determine them, as specified in sections E.2 and F.2 of these test procedures.

2.12 Labeling shall conform with the requirements specified in section 1965, title 13, CCR and the “California Environmental Performance Label Specifications for 2009 and Subsequent Model Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles” (incorporated by reference therein).

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 When 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.

2.15 For off-vehicle charge capable hybrid electric vehicles certifying to section F, the manufacturer shall provide the Urban Charge Depleting Cycle Range, the Urban Charge Depleting Actual Range, the Charge Depleting to Charge Sustaining Urban

Range, the Highway Charge Depleting Cycle Range, the Highway Charge Depleting Actual Range, the Charge Depleting to Charge Sustaining Highway Range, the Urban Equivalent All-Electric Range, the Highway Equivalent All-Electric Range, the Urban Electric Range Fraction, and the Highway Electric Range Fraction.

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. <u>If a manufacturer updates their annual California production numbers in their ZEV report, the annual NMOG production must also be updated.</u>

E. Determination of NEV Acceleration, Top Speed, and Constant Speed Range

The acceleration and constant speed range for a NEV shall be determined as specified in "Implementation of SAE Standard J1666 May 93: Electric Vehicle Acceleration, Gradeability, and Deceleration Test Procedure," ETA-NTP002 Revision 3, February 1, 2008, and "Electric Vehicle Constant Speed Range Tests," ETA-NTP004 Revision 3, February 1, 2008.

~~E~~F. Test Procedures for 2012 through 2017~~and Subsequent~~ Model Zero-Emission Vehicles (including Fuel Cell Vehicles and Hybrid Fuel Cell Vehicles) and All 2012 through 2017~~and Subsequent~~ Model Hybrid-Electric Vehicles, Except Off-Vehicle Charge Capable Hybrid Electric Vehicles.

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." Unless otherwise noted, these requirements shall apply to all ZEVs (including fuel cell vehicles and hybrid fuel cell vehicles) and all HEVs, except off-vehicle charge capable HEVs. A manufacturer may elect to certify a 2009, 2010, or 2011 model-year zero-emission vehicle or hybrid electric vehicle, except an off-vehicle charge capable hybrid electric vehicle, using this section ~~E~~F.

1. Electric Dynamometer. All ZEVs and HEVs must be tested using a 48-inch single roll electric dynamometer meeting the requirements of 40 CFR Subpart B, §86.108-00(b)(2) [October 22, 1996].

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 for Zero-Emission Vehicles (including Fuel Cell Vehicles and Hybrid Fuel Cell Vehicles). All 2012 and subsequent ZEVs shall be subject to the All-Electric Range Test specified below for the purpose of determining the energy efficiency and operating range of the ZEV.

3.1 **Determination of Urban All-Electric Range for Zero-Emission Vehicles.**

3.1.1 **Determination of Urban All-Electric Range for Battery Electric Vehicles.**

(a) **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. Charge time shall not exceed soak time.

(b) At the end of the cold soak period, the vehicle shall be placed or pushed, onto a dynamometer and operated through successive Urban Dynamometer Driving Schedules (UDDS), 40 CFR, Part 86, Appendix I [July 13, 2005], which is incorporated herein by reference. A 10-minute soak shall follow each UDDS.

(c) For vehicles with a maximum speed greater than or equal to the maximum speed on the UDDS, 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) [October 22, 1996], or the manufacturer determines that the test should be terminated for safety reasons, e.g. excessively high battery temperature, abnormally low battery voltage, etc.

(d) For vehicles with a maximum speed less than the maximum speed on the UDDS, 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) [October 22, 1996]. 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 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.

3.1.2 **Determination of Urban All-Electric Range for Fuel Cell Vehicles and Hybrid Fuel Cell Vehicles.**

(a) The urban all-electric range for a fuel cell vehicle and a hybrid fuel cell vehicle shall be determined in accordance with SAE J2572. As an option, a manufacturer may elect to determine the urban all-electric range for a fuel cell vehicle or a hybrid fuel cell vehicle in accordance with section F~~E~~.3.1.1 above.

3.2 **Determination of Highway All-Electric Range for Zero-Emission Vehicles and Range for Fuel Cell Vehicles and Hybrid Fuel Cell Vehicles.**

3.2.1 **Determination of Highway All-Electric Range for Battery Electric Vehicles.**

(a) **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. Charge time shall not exceed soak time.

(b) At the end of the cold soak period, the vehicle shall be either placed or pushed onto a dynamometer and operated through Continuous Highway Test Schedules of the Highway Fuel Economy Driving Schedule (HFEDS).

(c) For vehicles with a maximum speed greater than or equal to the maximum speed on the HFEDS, 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) [October 22, 1996], or the manufacturer determines that the test should be terminated for safety reasons, e.g. excessively high battery temperature, abnormally low battery voltage, etc.

(d) For vehicles with a maximum speed less than the maximum speed on the HFEDS, 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) [October 22, 1996]. 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 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.

(e) NEVs are exempt from the all-electric range highway test.

3.2.2 **Determination of Highway All-Electric Range for Fuel Cell Vehicles and Hybrid Fuel Cell Vehicles.**

(a) The highway all-electric range for a fuel cell vehicle and a hybrid fuel cell vehicle shall be determined in accordance with SAE J2572. As an option, a manufacturer may elect to determine the highway all-electric range for a fuel cell vehicle or a hybrid fuel cell vehicle in accordance with section ~~E~~F.3.2.1 above.

3.3 **Recording requirements.**

For all battery electric vehicles and hybrid electric vehicles, except off-vehicle charge capable hybrid electric vehicles: Once the vehicle is no longer able to maintain the speed and time requirements specified in ~~E~~F.3.1 or ~~E~~F.3.2 above, the vehicle shall be brought to an immediate stop and the following data shall be 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;

(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; and

(e) Measured AC and DC watt hours and amp hours shall be reported to the nearest hundredths of a kilowatt hour and tenths of an amp hour.

Battery charging shall begin within 1 hour after terminating the All-Electric Range Test.

3.4 **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 for normal driving conditions prior to the commencement of the test. The driving schedule speed and time tolerances specified in ~~E~~F.3.1 or ~~E~~F.3.2 shall not be exceeded due to the operation of the regenerative braking system.

3.5 **Measurement Accuracy**. For battery electric vehicles, the overall error in voltage and current recording instruments shall be NIST traceable and accurate to ±1% of the maximum value of the variable (AC/DC volts and amps) being measured. Suggested equipment: amp meter/power meter capable of sampling voltage and current. Voltage and current shall be sampled at a minimum rate of 20 hz.

3.6 **Watt Hour Calculation for Battery Electric Vehicles.**

DC energy (watt-hours) shall be calculated as follows

DC energy = $\int v(t) * i(t)\, dt$
Wherev = vehicle DC main battery pack voltage
i = vehicle DC main battery pack current

AC energy (in watt-hours) shall be calculated as follows

AC energy = $\int v(t) * i(t)\, dt$ in watt-hours
Wherev = AC instantaneous voltage
i = AC instantaneous current

3.7 **Charger Requirements for Battery Electric Vehicles.**

The standard charging apparatus (or equivalent) normally furnished with or specified for the vehicle shall be used for charging during vehicle testing.

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 for Vehicles Other Than ZEVs.

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 to obtain a grams per mile value.

6. Urban Emission Test Provisions for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Off-Vehicle Charge Capable Hybrid Electric Vehicles.

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" with the following supplemental requirements:

6.1.1 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.

6.1.2 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.

6.1.3 After setting battery state-of-charge, the hybrid electric vehicle shall be pushed or towed to a work area for the initial fuel drain and fill according to section III.D.1.4. of the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles."

6.1.4 Following the initial fuel drain and fill, the vehicle shall complete an initial soak period of a minimum of 6 hours. After completing the soak period, 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.

6.1.5 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 in section ~~F~~G.10 would be satisfied for the dynamometer procedure (section ~~E~~F.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 the second soak period of 12 to 36 hours.

(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 Urban Dynamometer Procedure for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Off-Vehicle Charge Capable Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §86.135-00 [October 22, 1996] with the following revisions. References to §86.110-94 shall mean §86.110-94 as last amended June 30, 1995.

6.2.1 Amend subparagraph (a).

Overview. The dynamometer run shall consist of two tests, a “cold” start test, after a second fuel drain and fill and a 12 to 36 hour soak period performed pursuant to the provisions of the “California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles” 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.

For all UDDS tests, the exhaust emissions are diluted with ambient air in the dilution tunnel as shown in Figure B94-5 and Figure B94-6

(§86.110-94). As an alternative, the bag mini-diluter may be used in-lieu of the constant volume sampling (CVS) method for exhaust emission measurement as described below. 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). Part 1065 of the CFR may be used as an optional particulate sampling method. Continuous proportional samples of gaseous emissions are collected for analysis during each test. For hybrid electric vehicles with 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 that are not "off-vehicle charge capable," and are equipped with petroleum-fueled diesel-cycle auxiliary power units (optional for natural gas-fueled, liquefied petroleum gas-fueled, and alcohol-fueled diesel-cycle vehicles), THC is sampled and analyzed continuously pursuant to the provisions of §86.110-94. 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 alcohol-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 alcohol-fueled auxiliary power units, alcohol 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 Subparagraphs (b) through (c). [No change.]

6.2.3 Subparagraph (d). [No change.]

6.2.4 Subparagraphs (e) through (g). [No change.]

6.2.5 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.

6.2.6 Subparagraph (i). [No change.]

6.3 Urban Dynamometer Test Run, Gaseous and Particulate Emissions for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Off-Vehicle Charge Capable Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §86.137-96 [March 24, 1993] with the following revisions:

6.3.1 Amend subparagraph (a): *General*. The dynamometer run shall consist of two tests, a "cold" start test, after a second fuel drain and fill and a 12 to 36 hour soak period performed pursuant to the provisions of the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" and a "hot" start test following the cold start test by 10 minutes. 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 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 vehicle is allowed to stand on the dynamometer during the 10 minute time period between each test.

6.3.2 Amend subparagraph (b) as follows.

6.3.2.1 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 alcohol exhaust sample, the formaldehyde exhaust sample, the dilution air sample bag, the alcohol 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.

6.3.2.2 Delete subparagraph (b)(13).

6.3.2.3 Amend subparagraph (b)(14): Turn the vehicle off 2 seconds after the end of the last deceleration (at 1,369 seconds).

6.3.2.4 Amend subparagraph (b)(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 alcohol 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 alcohol 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.

6.3.2.5 Amend subparagraph (b)(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.

6.3.2.6 Delete subparagraph (b)(19).

6.3.2.7 Delete subparagraph (b)(20).

6.3.2.8 Amend subparagraph (b)(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 in section ~~F~~G.10.

6.3.2.9 Amend subparagraph (b)(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."

6.4 Calculations - Exhaust Emissions for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Off-Vehicle Charge Capable Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §86.144-94 [July 13, 2005] with the following revisions:

6.4.1 Amend subparagraph (a): For light-duty vehicles and light duty trucks:

$$Y_{wm} = 0.43 * \left(\frac{Y_c}{D_c}\right) + 0.57 * \left(\frac{Y_h}{D_h}\right)$$

Where:

(1) Y_{wm} = Weighted mass emissions of each pollutant, i.e., THC, CO, THCE, NMOG, 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.

6.4.2 Subparagraphs (b) through (e). [No change.]

6.5 Calculations - Particulate Emissions for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Off-Vehicle Charge Capable Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §86.145-82 [November 2, 1982] with the following revisions. References to §86.110-94 shall mean §86.110-94 as last amended June 30, 1995.

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:

$$M_p = 0.43 * \left(\frac{M_{pc}}{D_c}\right) + 0.57 * \left(\frac{M_{ph}}{D_h}\right)$$

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.

6.5.2 Subparagraph (b). [No change.]

7. Highway Emission Test Provisions for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Off-Vehicle Charge Capable Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §600.111-08 [December 27, 2006] with the following revisions.

7.1 Subparagraph (a). [not applicable - delete]

7.2 Amend subparagraph (b) as follows:

7.2.1 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. Alcohol and formaldehyde samples are collected and individually analyzed for alcohol-fueled vehicles.

7.2.2 Amend subparagraph (b)(7)(i): The dynamometer procedure shall consist of two cycles of the Highway Fuel Economy Driving Schedule (§600.109(b)) separated by 15 seconds of idle. The first cycle of the Highway Fuel Economy Driving Schedule is driven to precondition the test vehicle and the second is driven for the fuel economy measurement.

7.2.3 Amend subparagraph (b)(7)(iii): Only one exhaust sample and one background sample shall be collected and analyzed for THC (except diesel hydrocarbons which are analyzed continuously), CO, CO_2, and NO_x. Alcohol and formaldehyde samples (exhaust and dilution air) are collected and analyzed for alcohol-fueled vehicles.

7.2.4 Add subparagraph(b)(7)(v): 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.

7.2.5 Amend subparagraph (b)(9)(v): Operate the vehicle over one HFEDS preconditioning cycle according to the dynamometer driving schedule specified in §600.109-08(b) [December 27, 2006]. 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.

7.2.6 Amend subparagraph (b)(9)(vi): 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.

7.2.7 Add subparagraph (b)(9)(viii): 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 in section F.10 is satisfied. If the SOC criterion is not satisfied, then repeat dynamometer test run from subparagraph (b)(9)(vi) and (b)(9)(vii). A total of three highway emission tests shall be allowed to satisfy the SOC criterion.

(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.

7.2.8 Delete subparagraph (b)(10).

7.3 Delete subparagraphs (c) through (e).

8. SFTP Emission Test Provisions for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Off-Vehicle Charge Capable Hybrid Electric Vehicles.

8.1 US06 Vehicle Preconditioning

To be conducted pursuant to 40 CFR §86.132-00 [October 22, 1996] with the following revisions.

8.1.1 Subparagraphs (a) through (m). [No change.]

8.1.2 Amend subparagraph (n): Aggressive Driving Test (US06) Preconditioning.

8.1.2.1 Amend subparagraph (1) as follows: If the US06 test follows the exhaust emission urban, highway, 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. For vehicles that allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at according to the following conditions:

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.

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.

8.1.2.1.1 Subparagraphs (i) through (iv). [No change.]

8.1.2.2 Subparagraph (2). [No change.]

8.1.3 Subparagraph (o). [No change.]

8.2 US06 Emission Test.

To be conducted pursuant to 40 CFR §86.159-08 [December 27, 2006] 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 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 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. The US06 cycle after the preconditioning cycle shall be used to calculate emissions and shall meet the state-of-charge net tolerances as calculated in section ~~E~~F.9.

8.2.2 Amend subparagraph (b) as follows.

8.2.2.1 Amend subparagraph (b)(2): Position the test vehicle on the dynamometer and restrain.

8.2.3 Subparagraph (c). [No change.]

8.2.4 Amend subparagraph (d): Practice runs over the prescribed driving schedule may be performed at test point to permit sampling system adjustment.

8.2.5 Subparagraph (e). [No change.]

8.2.6 Amend subparagraph (f) as follows.

8.2.6.1 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.

8.2.6.2 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 in section F.10 is satisfied. If the SOC criterion is not satisfied, then repeat dynamometer test run from subparagraph (f)(2)(i) without the preconditioning cycle. A total of three US06 emission tests shall be allowed to satisfy the SOC criterion.

(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 [October 22, 1996] with the following revisions.

8.3.1 Subparagraphs (a) through (n). [No change.]

8.3.2 Amend subparagraph (o): *Air Conditioning Test (SC03) Preconditioning*.

8.3.2.1 Amend subparagraph (1) as follows: 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. 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:

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.

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.

8.3.2.1.1 Subparagraphs (i) and (ii). [No change.]

8.3.2.2 Subparagraphs (2) through (3). [No change.]

8.4 SC03 Emission Test.

To be conducted pursuant to 40 CFR §86.160-00 [December 8, 2005] 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 simulate testing in an environmental test cell (see §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^{o}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 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 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. The SC03 cycle after the preconditioning cycle shall be used to calculate emissions and shall meet the state-of-charge net tolerances as calculated in section ~~E~~F.-9.

8.4.2 Amend subparagraph (b) as follows.

8.4.2.1 Amend subparagraph (b)(2): Position the test vehicle on the dynamometer and restrain.

8.4.3 Amend subparagraph (c) as follows.

8.4.3.1 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 (d) as follows.

8.4.4.1 Amend subparagraph (d)(10): At the conclusion of the SC03 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 in section F.10 is satisfied. If the SOC criterion is not satisfied, then turn off the cooling fan(s), allow the vehicle to soak in the ambient conditions of paragraph (c)(5) of this section for 10 ± 1 minutes, and repeat the dynamometer test run from subparagraph (d). Up to three SC03 emission tests shall be attempted to satisfy the SOC criterion.

(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 the vehicle two 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 the vehicle two seconds after the end of the last deceleration.

8.4.5 Subparagraph (e). [No change.]

9. State-of-Charge Net Change Tolerances for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Off-Vehicle Capable Hybrid Electric Vehicles.

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:

$$(\text{Amp-hr}_{final})_{max} = (\text{Amp-hr}_{initial}) + 0.01 * \left(\frac{NHV_{fuel} * m_{fuel}}{V_{system} * K_1} \right)$$

$$(\text{Amp-hr}_{final})_{min} = (\text{Amp-hr}_{initial}) - 0.01 * \left(\frac{NHV_{fuel} * m_{fuel}}{V_{system} * K_1} \right)$$

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}	=	Open circuit voltage (OCV) that corresponds to the SOC of the target SOC during charge sustaining operation. This value shall be submitted for testing purposes, and it shall be subject to confirmation by the Air Resources Board.

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

$V^2_{initial}$ = 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:

$$(rpm_{final})_{max} = \sqrt{rpm^2_{initial} + 0.01 * \frac{(2 * NHV_{fuel} * m_{fuel})}{I * K_3}}$$

$$(rpm_{final})_{min} = \sqrt{rpm^2_{initial} - 0.01 * \frac{(2 * NHV_{fuel} * m_{fuel})}{I * K_3}}$$

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
$rpm^2_{initial}$ = 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, $\frac{4\pi^2}{3600\sec^2 - rpm^2}$

I = Rated moment of inertia of the flywheel, in kg-m^2

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~~F~~G. Test Procedures for 2012 through 2017 ~~and Subsequent~~ Model Off-Vehicle Charge Capable Hybrid Electric Vehicles.

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," unless otherwise noted. A manufacturer may elect to certify a 2009, 2010, or 2011 model-year off-vehicle charge capable hybrid electric vehicle using this section ~~F~~G.

1. Electric Dynamometer.

All off-vehicle charge capable HEVs must be tested using a 48-inch single roll electric dynamometer meeting the requirements of 40 CFR Subpart B, §86.108-00(b)(2) [October 22, 1996].

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. General Testing Requirements.

3.1 Recording requirements.

For off-vehicle charge capable hybrid electric vehicles: The following data shall be recorded for all tests and for each individual test cycle therein, except for the 20°F and 50°F tests, conducted in accordance with section ~~F~~G.8:

(a) mileage accumulated during the All-Electric Range portion of the test, where applicable;

(b) Net DC energy from the battery that was expended during the test (may be reported as the total DC battery energy output and the total DC battery energy input);

(c) AC energy required to fully charge the battery after a charge depleting or charge sustaining test from the point where electricity is introduced from the electric outlet to the battery charger;

(d) DC energy required to fully charge the battery after a charge depleting or charge sustaining test from the point where electricity is introduced from the battery charger to the battery;

(e) Net DC amp-hrs from the battery that was expended during the test (may be reported as the total DC amp-hrs output and the total DC amp-hrs input); and

(f) Measured AC and DC watt hours and amp hours shall be reported to the nearest hundredths of a kilowatt hour and tenths of an amp hour.

3.2 **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 for normal driving conditions prior to the commencement of the test. The driving schedule speed and time tolerances specified in this section ~~F~~G shall not be exceeded due to the operation of the regenerative braking system.

3.3 **Measurement Accuracy**. The overall error in voltage and current recording instruments shall be NIST traceable and accurate to ±1% of the maximum value of the variable (AC/DC volts and amps) being measured. Suggested equipment: amp meter/power meter capable of sampling voltage and current. Voltage and current shall be sampled at a minimum rate of 20 hz.

3.4 **Watt Hour Calculation.**

DC energy (watt hours) shall be calculated as follows

DC energy = $\int v(t) * i(t)\, dt$
Where v = vehicle DC main battery pack voltage
i = vehicle DC main battery pack current

AC energy (in watt-hours) shall be calculated as follows

AC energy = $\int v(t) * i(t)\, dt$ in watt-hours
Where v = AC instantaneous voltage
i = AC instantaneous current

3.5 **Charger Requirements**

The standard charging apparatus (or equivalent) normally furnished with or specified for the vehicle shall be used for charging during vehicle testing.

4. 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 to obtain a grams per mile value.

5. Urban Test Provisions for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

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.

The criteria certification emissions for the Urban test shall be the worst case emissions of NMOG, CO, NOx, and PM from either the charge depleting or charge sustaining tests. The sum of NMOG + NOx emissions shall constitute the worst case for the urban charge sustaining or charge depleting modes of operation.

Vehicles with more than one mode of operation of the auxiliary power unit (e.g., economy mode, performance mode, etc.) for a given charge depleting or charge sustaining test cycle must be tested in the mode(s) which represents the worst case emissions of the auxiliary power unit. Confirmatory testing may also be performed in any mode of operation to ensure compliance with emission standards.

5.1 Vehicle Preconditioning.

To be conducted pursuant to the “California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles” with the following supplemental requirements:

5.1.1 For 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 vehicle to operate the auxiliary power unit for the maximum possible cumulative amount of time during the preconditioning drive.

5.1.2 For vehicles that allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at the lowest level allowed by the manufacturer.

5.1.3 After setting battery state-of-charge, the vehicle shall be pushed or towed to a work area for the initial fuel drain and fill according to section III.D.1.4 of the “California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles.”

5.1.4 Following the initial fuel drain and fill, the vehicle shall complete an initial soak period of a minimum of 6 hours.

5.1.5 After completing the soak period, the vehicle shall be pushed or towed into position on a dynamometer and preconditioned.

5.1.6 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.

5.1.7 For the charge depleting range test and the charge sustaining emission test, the preconditioning cycle shall be the UDDS. The vehicle must be in charge sustaining operation during the preconditioning drive. To determine charge sustaining operation, the vehicle must meet the SOC criterion in section

~~F~~G.10 from the start to the end of the two consecutive UDDSs. As an option, charge sustaining operation can be achieved for a single UDDS if data is provided showing that charge sustaining operation can consistently be maintained over one UDDS. The vehicle must meet the SOC criterion in section ~~F~~G.10 from the start to the end of a single UDDS. Alternative procedures may be used to determine charge sustain operation for the precondition drive if the alternate procedure demonstrates charge sustaining operation based on section ~~F~~G.10 and is approved in advance by the Executive Officer of the Air Resources Board.

5.1.8 A fuel drain and fill shall be performed pursuant to the provisions of the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles."

5.1.9 The vehicle shall be soaked for 12-36 hours. During this soak period, canister preconditioning shall be performed pursuant to the provisions of the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles."

5.1.10 For the urban charge depleting range test, the highway charge depleting range test, and the cold start US06 range test, charge the vehicle to full state-of-charge as specified by the vehicle manufacturer. The vehicle must be turned off during charging and charge time shall not exceed soak time.

5.2 Urban Dynamometer Procedure for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §86.135-00 [October 22, 1996] with the following revisions. References to §86.110-94 shall mean §86.110-94 as last amended June 30, 1995.

5.2.1 Amend subparagraph (a).

Overview. The charge depleting range test dynamometer run shall consist of a series of charge depleting UDDSs, each followed by a 10 minute key-off hot soak period until charge sustaining operation is achieved for two consecutive UDDSs. To determine charge sustaining operation, the vehicle must meet the SOC criterion in section ~~F~~G.10 from the start of the first UDDS until the end of the second UDDS. As an option, charge sustaining operation may be achieved for a single UDDS if data is provided showing that charge sustaining operation can consistently be maintained over one UDDS. To determine charge sustaining operation, in this case, the vehicle shall meet SOC criterion in section ~~F~~G.10 from the start to the end of a single UDDS. Emissions are measured for all UDDSs when the auxiliary power unit is operating.

The vehicle shall be turned off and 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. At the end of this cold soak period, the vehicle shall be placed or pushed onto a dynamometer.

The charge sustaining emission -test dynamometer run shall consist of two consecutive UDDSs with a 10 minute key-off hot soak in between. Vehicle emissions shall be measured over two UDDSs during charge sustaining operation, and the vehicle must meet the SOC criterion in section ~~F~~G.10 from the start of the first UDDS until the end of the second UDDS.

Vehicle charging -shall be initiated within three hours after either the charge depleting range test or the charge sustaining emission test pursuant to section ~~F~~G.5.4.2 or ~~F~~G.5.4.3, as applicable. During charging, all requirements in section ~~F~~G.3 must be met, and energy consumption shall be calculated pursuant to the requirements in section ~~F~~G.11.7.

For all exhaust emission tests, the exhaust emissions are diluted with ambient air in the dilution tunnel as shown in Figure B94-5 and Figure B94-6 (§86.110-94). As an alternative, the bag mini-diluter may be used in-lieu of the constant volume sampling (CVS) method for exhaust emission measurement as described below. A dilution tunnel is not required for testing vehicles waived from the requirement to measure particulates. For UDDSs, particulate samples are collected on filters for weighing during each UDDS. Each sample plus backup is collected during each UDDS (including shutdown). Part 1065 of the CFR may be used as an optional particulate sampling method. Continuous proportional samples of gaseous emissions are collected for analysis during each UDDS. For vehicles with Otto-cycle auxiliary power units, the composite samples collected in bags are analyzed for THC, CO, CO_2, CH_4 and NO_x. For vehicles with petroleum-fueled diesel-cycle auxiliary power units (optional for natural gas-fueled, liquefied petroleum gas-fueled, and alcohol-fueled diesel-cycle vehicles), THC is sampled and analyzed continuously pursuant to the provisions of §86.110-94. Parallel samples of the dilution air are similarly analyzed for THC, CO, CO_2, CH_4 and NO_x. For vehicles with natural gas-fueled, liquefied petroleum gas-fueled, and alcohol-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 vehicles with alcohol-fueled auxiliary power units, alcohol 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.

5.2.2 Subparagraphs (b) through (c). [No change.]

5.2.3 Subparagraph (d). [No change.]

5.2.4 Subparagraphs (e) through (g). [No change.]

5.2.5 Amend subparagraph (h): The driving distance, as measured by counting the number of dynamometer roll or shaft revolutions, shall be determined for all charge depleting and exhaust emission tests. The revolutions shall be measured on the same roll or shaft used for measuring the vehicle's speed.

5.2.6 Subparagraph (i). [No change.]

5.3 Urban Dynamometer Test Run, Gaseous and Particulate Emissions for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §86.137-96 [March 24, 1993] with the following revisions:

5.3.1 Amend subparagraph (a): *General*. The dynamometer run shall consist of a series of UDDSs, after a second fuel drain and fill and a 12 to 36 hour soak period performed pursuant to the provisions of the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles." 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 vehicle is allowed to stand on the dynamometer during the 10 minute time period between each UDDS.

5.3.2 Amend subparagraph (b) as follows.

5.3.2.1 Amend subparagraph (b)(9): Start the gas flow measuring device, direct the sample flow into the exhaust sample bag, the alcohol exhaust sample, the formaldehyde exhaust sample, the dilution air sample bag, the alcohol dilution air sample and the formaldehyde dilution air sample, 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.

5.3.2.2 Delete subparagraph (b)(13).

5.3.2.3 Subparagraph (b)(14). [No change.]

5.3.2.4 Amend subparagraph (b)(15): Five seconds after the vehicle is shutdown, simultaneously turn off the gas flow measuring device and particulate sample pump. 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

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the sample collection phase of the UDDS. Obtain alcohol 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 alcohol 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.

5.3.2.5 Amend subparagraph (b)(18): Repeat the steps in paragraphs (b)(2) through (b)(17) of this section for the hot start UDDS. The steps 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 UDDS.

5.3.2.6 Delete subparagraph (b)(19).

5.3.2.7 Delete subparagraph (b)(20).

5.3.2.8 Amend subparagraph (b)(21): As soon as possible, transfer the particulate filters to the weighing chamber for post-test conditioning, if applicable. For vehicles undergoing a cold start charge sustaining test, a valid test shall satisfy the SOC criterion in section ~~F~~G.10.

5.3.2.9 Amend subparagraph (b)(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."

5.4 Determination of Urban All-Electric Range and Urban Equivalent All-Electric Range for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

5.4.1 The **Urban All-Electric Range** shall be shall be defined as the distance that the vehicle is driven from the start of Urban Charge Depleting Range Test until the internal combustion engine first starts.

5.4.2 **Urban Charge Depleting Range Test.**

(i) **Vehicle preconditioning.** The vehicle shall be preconditioned according to ~~F~~G.5.1.

(ii) **Dynamometer run.** At the end of the cold soak period, the vehicle shall be placed or pushed, onto a dynamometer and operated through the Continuous Urban Test Schedule until the SOC Net Change Tolerances (specified in section ~~F~~G.10 of these test procedures) that indicate charge sustaining operation are met for two consecutive UDDSs, or a single UDDS if data is provided showing that charge sustaining operation can consistently be maintained in one UDDS. If there are no charge depleting hot start cycles, then use the next hot start cycle (after the cold start cycle) in the test sequence for the purpose of determining hot start emissions. For this case (no charge depleting hot start cycle), the manufacturer may optionally add one additional hot start cycle.

The Alternative Continuous Urban Test Schedule may be substituted for the Continuous Urban Test Schedule if the test facility is unable to perform the Continuous Urban Test Schedule. Refer to sections ~~F~~G.5.5, ~~F~~G.5.6, and ~~F~~G.11, for calculations of urban exhaust emissions, urban particulate emissions, and equivalent all-electric range, respectively. Emissions are measured for all test cycles when the auxiliary power unit is operating. For each test cycle for which emissions were not measured, the manufacturer must validate that the auxiliary power unit did not turn on at any time during the test cycle.

(iii) **Vehicle charging after testing.** Vehicle charging shall begin within three hours after either the charge depleting range test or the charge sustaining emission test, and the vehicle shall be charged to the manufacturer specified full state-of-charge. During charging, all applicable requirements in ~~F~~G.3 must be met, and energy consumption shall be calculated pursuant to the requirements in section ~~F~~G.11.7.

5.4.3 **Urban Charge Sustaining Emission Test.** The Urban Charge Sustaining Emission Test is conducted cold, and after charge sustaining operation has been reached, or an optional charge sustaining test mode has been activated, and no subsequent charge has been performed.

(i) **Vehicle preconditioning.** If the Urban Charge Sustaining Emission Test is performed within 36 hours after the Urban Charge Depleting Range Test, the vehicle shall be preconditioned pursuant to section ~~F~~G.5.1.9. If the Urban Charge Sustaining Emission Test is performed more than 36 hours after the Urban Charge Depleting Range Test, the vehicle shall be preconditioned pursuant to section ~~F~~G.5.1, except for vehicle charging. Sections ~~F~~G.5.1.1 through ~~F~~G.5.1.4 may be omitted if previously performed.

(ii) **Dynamometer run.** At the end of the cold soak period, the vehicle shall be placed or pushed onto a dynamometer, and two UDDSs shall be performed during charge sustaining operation, each separated by a 10 minute key-off hot soak period. The vehicle must meet the SOC criterion in section ~~F~~G.10 from the start of the first UDDS until the end of the second UDDS. If the SOC criterion is not satisfied, the test shall be stopped, the vehicle cold soak shall be conducted again, and the dynamometer test run shall be conducted again.

(iii) **Vehicle charging after testing.** If the vehicle was not charged after the Urban Charge Depleting Range Test, then vehicle charging shall begin within three hours after the Urban Charge Sustaining Emission Test and the vehicle shall be charged to the manufacturer specified full state-of-charge. During charging, all requirements in ~~F~~G.3 must be met, and energy consumption shall be calculated pursuant to the requirements in section ~~F~~G.11.7.

5.5 Calculations - Urban Exhaust Emissions for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §86.144-94 [July 13, 2005] with the following revisions:

5.5.1 Amend subparagraph (a):

Gaseous Emissions – Urban Charge Depleting Range Test.

For light-duty vehicles and light duty trucks:

$$Y_{wm} = 0.43 * \left(\frac{Y_c}{D_c}\right) + 0.57 * \left(\frac{\Sigma Y_n}{\Sigma D_n}\right)$$

Where:

Y_{wm} = Weighted mass emissions of each pollutant, i.e., THC, CO, THCE, NMOG, NMHCE, CH_4, NOx, or CO_2, in grams per vehicle mile.

Y_c = Mass emissions as calculated from the cold start UDDS, in grams per test.

D_c = The measured driving distance from the cold start UDDS, in miles.

n = number of hot start UDDSs in Charge Depleting operation
If there are no charge depleting hot start cycles, then use the next hot start cycle (after the cold start cycle) in the test sequence for the purpose of determining hot start emissions. For this case (no charge depleting hot start cycle), the manufacturer may optionally add one additional hot start cycle for an n=2.

Gaseous Emissions – Urban Charge Sustaining Emission Test.

For light-duty vehicles and light-duty trucks:

$$Y_{wm} = 0.43 * \left(\frac{Y_c}{D_c}\right) + 0.57 * \left(\frac{Y_h}{D_h}\right)$$

Where:

Y_{wm} = Weighted mass emissions of each pollutant, i.e., THC, CO, THCE, NMOG, NMHCE, CH_4, NO_x, or CO_2, in grams per vehicle mile.

Y_c = Mass emissions as calculated from the cold start UDDS, in grams per test.

Y_h = Mass emissions as calculated from the hot start UDDS, in grams per test.

D_c = The measured driving distance from the cold start UDDS, in miles.

D_h = The measured driving distance from the hot start UDDS, in miles.

5.5.2 Subparagraphs (b) through (e). [No change.]

5.6 Calculations - Urban Particulate Emissions for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §86.145-82 [November 2, 1982] with the following revisions. References to §86.110-94 shall mean §86.110-94 as last amended June 30, 1995.

5.6.1 Amend subparagraph (a):

Particulate Emissions – Urban Charge Depleting Range Test.

The final reported test results for the mass particulate (M_p) in grams/mile shall be computed as follows:

$$M_p = 0.43 * \left(\frac{M_{pc}}{D_c}\right) + 0.57 * \left(\frac{\Sigma M_{pn}}{\Sigma D_n}\right)$$

Where:

M_{pc} = Mass of particulate determined from the cold start UDDS, in grams per vehicle mile. (See §86.110-94 for determination.)

D_c = The measured driving distance from the cold start UDDS, in miles.

n = number of hot start UDDSs in Charge Depleting operation
If there are no charge depleting hot start cycles, then use the next hot start cycle (after the cold start cycle) in the test sequence for the purpose of determining hot start emissions. For this case (no charge depleting hot start cycle), the manufacturer may optionally add one additional hot start cycle for an n=2.

Particulate Emissions – Urban Charge Sustaining Emission Test.

The final reported test results for the mass particulate (M_p) in grams/mile shall be computed as follows:

$$M_p = 0.43 * \left(\frac{M_{pc}}{D_c}\right) + 0.57 * \left(\frac{M_{ph}}{D_h}\right)$$

Where:
M_{pc} = Mass of particulate determined from the cold start UDDS, in grams per vehicle mile. (See §86.110-94 for determination.)
M_{ph} = Mass of particulate determined from the hot start UDDS, in grams per vehicle mile. (See §86.110-94 for determination.)
D_c = The measured driving distance from the cold start UDDS, in miles.
D_h = The measured driving distance from the hot start UDDS, in miles.

5.6.2 Subparagraph (b). [No change.]

5.6.3 **Equivalent All-Electric Range** shall be calculated in accordance with section ~~F~~G.11 of these test procedures.

6. Highway Test Provisions for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

Vehicles with more than one mode of operation of the auxiliary power unit (e.g., economy mode, performance mode, etc.) for a given charge depleting or charge sustaining test cycle must be tested in the mode(s) which represents the worst case emissions of the auxiliary power unit. Confirmatory testing may also be performed in any mode of operation to ensure compliance with emission standards.

The third emission test HFEDS of the Highway Charge Sustaining Test shall be used to calculate highway NOx emissions and must be within the SOC criterion in section ~~F~~G.10. As an option, the manufacturer may perform the Highway Charge Sustaining Test with two emission test HFEDSs provided that the second HFEDS meets the SOC criterion in section ~~F~~G.10. In this case, the second HFEDS shall be used to calculate emissions.

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Highway NOx emissions may be determined from the HFEDS in the Highway Charge Depleting Range Test that demonstrates charge sustaining operation.

6.1 Vehicle Preconditioning.

If the Highway Charge Depleting Range Test is performed within 36 hours after completion of either the Urban Charge Depleting Range Test or the Urban Charge Sustaining Emission Test, the vehicle shall be preconditioned pursuant to sections ~~F~~G.5.1.9 through ~~F~~G.5.1.10, without canister preconditioning. If the Highway Charge Depleting Range Test is performed more than 36 hours after completion of either the Urban Charge Depleting Range Test or the Urban Charge Sustaining Emission Test, the vehicle shall be preconditioned pursuant to section ~~F~~G.5.1, without canister preconditioning. Sections ~~F~~G.5.1.1 through ~~F~~G.5.1.4 may be omitted if previously performed.

If the Highway Charge Sustaining Emission Test is performed within 36 hours after completion of either the Urban Charge Depleting Range Test, the Urban Charge Sustaining Emission Test, or the Highway Charge Depleting Range Test, the vehicle shall be preconditioned pursuant to section ~~F~~G.5.1.9 without canister preconditioning. If the Highway Charge Sustaining Emissions Test is performed more than 36 hours after completion of either the Urban Charge Depleting Range Test, the Urban Charge Sustaining Emission Test, or the Highway Charge Depleting Range Test, the vehicle shall be preconditioned pursuant to section ~~F~~G.5.1 without canister precondition and vehicle charging. Sections ~~F~~G.5.1.1 through ~~F~~G.5.1.4 may be omitted if previously performed.

6.2 Highway Dynamometer Procedure for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §600.111-08 [December 27, 2006] with the following revisions. This section ~~F~~G.6.2 shall apply during both charge sustaining and charge depleting operation.

6.2.1 Subparagraph (a). [n/a]

6.2.2 Amend subparagraph (b) as follows:

6.2.2.1 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. Alcohol and formaldehyde samples are collected and individually analyzed for alcohol-fueled vehicles.

6.2.2.2 Replace subparagraph (b)(6) with: 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. At the end of the cold soak period, the vehicle shall be placed or pushed onto a dynamometer.

6.2.2.3 Amend subparagraph (b)(7)(i): The Highway Charge Sustaining Emission Test is conducted cold, and after charge sustaining operation has been reached, or an optional charge sustaining test mode has been activated, and no subsequent charge has been performed.

At the end of the cold soak period, the vehicle shall be placed or pushed onto a dynamometer. A cold start HFEDS followed by three emission measurement HFEDSs, separated by a 15 second key-on hot soak period, shall be performed. The vehicle must meet the SOC criterion in section ~~F~~G.10 for the third emission measurement HFEDS. As an option the manufacturer may perform two emission measurement HFEDSs in lieu of three emission measurement HFEDSs, if the SOC criterion is satisfied for the second emission measurement HFEDS. If the SOC criterion is not satisfied, the test shall be stopped, and the procedure shall be repeated starting at section ~~F~~G.6.2.2.2.

6.2.2.4 Amend subparagraph (b)(7)(iii): One exhaust sample and one background sample per each HFEDS shall be collected and analyzed for THC (except diesel hydrocarbons which are analyzed continuously), CO, CO_2, and NO_x. Alcohol and formaldehyde samples (exhaust and dilution air) are collected and analyzed for alcohol-fueled vehicles.

6.2.2.5 Add subparagraph (b)(7)(v): For 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 vehicle to operate the auxiliary power unit for the maximum possible cumulative amount of time during the HFEDS preconditioning cycle. For vehicles that allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at the lowest level allowed by the manufacturer.

6.2.2.6 Amend subparagraph (b)(9)(v): Operate the vehicle over the continuous highway test schedule, consisting of repeated HFEDSs according to the dynamometer driving schedule specified in §600.109-08(b) [December 27, 2006]. 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.

6.2.2.7 Amend subparagraph (b)(9)(vi): When the vehicle reaches zero speed between each HFEDS, the driver has 17 seconds to prepare for the

HFEDS emission measurement cycle of the test. During the idle period, one of the following conditions shall apply:

(a) For vehicles that do not allow the auxiliary power unit to be manually activated, the vehicle shall remain turned on during the idle period.

(b) For 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.

6.2.2.8 Add subparagraph (b)(9)(viii): At the conclusion of the HFEDS emission test, the following conditions shall apply: For 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 in section F.10 is satisfied. If the SOC criterion is not satisfied, then repeat the dynamometer test run from subparagraph (b)(9)(vi) and (b)(9)(vii). Up to three highway emission tests shall be allowed to satisfy the SOC criterion.

6.2.2.9 Delete subparagraph (b)(10).

6.2.3 Delete subparagraphs (c) through (e).

6.3 Determination of Highway All-Electric Range and Highway Equivalent All-Electric Range for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

6.3.1 The **Highway All-Electric Range** shall be defined as the distance that the vehicle is driven from the start of test until the internal combustion engine starts.

6.3.2 **Highway Charge Depleting Range Test.**

(i) **Vehicle preconditioning.** The vehicle shall be preconditioned pursuant to section ~~F~~G.6.1.

(ii) **Dynamometer run.** At the end of the cold soak period, the vehicle shall be placed or pushed, onto a dynamometer and operated through the Continuous Highway Test Schedule until the State–of-Charge Net Change Tolerances (specified in section ~~F~~G.10 of these test procedures) that indicate charge sustaining operation is met for one HFEDS. The Alternative Continuous Highway Test Schedule may be substituted for the Continuous Highway Test Schedule if the test facility is unable to perform the Continuous Highway Test Schedule. Refer to section ~~F~~G.11, for calculations of highway exhaust emissions and equivalent all-electric range, respectively. Emissions are measured for all test cycles when the auxiliary power unit is operating. For each test cycle for which emissions were not measured, the manufacturer must validate that the auxiliary power unit did not turn on at any time during the test cycle.

(iii) **Vehicle charging after testing.** Vehicle charging shall begin within three hours after the Highway Charge Depleting Range Test and the vehicle shall be charged to the manufacturer specified full state-of-charge. During charging, all applicable requirements in section ~~F~~G.3 must be met, and energy consumption shall be calculated according to the requirements in section ~~F~~G.11.7. If the manufacturer provides supplemental data demonstrating that the energy required to charge the vehicle from highway charge sustaining operation to full charge is equivalent (within ± 1% of the AC energy) to the energy required to charge the vehicle from urban charge sustaining operation to full charge, then the energy required to charge the vehicle from urban charge sustaining operation to full charge may be used to determine highway energy consumption pursuant to section ~~F~~G.11.7. Data shall be approved in advance by the Executive Officer of the Air Resources Board.

6.3.3 **Highway Charge Sustaining Emission Test.** The Highway Charge Sustaining Emission Test is conducted cold, and after charge sustaining operation has been reached, or an optional charge sustaining test mode has been activated, and no subsequent charge has been performed:

(i) **Vehicle preconditioning.** The vehicle shall be preconditioned pursuant to section ~~F~~G.6.1.

(ii) **Dynamometer run.** At the end of the cold soak period, the vehicle shall be placed or pushed onto a dynamometer. A cold start HFEDS followed by three emission measurement HFEDSs, separated by a 15 second key-on hot soak period, shall be performed. The vehicle must meet the SOC criterion in section ~~F~~G.10 for the third emission measurement HFEDS. As an option, the manufacturer may perform two emission measurement HFEDSs in lieu of three emission measurement HFEDSs, if the SOC criterion is satisfied for the second HFEDS. If the

SOC criterion is not satisfied, the test shall be stopped, and the procedure shall be repeated starting at section ~~F~~G.6.3.3.

6.3.4 **Equivalent All-Electric Range** shall be calculated in accordance with section ~~F~~G.11 of these test procedures.

7. SFTP Emission Test Provisions for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

Vehicles with more than one mode of operation of the auxiliary power unit (e.g., economy mode, performance mode, etc.) for a given charge depleting or charge sustaining test cycle must be tested in the mode(s) which represents the worst case emissions of the auxiliary power unit. Confirmatory testing may also be performed in any mode of operation to ensure compliance with emission standards.

7.1 US06 Vehicle Preconditioning.

To be conducted pursuant to 40 CFR §86.132-00 [October 22, 1996] with the following revisions. This section ~~F~~G.1 shall apply during charge sustaining operation or at an optional charge sustaining test mode that has been activated, if no subsequent charge has been performed.

7.1.1 Subparagraphs (a) through (m). [No change.]

7.1.2 Amend subparagraph (n) *Aggressive Driving Test (US06) Preconditioning*. as follows:

7.1.2.1 Amend subparagraph (1) as follows: If the US06 test follows the exhaust emission urban, highway, 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. For vehicles that allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at the lowest level allowed by the manufacturer, and the auxiliary power unit shall be manually activated at the beginning of and operated throughout the US06 preconditioning cycle.

7.1.2.1.1 Subparagraphs (i) through (iv). [No change.]

7.1.2.2 Subparagraph (2). [No change.]

7.1.3 Subparagraph (o). [No change.]

As Amended: March 22, 2012
Date of Hearing: January 26-27, 2012

7.2 US06 Emission Test.

To be conducted pursuant to 40 CFR §86.159-08 [December 27, 2006] with the following revisions. This section 7.2 shall apply during charge sustaining operation or at an optional charge sustaining test mode that has been activated, if no subsequent charge has been performed.

7.2.1 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 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 vehicles with Otto-cycle auxiliary power units, the composite samples collected in bags are analyzed for THC, CO, CO_2, CH_4 and NO_x. For vehicles with 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. The US06 cycle after the preconditioning cycle shall be used to calculate emissions and shall meet the state-of-charge net tolerances as calculated in section ~~F~~G.10.

7.2.2 Amend subparagraph (b) as follows.

7.2.2.1 Amend subparagraph (b)(2): Position the test vehicle on the dynamometer and restrain.

7.2.3 Subparagraph (c). [No change.]

7.2.4 Amend subparagraph (d): Practice runs over the prescribed driving schedule may be performed at test point to permit sampling system adjustment.

7.2.5 Subparagraph (e). [No change.]

7.2.6 Amend subparagraph (f) as follows.

7.2.6.1 Amend subparagraph (f)(2)(i): Immediately after completion of the 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 vehicles that do not allow the auxiliary power unit to be manually activated, the vehicle shall remain on during the idle period.

(ii) For 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.

7.2.6.2 Amend subparagraph (f)(2)(ix): At the completion of the test US06 cycle, determine if the SOC criterion in section ~~F~~G.10 is satisfied. If the SOC criterion is not satisfied, then repeat the dynamometer test run from subparagraph (f)(2)(i), without the preconditioning cycle. Up to three US06 emission tests shall be allowed to satisfy the SOC criterion. The idle period between multiple test cycles shall not to be less than one minute and not greater than two minutes. For the final test cycle, turn off the vehicle two seconds after the end of the last deceleration. During the idle period between multiple test cycles, one of the following conditions shall apply:

(i) For vehicles that do not allow the auxiliary power unit to be manually activated, the vehicle shall remain on during the idle period.

(ii) For 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.

7.3 SC03 Vehicle Preconditioning.

To be conducted pursuant to 40 CFR §86.132-00 [October 22, 1996] with the following revisions. This section 7.3 shall apply during charge sustaining operation or at an optional charge sustaining test mode that has been activated, if no subsequent charge has been performed.

7.3.1 Subparagraphs (a) through (n). [No change.]

7.3.2 Amend subparagraph (o): *Air Conditioning Test (SC03) Preconditioning*.

7.3.2.1 Amend subparagraph (1) as follows: If the SC03 test follows the exhaust emission urban, highway, 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. For vehicles that allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at the lowest level allowed by the manufacturer, and the auxiliary power unit shall be manually activated at the beginning of and operated throughout the SC03 preconditioning cycle.

7.3.2.1.1 Subparagraphs (i) and (ii). [No change.]

7.3.2.2 Subparagraphs (2) through (3). [No change.]

7.4 SC03 Emission Test.

To be conducted pursuant to 40 CFR §86.160-00 [December 8, 2005] with the following revisions. This section 7.4 shall apply during charge sustaining operation or at an optional charge sustaining test mode that has been activated, if no subsequent charge has been performed. References to §86.162-03 shall mean §86.162-03 as adopted October 22, 1996.

7.4.1 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 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 simulate testing in an environmental test cell (see §86.162-03 (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^{o}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 vehicles with Otto-cycle auxiliary power units, the composite samples collected in bags are analyzed for THC, CO, CO_2, CH_4 and NO_x. For vehicles with 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. The SC03 cycle after the preconditioning cycle shall be used to calculate emissions and shall meet the state-of-charge net tolerances as calculated in section ~~F~~<u>G</u>.10.

7.4.2 Amend subparagraph (b) as follows.

7.4.2.1 Amend subparagraph (b)(2): Position the test vehicle on the dynamometer and restrain.

7.4.3 Amend subparagraph (c) as follows.

7.4.3.1 Amend subparagraph (c)(9): Start vehicle (with air conditioning system also running). If the auxiliary power unit of the 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.

7.4.4 Amend subparagraph (d) as follows.

7.4.4.1 Amend subparagraph (d)(10): At the conclusion of the SC03 emission test, one of the following conditions shall apply:

(i) For vehicles that do not allow the auxiliary power unit to be manually activated and are charge-sustaining over the SC03 test, record the battery state-of-charge to determine if the SOC criterion in section ~~F~~G.10 is satisfied. If the SOC criterion is not satisfied , then turn off the engine and the cooling fan(s), allow the vehicle to soak in the ambient conditions of paragraph (c)(5) of this section for 10 ± 1 minutes, and repeat the dynamometer test run from subparagraph (d). Up to three SC03 emission tests shall be attempted to satisfy the SOC criterion.

(ii) For vehicles that allow the auxiliary power unit to be manually activated, turn off the vehicle two seconds after the end of the last deceleration.

7.4.5 Subparagraph (e). [No change.]

7.5 Optional Cold Start US06 Range Test.

7.5.1 **Cold soak and vehicle charging.** 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 battery shall be charged to a full state-of-charge. The vehicle must be turned off during charging. Charge time shall not exceed soak time.

7.5.2 At the end of the cold soak period, the vehicle shall be placed or pushed onto a dynamometer, and shall be driven on a continuous US06 test cycle until either:

(a) the auxiliary power unit starts, or

(b) the vehicle can no longer meet the speed trace limits of the US06 driving schedule as specified in CFR 86 Appendix I to within 2 mph higher than the highest point on the trace within 1 second for the upper limit or within 2 mph lower than the lowest point on the trace within 1 second for the lower limit.

When either of these conditions is met, the test shall be ended. The range for this test, in miles, shall be the distant driven from the start of the test to when condition (a) or (b) is met. Emission sampling is not required for this test.

8. 50°F and 20°F Test Provision for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

50 °F testing shall be conducted pursuant to section ~~F~~G.5 with the modifications in Part II, Section C of the "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Year Passenger Cars, Light Duty Trucks, and Medium Duty Vehicles" and the additional following revisions.

20 °F testing shall be conducted pursuant to section ~~F~~G.5 and shall include the temperature provisions in 40 CFR Part 86 Subpart C - Emission Regulations for 1994 and Later Model Year Gasoline-Fueled New Light-Duty Vehicles, New Light-Duty Trucks and New Medium-Duty Passenger Vehicles; Cold Temperature Test Procedures.

For 50 °F and 20 °F charge depleting testing, vehicle charging, prior to emissions testing, shall be performed during the soak period at 50 °F and 20 °F, respectively.

8.1 To satisfy test requirements for the 50°F emission test, the vehicle shall be tested in the worst case (NMOG + NOx) of the urban charge depleting range test or urban charge sustaining emission test as defined in section ~~F~~G.5. To satisfy test requirements for the 20°F emission test, the vehicle shall be tested in the worst case (CO) of the urban charge depleting range test or urban charge sustaining emission test as defined in section ~~F~~G.5. For the 20°F and 50°F emission tests, the vehicle is not required to meet SOC net tolerances.

8.2 If the worst case for emissions is charge sustaining operation, the vehicle shall be preconditioned, and one of the following two emission test options must be performed.

(i) A three phase test that includes phase one as the first 505 seconds of the UDDS, phase two as 506 seconds to the end of the UDDS, a 10 minute key-off soak period, and phase three the first 505 seconds of the UDDS. The first two phases test shall be counted as the first UDDS and the second and third phases will constitute the second UDDS. Emission weighting is as follows:

$$Y_{wm} = 0.43*\left(\frac{Y_1 + Y_2}{D_1 + D_2}\right) + 0.57*\left(\frac{Y_2 + Y_3}{D_2 + D_3}\right)$$

Where:

Y_{wm} = Weighted mass emissions of each pollutant, i.e., THC, CO, THCE, NMOG, NMHCE, CH_4, NO_x, or CO_2, in grams per vehicle mile.

Y_1 = Mass emissions as calculated from phase one of the three phase test.

Y_2 = Mass emissions as calculated from phase two of the three phase test.

Y_3 = Mass emissions as calculated from phase three of the three phase test.

D_1 = The measured driving distance from phase one of the three phase tests, in miles.

D_2 = The measured driving distance from phase two of the three phase tests, in miles.

D_3 = The measured driving distance from phase three of the three phase tests, in miles.

(ii) A two phase test that includes phase one as a UDDS, a 10 minute key-off soak period, and phase two as a UDDS. Emission weighting for the four phase test will follow the procedure outlined in section ~~F~~G.5.5.1.

8.3 If measurement of worst case emissions requires the urban charge depleting range test to be performed, the vehicle shall be preconditioned and fully charged. The continuous urban test schedule shall then be performed. The UDDS, in which the auxiliary power unit first starts, shall be the cold UDDS. Emissions shall be sampled according to one of the options in section ~~F~~G.8.2. For the three phase test option, if the auxiliary power unit starts in phase two of the UDDS, phase one emissions are considered zero for emission calculation purposes. Emissions are weighted according to section ~~F~~G.8.2.

9. Additional Provisions.

9.1 Confirmatory testing may be performed on all tests to establish if higher emissions occur at different states-of-charge in charge depleting mode. This is to ensure that cold start and other emissions standards are not exceeded at other operating SOCs.

9.2 Confirmatory testing may be performed on the US06 test or the manufacturer may provide data to show that potential cold start off-cycle emissions are controlled to the extent that they are controlled for the UDDS.

9.3 Confirmatory testing may be performed on vehicles equipped with an optional charge sustaining operation mode selector with selector set to simulate charge sustaining operation or in actual charge sustaining operation in accordance with section F of these test procedures.

9.4 For an example of an off-vehicle charge capable hybrid electric vehicle with all-electric range and blended operation that has charge depleting actual range and charge depleting cycle range, please see section ~~H~~I, Figure 1.

9.5 For an example of charge depleting to charge sustaining range with and without transitional range and end of test conditions, please see section ~~H~~I, Figure 2.

9.6 When determining the SOC tolerance during testing, the current drive cycle may be aborted if the SOC tolerance is met for previous drive cycle.

9.7 If the manufacturer determines there is insufficient fuel to run the subsequent test, the manufacturer may perform a fuel drain and fill or add fuel pursuant to the provisions of the “California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles.”

10. State-of-Charge Net Change Tolerances.

10.1 For vehicles that use a battery as an energy storage device, the following state-of-charge net change tolerance shall apply:

$$(\text{Amp-hr}_{\text{final}})_{\text{max}} = (\text{Amp-hr}_{\text{initial}}) + 0.01 * \left(\frac{NHV_{fuel} * m_{fuel}}{V_{system} * K_1}\right)$$

$$(\text{Amp-hr}_{\text{final}})_{\text{min}} = (\text{Amp-hr}_{\text{initial}}) - 0.01 * \left(\frac{NHV_{fuel} * m_{fuel}}{V_{system} * K_1}\right)$$

Where:

$(\text{Amp-hr}_{\text{final}})_{\text{max}}$	=	Maximum allowed Amp-hr stored in battery at the end of the test
$(\text{Amp-hr}_{\text{final}})_{\text{min}}$	=	Minimum allowed Amp-hr stored in battery at the end of the test
$(\text{Amp-hr}_{\text{initial}})$	=	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}	=	Open circuit voltage (OCV) that corresponds to the SOC of the target SOC during charge sustaining operation. This value shall be submitted for testing purposes, and it shall be subject to confirmation by the Air Resources Board.

An alternate state-of-charge net tolerance may be used if shown to be technically necessary and if approved in advance by the Executive Officer of the Air Resources Board.

10.2 For 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

10.3 For vehicles that use an electro-mechanical flywheel as an energy storage device, the following state-of-charge net change tolerance shall apply:

$$(rpm_{final})_{max} = \sqrt{rpm_{initial}^2 + 0.01 * \frac{(2 * NHV_{fuel} * m_{fuel})}{I * K_3}}$$

$$(rpm_{final})_{min} = \sqrt{rpm_{initial}^2 - 0.01 * \frac{(2 * NHV_{fuel} * m_{fuel})}{I * K_3}}$$

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, $\frac{4\pi^2}{3600\sec^2 - rpm^2}$

I = Rated moment of inertia of the flywheel, in kg-m^2

11. Calculations – Equivalent All-Electric Range for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

11.1 Charge Depleting CO_2 Produced means the cumulative tailpipe CO_2 emissions produced, M_{cd}, in grams per mile during the charge depleting cycle range.

$$M_{cd} = \Sigma Y_i$$

where:

Y_i = The sum of the CO_2 grams per mile in the charge depleting mode from each test cycle (UDDS or HFEDS)

i = Number (UDDS or HFEDS) of the test over the charge depleting cycle range, R_{cdc}

11.2 Charge Sustaining CO_2 Produced - urban means the cumulative tailpipe CO_2 emissions produced, M_{cs}, in grams per mile, during the cold start charge sustaining urban test.

$$M_{cs} = Y_c + Y_h * \left[\frac{(R_{cdcu} - D_c)}{D_c}\right]$$

where:

R_{cdcu} = Urban Charge Depleting Cycle Range, in miles

D_c = The measured driving distance from the cold start UDDS, in miles

Y_c = Grams per mile CO_2 emissions as calculated from the cold start UDDS

Y_h = Grams per mile CO_2 emissions as calculated from the hot start UDDS

11.3 Charge Sustaining CO_2 Produced - highway means the grams per mile tailpipe CO_2 emissions produced, M_{cs}, during the cold start charge sustaining highway test.

$$M_{cs} = \left(\frac{R_{cdch}}{D_h}\right) * Y_h$$

where:

R_{cdch} = Highway Charge Depleting Cycle Range, in miles

D_h = The measured driving distance from the hot start HFEDS, in miles

Y_h = Grams per mile emissions as calculated from the hot start HFEDS

11.4 Urban Equivalent All-Electric Range ($EAER_u$) shall be calculated as follows:

$$EAER_u = \left(\frac{M_{cs} - M_{cd}}{M_{cs}}\right) * R_{cdcu}$$

where:

M_{cs} is as defined in ~~F~~G.11.2.

M_{cd} is as defined in ~~F~~G.11.1, using the UDDS test cycle.

11.5 Highway Equivalent All-Electric Range ($EAER_h$) shall be calculated as follows:

$$EAER_h = \left[\frac{M_{cs} - M_{cd}}{M_{cs}}\right] * R_{cdch}$$

where:

M_{cs} is as defined in ~~F~~G.11.3.

M_{cd} is as defined in ~~F~~G.11.1, using the HFEDS test cycle.

R_{cdch} is as defined in ~~F~~G.11.3

11.6 Electric Range Fraction (%).

The Electric Range Fraction means fraction of the total miles driven electrically (with the engine off) for blended operation hybrid electric vehicles.

The Urban Electric Range Fraction (ERF_u) is calculated as follows:

$$ERF_u\ (\%) = \left(\frac{EAER_u}{R_{cda}}\right) * 100$$

The Highway Electric Range Fraction (ERF_h) is calculated as follows:

$$ERF_h\ (\%) = \left(\frac{EAER_h}{R_{cdah}}\right) * 100$$

11.7 Equivalent All-Electric Range Energy Consumption.

The Urban Equivalent All-Electric Range Energy Consumption ($EAEREC_u$) shall be calculated as follows:

$$EAEREC_u\ (\text{wh/mi}) = \frac{E_{cd}}{EAER_u}$$

where:

E_{cd} = Total electrical energy used to fully charge the vehicle battery from an external power source after the charge depleting test has been completed. This shall be calculated for both AC and DC energy.

The Highway Equivalent All-Electric Range Energy Consumption ($EAEREC_h$) shall be calculated as follows:

$$EAEREC_h\ (\text{wh/mi}) = \frac{E_{cd}}{EAER_h}$$

where:

E_{cd} = Total electrical energy used to fully charge the vehicle battery from an external power source after the charge depleting test has been completed. This shall be calculated for both AC and DC energy.

11.8 The Urban Charge Depleting Cycle Range, R_{cdcu}, (see section H for an illustration of R_{cdcu}) shall be defined as the distance traveled on the Urban Charge Depleting Procedure up to the UDDS prior to where the state-of-charge is above the lower bound state-of-charge tolerance for one test cycle given by:

$$(\text{Amp-hr}_{final})_{min} = (\text{Amp-hr}_{initial}) - 0.01 * \left(\frac{NHV_{fuel} * m_{fuel}}{V_{system} * K_1}\right)$$

Where:

$(Amp\text{-}hr_{final})_{min}$ = Minimum allowed Amp-hr stored in battery at the end of the test
$(Amp\text{-}hr_{initial})$ = 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} = Open circuit voltage (OCV) that corresponds to the SOC of the target SOC during charge sustaining operation. This value shall be submitted for testing purposes, and it shall be subject to confirmation by the Air Resources Board.

11.9 The Charge Depleting Actual Range, R_{cda}, shall be defined as the range at which the state-of-charge is first equal to the average state-of-charge of the one or two UDDSs used to end the Urban Charge Depleting Test. This range must be reported to the nearest 0.1 miles. For an illustration of R_{cda} see section ~~H~~I.

11.10 The Charge Depleting to Charge Sustaining Urban Range shall be defined as the distance driven in miles from the start of the Urban Charge Depleting Test through the UDDS preceding the one or two UDDSs used to end the Urban Charge Depleting Test.

11.11 The Highway Charge Depleting Cycle Range, R_{cdch}, shall be defined as the sum of the distance traveled on the Highway Charge Depleting Test up to the HFEDS prior to where the state-of-charge is above the lower bound state-of-charge tolerance for one test cycle given by:

$$(Amp\text{-}hr_{final})_{min} = (Amp\text{-}hr_{initial}) - 0.01 * \left(\frac{NHV_{fuel} * m_{fuel}}{V_{system} * K_1} \right)$$

Where:
$(Amp\text{-}hr_{final})_{min}$ = Minimum allowed Amp-hr stored in battery at the end of the test
$(Amp\text{-}hr_{initial})$ = 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} = Open circuit voltage (OCV) that corresponds to the SOC of the target SOC during charge sustaining operation. This value shall be submitted for testing purposes, and it shall be subject to confirmation by the Air Resources Board.

11.12 The Charge Depleting to Charge Sustaining Highway Range shall be defined as the distance driven in miles from the start of the Highway Charge Depleting Test through the HFEDS preceding the final HFEDS.

11.13 The Urban Equivalent All Electric Range for vehicles with an urban charge depleting actual range greater than 40 miles, $EAER_{u40}$, is determined through the following equation:

$$EAER_{u40}\text{ (miles)} = \left(\frac{ERF_u \times 40\,mi}{100}\right)$$

12. The Calculations of the Combined Green House Gas Regulatory Rating of Off-vehicle Charge Capable Hybrid Electric Vehicles

12.1 The combined Greenhouse Gas (GHG) emissions value is determined by the following equation.

$$GHG_{PHEV,\ combined} = 0.55 * (GHG_{urban}) + 0.45 * (GHG_{highway}) \qquad \text{(Eq. 1)}$$

12.2 The urban GHG emissions value for off-vehicle charge capable hybrid electric vehicles is calculated using the following equations.

12.2.1 The urban GHG emissions value is determined by the following equation.

$$GHG_{urban} = \sum_{i=1}^{N_{urban}} (UF_i) * \left(\frac{Y_{CD.i}}{D_i} + GHG_{cd.AC.i}\right) - \sum_{i=1}^{N_{urban}} (UF_i) * G_{upstream} + \left(1 - \sum_{i=1}^{N_{urban}} (UF_i)\right) * (Y_{cs.urban})$$

(Eq. 2)

Where,

GHG_{urban} = Rated urban GHG emissions for PHEV, in gCO_2e/mile
i = Number of charge-depleting urban test cycle
N_{urban} = Total number of urban test cycles in charge depleting to charge sustaining range (R_{cdtcs})
UF_i = Utility factor for urban test cycle i
$Y_{CD.i}$ = Mass emissions of CO_2 in grams per vehicle mile, for the "i"th test in the charge depleting test
D_i = Distance of the "i"th urban test cycle, in miles.
$GHG_{cd.AC.i}$ = Rated GHG emissions for test cycle i, in gCO_2e/mile
$Y_{cs.urban}$ = Weighted mass emissions of CO_2 in grams/mi of the charge sustaining test.
$G_{upstream}$ = Gasoline upstream factor = $0.25 * GHG_{target}$.

12.2.2 The Charge Depleting to Charge Sustaining Range (R_{cdtcs}) is the total number of cycles driven at least partially in charge depleting mode times the cycle distance. Cycles meets charge sustaining criterion are not included in the R_{cdtcs}. The R_{cdtcs} includes the transitional cycle, where the vehicle may have operated in both depleting and sustaining modes.

12.2.3 The utility factors for urban and highway cycles are provided in the following table.

Utility factors for each PHEV drive cycle test with charge-depletion operation

Test cycle number	Test cycle utility factor	
	Urban, UF_i	Highway, UF_j
1	0.176	0.233
2	0.141	0.172
3	0.112	0.127
4	0.091	0.095
5	0.074	0.071
6	0.059	0.054
7	0.049	0.041
8	0.039	0.032
9	0.033	0.025
10	0.027	0.020
11	0.023	0.017
12	0.019	0.013

12.2.4 This charge-depleting GHG rate from electricity use in each test cycle is defined by the following equation:

$$GHG_{cd.AC.i} = GHG_{grid} * E_{cd.AC.i} \qquad \text{(Eq. 3)}$$

Where,

$GHG_{cd.AC.i}$ = Rated GHG emissions for charge-depleting PHEV, in gCO_2e/mile
$E_{cd.AC.i}$ = Urban or highway charge depleting electricity use, in kWh/mile
GHG_{grid} = Lifecycle California electricity GHG intensity, 270 gCO_2e/kWh

12.2.5 The urban or highway charge depleting electricity use is defined by the following formula:

$$E_{cd.AC.i} = \frac{E_{cd.DC.i}}{\sum_{i=1}^{N} E_{cd.DC.i}} * E_{cd.AC.total} \qquad \text{(Eq. 4)}$$

Where,

N = Total number of test cycles in the charge depleting to charge sustaining range (R_{cdtcs}) of the urban or highway charge depleting test.
$E_{cd.AC.i}$ = AC kWh consumed in the "i"th cycle of the charge depleting test.

$E_{cd.DC.i}$ = Depleted DC energy for the "i"th cycle in the charge depleting test. It is defined in section F.3.4 of these test procedures.

$E_{cd.AC.total}$ = Charge-depleting net AC energy consumption is determined according to section F.3.4 of these test procedures.

12.2.6 The $Y_{cs.urban}$, which is the weighted CO_2 mass emissions of the charge-sustaining test, is determined by the following equation, which can be found in section F.5.5 of these test procedures.

$$Y_{CS.Urban} = 0.43 * \frac{Y_C}{D_C} + 0.57 * \frac{Y_H}{D_H} \quad \text{(Eq. 5)}$$

Where,

$Y_{CS.Urban}$ = Weighted mass emissions of CO_2 in grams/mi of the charge sustaining test.

Y_C = Mass emissions as calculated from the cold start UDDS, in grams per cycle.

Y_H = Mass emissions as calculated from the hot start UDDS, in grams per cycle.

D_C = The measured driving distance from the cold start UDDS, in miles.

D_H = The measured driving distance from the hot start UDDS, in miles.

12.3 The highway GHG emissions value for off-vehicle charge capable hybrid electric vehicles is calculated using the following equation.

$$GHG_{highway} = \sum_{j=1}^{N_{highwayn}} (UF_j\} * (\frac{Y_{CD.j}}{D_j} + GHG_{cd.AC.j}) - \sum_{j=1}^{N_{highway}} (UF_i) * G_{upstream} + (1 - \sum_{j=1}^{N_{highway}} (UF_j)) * (Y_{cs.highway})$$

(Eq. 7)

Where,

$GHG_{highway}$ = Rated highway GHG emissions for PHEV, in gCO_2e/mile

j = Number of charge-depleting highway test cycle

$N_{highway}$ = Total number of highway test cycles in charge depleting to charge sustaining range (R_{cdtcs})

UF_j = Utility factor for highway test cycle j (see Table 1)

$Y_{CD.j}$ = Mass emissions of CO_2 in grams per vehicle mile, for the "j"th test in the charge depleting test

D_j = Distance of the HFEDS cycle, in miles.

$GHG_{cd.AC.j}$ = Rated GHG emissions for test cycle *j*, in gCO_2e/mile (see Eq. 3)

$Y_{cs.highway}$ = Mass emissions of CO_2 in grams/mi of the highway charge sustaining emission test, which can be found in section F.6.3.3 of these test procedures.

$G_{upstream}$ = Gasoline upstream factor $0.25 * GHG_{tar}$

~~G~~H. Off-Vehicle Charge Capable Hybrid Electric Vehicle Exhaust Emission Test Sequence.

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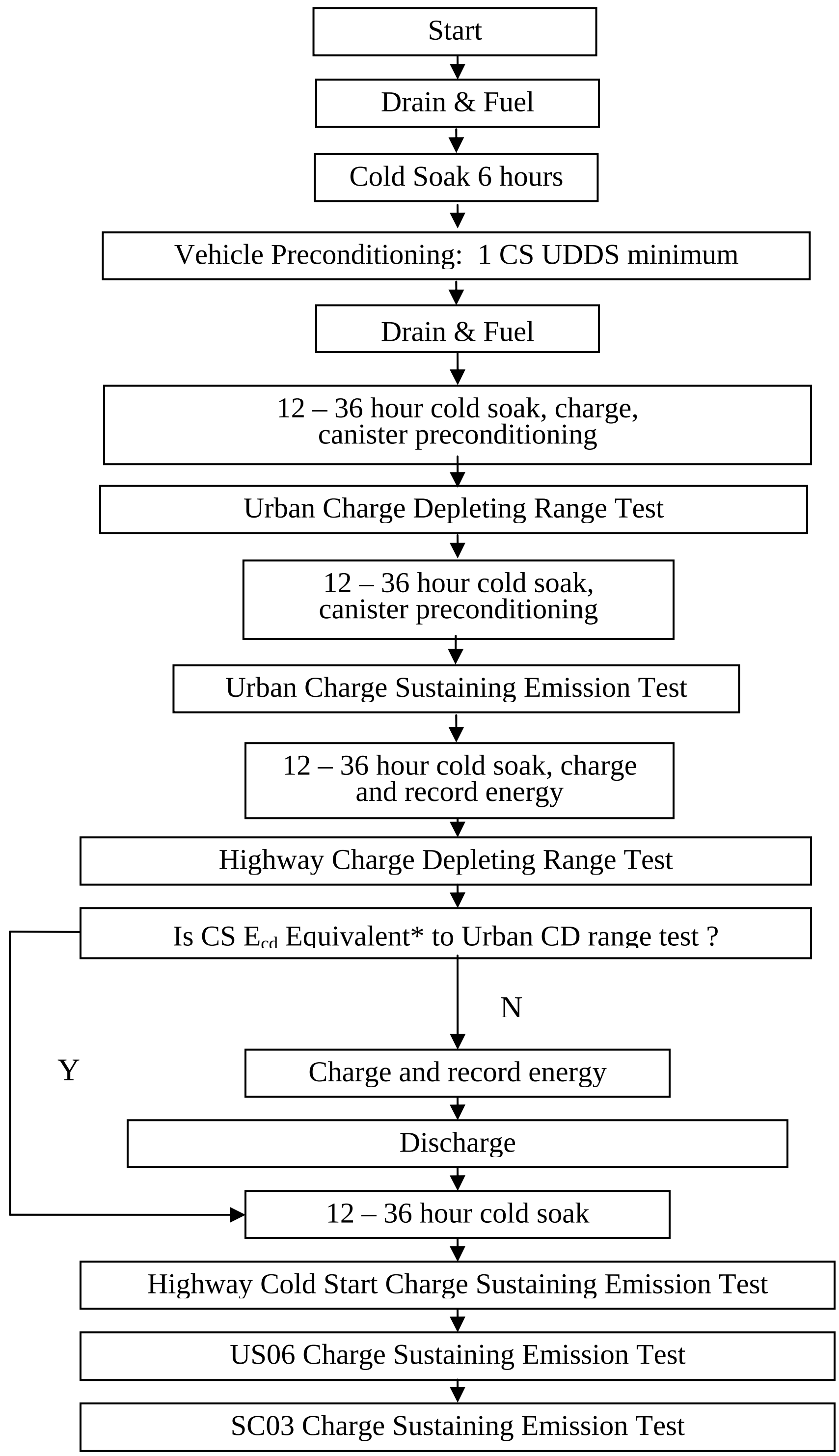
As Amended: March 22, 2012
Date of Hearing: January 26-27, 2012

Off-Vehicle Charge Capable HEV Exhaust Emissions Test Sequence

* Equivalent to within ± 1% of AC energy used to charge battery to full state of charge



~~II~~I. Examples of Off-Vehicle Charge Capable Hybrid Electric Vehicle Terminology.

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Example of an Off-Vehicle Charge Capable HEV with AER and Blended Operation Undergoing the Urban Charge Depleting Range Test

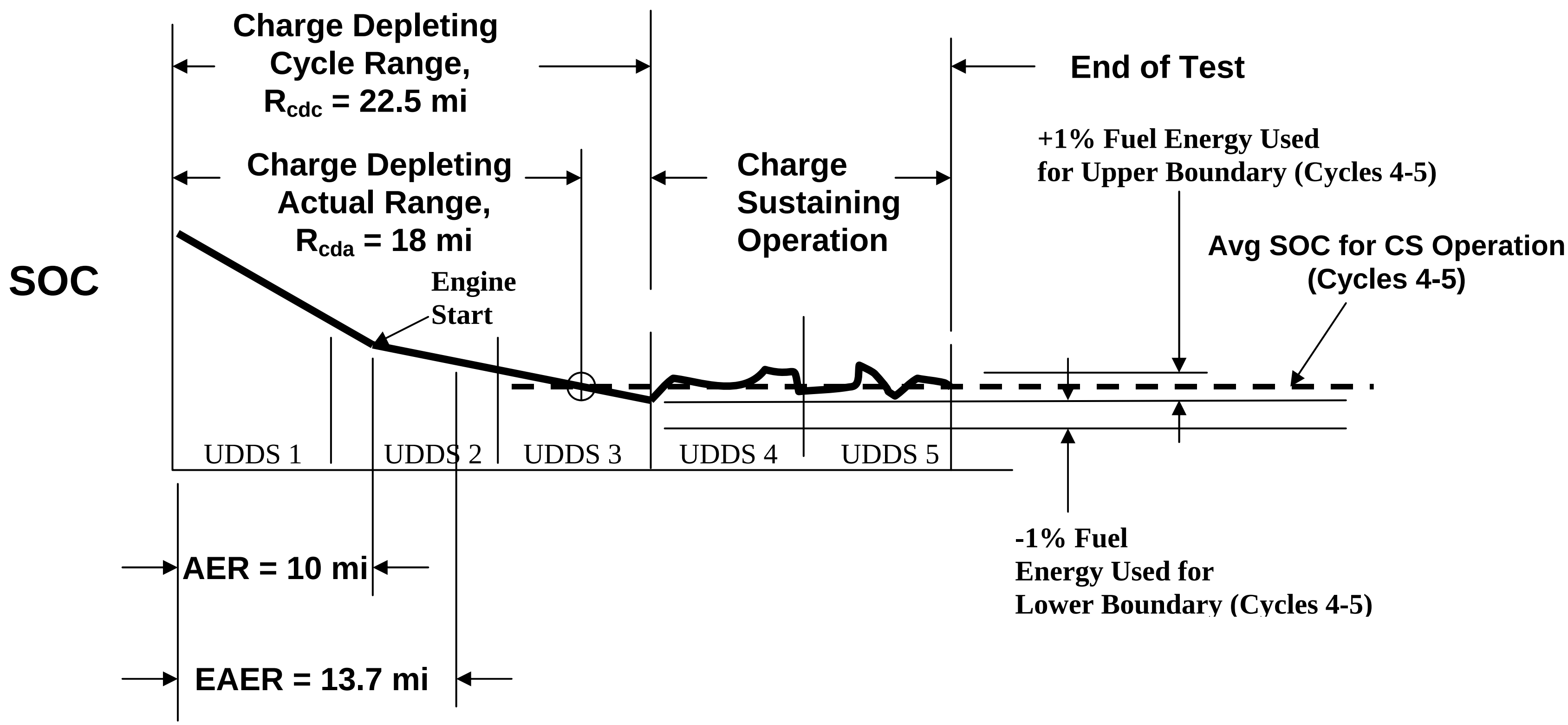
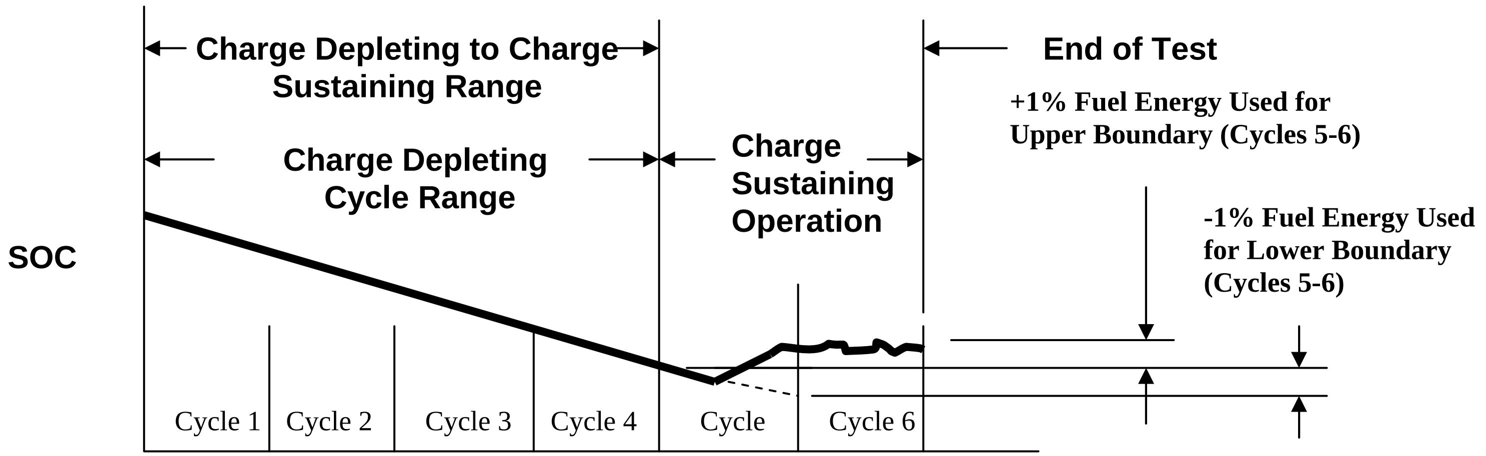


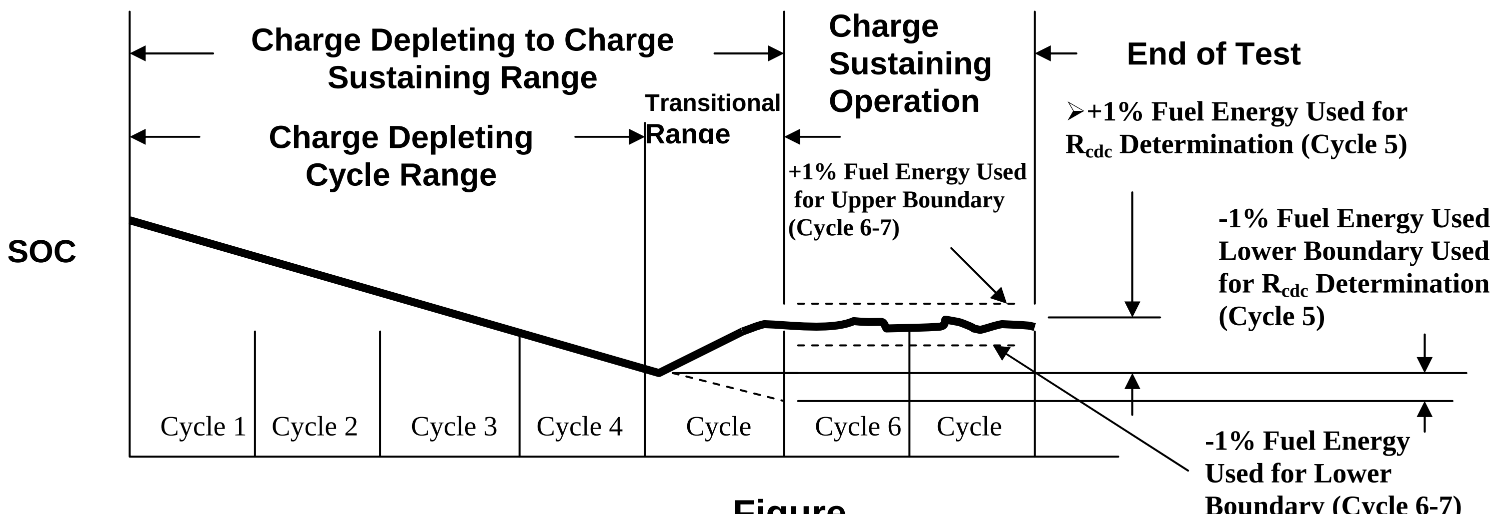
Figure 1

As Amended: March 22, 2012
Date of Hearing: January 26-27, 2012

Example of Urban End of Test Conditions for Off-Vehicle Charge Capable HEV



Example of Urban End of Test Conditions for Off-Vehicle Charge Capable HEV with Transitional Range



Figure

~~I~~J. Test Procedures for 2009 through 2011 Model Zero-Emission Vehicles and Hybrid-Electric Vehicles.

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.”

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 2009 through 2011 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”.

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 Urban All-Electric Range.**

(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 Highway All-Electric Range.**

(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 highway all-electric range 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 for Vehicles Other Than ZEVs.

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^{o}F and 86^{o}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” 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”.

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”~~,~~ 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 Subparagraph (d). [No change.]

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" 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”.

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 SC03 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 ± 1 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 ± 1 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:

$$(\text{Amp-hr}_{final})_{max} = (\text{Amp-hr}_{initial}) + 0.01 \frac{* (NHV_{fuel} * m_{fuel})}{(V_{system} * K_1)}$$

$$(\text{Amp-hr}_{final})_{min} = (\text{Amp-hr}_{initial}) - 0.01 * \frac{(NVH_{fuel} * m_{fuel})}{(V_{system} * K_1)}$$

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}	=	Open circuit voltage (OCV) that corresponds to the SOC of the target SOC during charge sustaining operation. This value shall be submitted for testing purposes, and it shall be subject to confirmation by the Air Resources Board.

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:

$$(rpm_{final})_{max} = \sqrt{(\mathrm{rpm}_{\mathrm{initial}})^2 + 0.01 * \frac{(2 * \mathrm{NVH}_{\mathrm{fuel}} * \mathrm{m}_{\mathrm{fuel}})}{(1 * \mathrm{K}_3)}}$$

$$(rpm_{final})_{min} = \sqrt{(\mathrm{rpm}_{\mathrm{initial}})^2 - 0.01 * \frac{(2 * \mathrm{NVH}_{\mathrm{fuel}} * \mathrm{m}_{\mathrm{fuel}})}{(1 * \mathrm{K}_3)}}$$

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 $kg\text{-}m^2$

K. Advanced Technology Demonstration Program data requirements.

A vehicle placed in a California advanced technology demonstration program may earn ZEV credits even if it is not "delivered for sale" in accordance with the ZEV regulation section 1962.1(g)(4). Approval by the ARB's Executive Officer is required for Advanced Technology Demonstration Program credits. The following data shall be provided in order to evaluate applications for an Executive Order:

1. Project Description

(a) General description
(b) Goal
(c) Specific objectives (e.g. durability tests, customer marketability)
(d) Location (include state, city, and agency/organization)

2. Vehicle data

(a) Model
(b) Model year
(c) Date placed in program
(d) Vehicle Identification Number (VIN)

3. Vehicle specifications

(a) Passenger car (PC) or light duty truck (LDT)
(b) Curb weight – pounds (lbs)
(c) Payload (lbs)
(d) City/highway range – miles (mi)
(e) Estimated fuel economy or EPA fuel economy city/highway – miles per gallon (mpg)
(f) Fuel type
(g) Refueling time
(h) Electric motor output – kilowatts (kW)
(i) Hybrid energy storage; type, capacity and peak power
(j) For Fuel Cell Vehicles (FCVs), fuel cell stack: type, peak output, manufacturer and estimated design life.

L. Fast refueling capability

The “fast refueling capability” criterion for a 2009 through 2017 model-year Type III, IV and V ZEV in CCR, Title 13, Section 1962.1(d)(5)(A), “ZEV Tiers for Credit Calculations,” will be considered met for a particular ZEV if the manufacturer declares that this ZEV can be fast refueled at an “ideal” or prototype refueling or charging station and provides the documentation described below.

The fast refueling description shall include (but not necessarily be limited to):

(a) Tank or battery specifications
(b) Ambient and tank conditions prior to the qualifying fill/charge
(c) Plot or table of kilograms (kg) (or kilowatt-hour (kw-hr)) versus time for this “ideal” fill or charge
(d) A general description of the fill or charge type.

As Amended: March 22, 2012
Date of Hearing: January 26-27, 2012

Attachment B-3

FINAL REGULATION ORDER

Zero Emission Vehicle Regulation: 2018 and Subsequent Model Years

Title 13, California Code of Regulations

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Attachment B-3
FINAL REGULATION ORDER

Adopt section 1962.2, title 13, California Code of Regulation (CCR), to read as follows:

[Note: Set forth below are the 2012 amendments to the California zero emission vehicle (ZEV) regulation. This is a newly adopted regulation, shown without underline as permitted by California Code of Regulations, title 1, section 8.]

§ 1962.2 Zero-Emission Vehicle Standards for 2018 and Subsequent Model Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles.

(a) ***ZEV Emission Standard.*** The Executive Officer shall certify new 2018 and subsequent model year passenger cars, light-duty trucks, and medium-duty vehicles as ZEVs, vehicles that produce zero exhaust emissions of any criteria pollutant (or precursor pollutant) or greenhouse gas, excluding emissions from air conditioning systems, under any possible operational modes or conditions.

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

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

(A) ***Basic Requirement.*** The minimum ZEV credit percentage requirement for each manufacturer is listed in the table below as the percentage of the PCs and LDTs, produced by the manufacturer and delivered for sale in California that must be ZEVs, subject to the conditions in this subdivision 1962.2(b). The ZEV requirement will be based on the annual NMOG production report for the appropriate model year.

Model Year	Credit Percentage Requirement
2018	4.5%
2019	7.0%
2020	9.5%
2021	12.0%
2022	14.5%
2023	17.0%
2024	19.5%
2025 and subsequent	22.0%

(B) ***Calculating the Number of Vehicles to Which the Percentage ZEV Requirement is Applied.*** For 2018 and subsequent model years, a manufacturer's production volume for the given model year will be based on the three-year average of the manufacturer's volume of PCs and LDTs, produced and delivered for sale in California in the prior second, third, and fourth model year [for example, 2019 model year ZEV requirements will be based on California production volume average of PCs and LDTs for the 2015 to 2017 model years]. This production averaging is used to determine ZEV requirements only, and has no effect on a manufacturer's size determination (eg. three-year average calculation method). In applying the ZEV requirement, a PC or LDT, that is produced by one manufacturer (e.g., Manufacturer A), but is marketed in California by another manufacturer (e.g., Manufacturer B) under the other manufacturer's (Manufacturer B) nameplate, shall be treated as having been produced by the marketing manufacturer (i.e., Manufacturer B).

1. ***[Reserved]***

2. ***[Reserved]***

3. A manufacturer may apply to the Executive Officer to be permitted to base its ZEV obligation on the number of PCs and LDTs, produced by the manufacturer and delivered for sale in California that same model year (ie, same model-year calculation method) as an alternative to the three-year averaging of prior year production described above, for up to two model years, total, between model year 2018 and model year 2025. For the same model-year calculation method to be allowed, a manufacturer's application to the Executive Officer must show that their volume of PCs and LDTs produced and delivered for sale in California has decreased by at least 30 percent from the previous year due to circumstances that were unforeseeable and beyond their control.

(C) ***[Reserved]***

(D) ***Exclusion of ZEVs in Determining a Manufacturer's Sales Volume.*** In calculating a manufacturer's applicable sales, using either method described in subdivision 1962.2(b)(1)(B), a manufacturer shall exclude the number of NEVs produced and delivered for sale in California by the manufacturer itself, or by a subsidiary in which the manufacturer has more than 33.4% percent ownership interest.

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

(A) ***[Reserved]***

(B) ***[Reserved]***

(C) ***[Reserved]***

(D) ***[Reserved]***

(E) ***Requirements for Large Volume Manufacturers in 2018 and through 2025 Model Years.*** LVMs must produce credits from ZEVs equal to minimum ZEV floor percentage requirement, as enumerated below. Manufacturers may fulfill the remaining ZEV requirement with credits from TZEVs, as enumerated below.

Model Years	Total ZEV Percent Requirement	Minimum ZEV floor	TZEVs
2018	4.5%	2.0%	2.5%
2019	7.0%	4.0%	3.0%
2020	9.5%	6.0%	3.5%
2021	12.0%	8.0%	4.0%
2022	14.5%	10.0%	4.5%
2023	17.0%	12.0%	5.0%
2024	19.5%	14.0%	5.5%
2025	22.0%	16.0%	6.0%

(F) ***Requirements for Large Volume Manufacturers in Model Year 2026 and Subsequent.*** In 2026 and subsequent model years, a manufacturer must meet a total ZEV credit percentage of 22%. The maximum portion of a manufacturer's credit percentage requirement that may be satisfied by TZEV credits is limited to 6% of the manufacturer's applicable California PC and LDT production volume. ZEV credits must satisfy the remainder of the manufacturer's requirement.

(3) ***Requirements for Intermediate Volume Manufacturers*****.** For 2018 and subsequent model years, an intermediate volume manufacturer may meet all of its ZEV credit percentage requirement, under subdivision 1962.2(b), with credits from TZEV.

(4) ***Requirements for Small Volume Manufacturers.*** A small volume manufacturer is not required to meet the ZEV credit percentage requirements. However, a small volume manufacturer may earn, bank, market, and trade credits for the ZEVs and TZEVs it produces and delivers for sale in California.

(5) ***[Reserved]***

(6) ***[Reserved]***

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

(A) ***Increases in California Production Volume.*** In 2018 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 (i.e., total production volume exceeds 13,500 vehicles in a three-year period), for three consecutive averages, the manufacturer shall no longer be treated as a small volume manufacturer, and must comply with the ZEV requirements for intermediate volume manufacturers beginning with the next model year after the last model year of the third consecutive average. For example, if (a small volume)

Manufacturer A exceeds 4,500 PCs, LDTs, and MDVs for their 2018 – 2020, 2019 – 2021, and 2020 – 2022 model year averages, Manufacturer A would be subject to intermediate volume requirements starting in 2023 model year.

If an intermediate volume manufacturer's average California production volume exceeds 20,000 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 (i.e., total production volume exceeds 60,000 vehicles in a three-year period), for three consecutive averages, the manufacturer shall no longer be treated as an intermediate volume manufacturer and shall comply with the ZEV requirements for large volume manufacturers beginning with the next model year after the last model year of the third consecutive average. For example, if (an intermediate volume) Manufacturer B exceeds 20,000 PCs, LDTs, and MDVs for its 2018 – 2020, 2019 – 2021, and 2020 – 2022 average, Manufacturer B would be subject to large volume manufacturer requirements starting in 2023 model year.

Any new requirement described in the this subdivision will begin with the next model year after the last model year of the third consecutive average when a manufacturer ceases to be a small or intermediate volume manufacturer in 2018 or subsequent years due to the aggregation requirements in majority ownership situations.

(B) ***Decreases in California Production Volume****.* If a manufacturer's average California production volume falls below 4,500 or 20,000 units of new PCs, LDT1 and 2s, and MDVs, based on the average number of vehicles produced and delivered for sale for the three previous consecutive model years, for three consecutive averages, the manufacturer shall be treated as a small volume or intermediate volume manufacturer, as applicable, and shall be subject to the requirements for a small volume or intermediate volume manufacturer beginning with the next model year. For example, if Manufacturer C falls below 20,000 PCs, LDTs, and MDVs for its 2019 – 2021, 2020 – 2022, and 2021 – 2023 averages, Manufacturer C would be subject to IVM requirements starting in 2024 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. When a manufacturer is simultaneously producing two model years of vehicles at the time of a change of ownership, the basis of determining next model year must be the earlier 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 2019 calendar year occurs and the manufacturer is producing both 2019 and 2020 model year vehicles 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 2020 model year will be based on the production volumes of Manufacturers A and B in the 2017 – 2019 model years. Where the production volume of Manufacturer A must be aggregated with the production volumes of Manufacturers B and C for the 2019 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 2020 model year will be based on the production volumes of Manufacturers A and C in the 2017 – 2019 model years. In either case, the lead time provisions in subdivisions 1962.2(b)(7)(A) and (B) will apply.

(c) Transitional Zero Emission Vehicles (TZEV).

(1) ***Introduction.*** This subdivision 1962.2(c) sets forth the criteria for identifying vehicles delivered for sale in California as TZEVs.

(2) ***TZEV Requirements*****.** In order for a vehicle to be eligible to receive a ZEV allowance, the manufacturer must demonstrate compliance with all of the following requirements:

(A) ***SULEV Standards.*** Certify the vehicle to the 150,000-mile SULEV 20 or 30 exhaust emission standards for PCs and LDTs in subdivision 1961.2(a)(1). Bi-fuel, fuel flexible and dual-fuel vehicles must certify to the applicable 150,000-mile SULEV 20 or 30 exhaust emission standards when operating on both fuels. Manufacturers may certify 2018 and 2019 TZEVs to the 150,000-mile SULEV exhaust emission standards for PCs and LDTs in subdivision 1961(a)(1);

(B) ***Evaporative Emissions.*** Certify the vehicle to the evaporative emission standards in subdivision 1976(b)(1)(G). Manufacturers may certify 2018 and 2019 TZEVs to the evaporative standards for PCs and LDTs in subdivision 1976(b)(1)(E);

(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 subdivisions 2037(b)(2) and 2038(b)(2) 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) ***Allowances for TZEVs***

(A) ***Zero Emission Vehicle Miles Traveled TZEV Allowance Calculation.*** A vehicle that meets the requirements of subdivision 1962.2(c)(2) and has zero-emission vehicle miles traveled (VMT), as defined by and calculated by the "California Exhaust Emission Standards And Test Procedures For 2018 And

Subsequent Model Zero-Emission Vehicles And Hybrid Electric Vehicles, In The Passenger Car, Light-Duty Truck And Medium-Duty Vehicle Classes", incorporated by reference, and measured as equivalent all electric range (EAER) capability will generate an allowance according to the following equation:

UDDS Test Cycle Range (R_{cda})	*Allowance*
<10 all electric miles	0.00
≥10 all electric miles	TZEV Credit = [(0.01) * R_{cda} + 0.30]
>80 miles (credit cap)	1.10

1. Allowance for US06 Capability. TZEVs with US06 all electric range capability (AER) of at least 10 miles shall earn an additional 0.2 allowance. US06 test cycle range capability shall be determined in accordance with section E.8 of the "California Exhaust Emission Standards and Test Procedures for the 2018 and Subsequent Model Zero-Emission Vehicles, and Hybrid Electric Vehicles in the Passenger Car, Light-Duty Truck, and Medium Duty Vehicle Classes," incorporated by reference in subdivision 1962.2(h).

(B) ***[Reserved]***

(C) ***[Reserved]***

(D) ***[Reserved]***

(E) ***Credit for Hydrogen Internal Combustion Engine Vehicles.*** A hydrogen internal combustion engine vehicle that meets the requirements of subdivision 1962.2(c)(2) and has a total range of at least 250 UDDS miles will earn an allowance of 0.75, which may be in addition to allowances earned in subdivision 1962.2(c)(3)(A), and subject to an overall credit cap of 1.25

(d) ***Qualification for Credits From ZEVs*.**

(1) ***[Reserved]***

(2) ***[Reserved]***

(3) ***[Reserved]***

(4) ***[Reserved]***

(5) ***Credits for 2018 and Subsequent Model Year ZEVs.***

(A) ***ZEV Credit Calculations*.** Credits from a ZEV delivered for sale are based on the ZEV's UDDS all electric range, determined in accordance with the "California Exhaust Emission Standards and Test Procedures for the 2018 and Subsequent Model Zero-Emission Vehicles, and Hybrid Electric Vehicles in the Passenger Car, Light-Duty Truck, and Medium Duty Vehicle Classes," incorporated by reference, using the following equation:

ZEV Credit = (0.01) * (UDDS range) + 0.5

1. A ZEV with less than 50 miles UDDS range will receive zero credits.

2. Credits earned under this provision 1962.2(d)(5)(A) are be capped at 4 credits per ZEV.

(B) ***[Reserved]***

(C) ***[Reserved]***

(D) ***[Reserved]***

(E) ***Counting Specified ZEVs Placed in Service in a Section 177 State and in California.*** Large volume manufacturers and intermediate volume manufacturers with credits earned from hydrogen fuel cell vehicles that are certified to the California ZEV standards applicable for the ZEV's model year, delivered for sale and placed in service in California or in a section 177 state, may be counted towards compliance in California and in all section 177 states with the percentage ZEV requirements in subdivision 1962.2(b). The credits earned are multiplied by the ratio of a manufacturer's applicable production volume for a model year, as specified in subdivision 1962.2(b)(1)(B), in the state receiving credit to the manufacturer's applicable production volume as specified in subdivision 1962.2(b)(1)(B), for the same model year in California(hereafter, "proportional value"). Credits generated from ZEV placement in a section 177 state will be earned at the proportional value in the section 177 state, and earned in California at the full value specified in subdivision 1962.2(d)(5)(A).

2. ***Optional Section 177 State Compliance Path.***

a*.* ***Reduced ZEV and TZEV Percentages.*** Large volume manufacturers and intermediate volume manufacturers that have fully complied with the optional section 177 state compliance path requirements in subdivision 1962.1(d)(5)(E)3. are allowed to meet ZEV percentage requirements and optional TZEV percentages reduced from the minimum ZEV floor percentages and TZEV percentages in subdivision 1962.2(b)(2)(E) in each section 177 state equal to the following percentages of their sales volume determined under subdivision 1962.2(b)(1)(B):

ZEVs

Model Year	2018	2019	2020	2021
Existing Minimum ZEV Floor	2.00%	4.00%	6.00%	8.00%
Section 177 State Adjustment for Optional Compliance Path	62.5%	75%	87.5%	100%
Minimum Section 177 State ZEV Requirement	1.25%	3.00%	5.25%	8.00%

TZEVs

Model Year	2018	2019	2020	2021
Existing TZEV Percentage	2.50%	3.00%	3.50%	4.00%
Section 177 State Adjustment for Optional Compliance Path	90.00%	100%	100%	100%
New Section 177 State TZEV Percentage	2.25%	3.00%	3.50%	4.00%

Total Percent Requirement

Model Year	2018	2019	2020	2021
New Total Section 177 State Optional Requirements	3.50%	6.00%	8.75%	12.00%

i. Trading and Transferring ZEV and TZEV Credits within West Region Pool and East Region Pool. Manufacturers that have fully complied with the optional section 177 state compliance path requirements in subdivision 1962.1(d)(5)(E)3. may trade or transfer specified model year ZEV and TZEV credits within the West Region pool to meet the same model year requirements in subdivision 1962.2(d)(5)(E)2.a, and will incur no premium on their credit values. For example, for a manufacturer to make up a 2019 model year shortfall of 100 credits in State X, the manufacturer may transfer 100 (2019 model year) ZEV credits from State Y, within the West Region pool. Manufacturers that have fully complied with the optional section 177 state compliance path requirements in subdivision 1962.1(d)(5)(E)3. may trade or transfer specified model year ZEV and TZEV credits within the East Region pool to meet the same model year requirements in subdivision 1962.2(d)(5)(E)2.a, and will incur no premium on their credit values. For example, for a manufacturer to make up a 2019 model year shortfall of 100 credits in State W, the manufacturer may transfer 100 (2019 model year) ZEV credits from State Z, within the East Region pool.

ii. Trading and Transferring ZEV and TZEV Credits between the West Region Pool and East Region Pool. Manufacturers that have fully complied with the optional section 177 state compliance path requirements in subdivision

1962.1(d)(5)(E)3. may trade or transfer specified model year ZEV and TZEV credits to meet the same model year requirements in subdivision 1962.2(d)(5)(E)2.a. between the West Region pool and the East Region pool; however, any credits traded will incur a premium of 30% of their value. For example, in order for a manufacturer to make up a 2019 model year shortfall of 100 credits in the West Region Pool, the manufacturer may transfer 130 (2019 model year) credits from the East Region Pool. No credits may be traded or transferred to the East Region pool or West Region pool from a manufacturer's California ZEV bank, or from the East Region pool or West Region pool to a manufacturer's California ZEV bank.

b. ***Reporting Requirements.*** On an annual basis, by May 1st of the calendar year following the close of a model year, each manufacturer that elects the optional section 177 state compliance path under subdivision 1962.1(d)(5)(E)3, shall submit, in writing, to the Executive Officer and each section 177 state a report, including an itemized list, that indicates where vehicles have been placed within the East Region pool and within the West Region pool. The itemized list shall include the following:

i. The manufacturer's total applicable volume of PCs and LDTs delivered for sale in each section 177 state within the regional pool, as determined under subdivision 1962.2(b)(1)(B).

ii. Make, model, vehicle identification number, credit earned, and section 177 state where delivery for sale of each TZEV and ZEV occurred and to meet manufacturer's requirements under subdivision 1962.2(d)(5)(E)2.a.

c. ***Failure to Meet Optional Section 177 State Compliance Path Requirements.*** A manufacturer that elects the optional section 177 state compliance path under subdivision 1962.1(d)(5)(E)3, and does not meet the modified percentages in subdivision 1962.2(d)(5)(E)2.a. in a model year or make up their deficit within the specified time and with the specified credits allowed by subdivision 1962.2(g)(7)(A) in all section 177 states of the applicable pool, shall be treated as subject to the total ZEV percentage requirements in section 1962.2(b) for the 2018 through 2021 model years in each section 177 state, and the pooling provisions in subdivision 1962.2(d)(5)(E)2.a. shall not apply. Any transfers of ZEV or TZEV credits between section 177 states will be null and void if a manufacturer fails to comply, and ZEV or TZEV credits will return to the section 177 state in which the credits were earned. Penalties shall be calculated separately by each section 177 state where a manufacturer fails to make up the ZEV deficits by the end of the 2018 model year.

d. The provisions of section 1962.2 shall apply to a manufacturer electing the optional section 177 state compliance path, except as specifically modified by this subdivision 1962.2(d)(5)(E)2.

(F) ***NEVs.*** NEVs must meet the following to be eligible for 0.15 credits:

1. ***Specifications****.* A NEV earns credit when it meets all the following specifications:

a. ***Acceleration.*** The vehicle has a 0-20 mph acceleration of 6.0 seconds or less when operating with a payload of at least 332 pounds and starting with the battery at a 50% state of charge.

b. ***Top Speed.*** The vehicle has a minimum top speed of 20 mph when operating with a payload of at least 332 pounds and starting with the battery at a 50% state of charge. The vehicle's top speed shall not exceed 25 mph when tested in accordance with 49 CFR 571.500 (68 FR 43972, July 25, 2003).

c. ***Constant Speed Range.*** The vehicle has a minimum 25-mile range when operating at constant top speed with a payload of least 332 pounds and starting with the battery at 100% state of charge.

2. ***Battery Requirement*****.** A NEV must be equipped with one or more sealed, maintenance-free batteries.

3. ***Warranty Requirement*****.** A NEV drive train, including battery packs, must be covered for a period of at least 24 months. The first 6 months of the NEV warranty period must be covered by a full warranty; the remaining warranty period may be optional extended warranties (available for purchase) and may be prorated. If the extended warranty is prorated, the percentage of the battery pack's original value to be covered or refunded must be at least as high as the percentage of the prorated coverage period still remaining. For the purpose of this computation, the age of the battery pack must be expressed in intervals no larger than three months. Alternatively, a manufacturer may cover 50 percent of the original value of the battery pack for the full period of the extended warranty.

Prior to credit approval, the Executive Officer may request that the manufacturer provide copies of representative vehicle and battery warranties.

4. ***NEV Charging Requirements.*** A NEV must meet charging requirements specific in subdivision 1962.3(c)(2).

(G) ***BEVx.*** A BEVx must meet the following in order to receive credit, based on its all electric UDDS Range, through subdivision 1962.2(d)(5)(A):

1. ***Emissions Requirements.*** BEVxs must meet all TZEV requirements, specified in subdivision 1962.2(c)(2)(A) through (D).

2. ***APU Operation.*** The vehicle's UDDS range after the APU first starts and enters "charge sustaining hybrid operation" must be less than or equal to the vehicle's UDDS all-electric test range prior to APU start. The vehicle's APU cannot start under any user-selectable driving mode unless the energy storage system used for traction power is fully depleted.

3. ***Minimum Zero Emission Range Requirements.*** BEVxs must have a minimum of 75 miles UDDS all electric range.

(e) ***[Reserved]***

(f) ***[Reserved]***

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

(1) ***Introduction.*** A manufacturer that produces and delivers for sale in California ZEVs or TZEVs in a given model year exceeding the manufacturer's ZEV requirement set forth in subdivision 1962.2(b) shall earn ZEV credits in accordance with this subdivision 1962.2(g).

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

(A) ***Credits from ZEVs.*** The amount of credits earned by a manufacturer in a given model year from ZEVs shall be expressed in units of credits, 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, or, if applicable, requirements specified under subdivision 1962.2(d)(5)(E)2.a. for the model year subtracted from the number of ZEVs produced and delivered for sale in California by the manufacturer in the model year.

(B) ***Credits from TZEVs.*** The amount of credits earned by a manufacturer in a given model year from TZEVs shall be expressed in units of credits, and shall be equal to the total number of TZEVs produced and delivered for sale in California that the manufacturer applies towards meeting its ZEV requirement, or, if applicable, requirements specified under subdivision 1962.2(d)(5)(E)2.a. for the model year subtracted from the total number of ZEV allowances from TZEVs produced and delivered for sale in California by the manufacturer in the model year.

(C) ***Separate Credit Accounts.*** Credits from a manufacturer's ZEVs, BEVxs, TZEVs, and NEVs shall each be maintained in separate accounts.

(D) Rounding Credits. ZEV credits and debits shall be rounded to the nearest 1/100th only on the final credit and debit totals using the conventional rounding method.

(3) ***ZEV Credits for MDVs.*** Credits from ZEVs and TZEVs classified as MDVs, may be counted toward the ZEV requirement for PCs and LDTs, and included in the calculation of ZEV credits as specified in this subdivision 1962.2(g) if the manufacturer so specifies.

(4) ***ZEV Credits for Advanced Technology Demonstration Programs.***

(A) ***[Reserved]***

(B) ***ZEVs.*** ZEVs, including BEVxs, excluding NEVs, placed in a small or intermediate volume manufacturer's California advanced technology demonstration program for a period of two or more years, may earn ZEV credits even if the vehicle is not "delivered for sale" or registered with the California 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 operated in California. Such a vehicle is eligible to receive the same credit that it would have earned if delivered for sale, and for fuel cell vehicles, 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 up to 25 vehicles per model, per section 177 state, per year under this subdivision1962.2(g)(4). A manufacturer's vehicles in excess of the 25-vehicle cap will not be eligible for advanced technology demonstration program credits.

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

(A) ***[Reserved]***

(B) ***[Reserved]***

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

1. ***ZEVs*****.** Transportation system credits earned or allocated by ZEVs or BEVxs pursuant to subdivision 1962.1 (g)(5), not including any 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, and may be used to satisfy up to one-tenth of a manufacturer's ZEV obligation which must be met with ZEVs, as specified in subdivision 1962.2(b)(2)(E) or, if applicable, requirements specified under subdivision 1962.2(d)(5)(E)2.a..

2. ***TZEVs*.** Transportation system credits earned or allocated by TZEVs pursuant to subdivision 1962.1(g)(5), not including all credits earned by the vehicle itself, may be used to satisfy up to one-tenth of the portion of a manufacturer's ZEV obligation that may be met with TZEVs, or, if applicable, the portion of a manufacturer's obligation that may be met with TZEVs specified under subdivision 1962.2(d)(5)(E)2.a. in any given model year, but may only be used in the same manner as other credits earned by vehicles of that category.

(6) ***Use of ZEV Credits*.** A manufacturer may meet the ZEV requirements in a given model year by submitting to the Executive Officer a commensurate amount of ZEV credits, consistent with subdivision 1962.2(b). Credits in each of the categories may be used to meet the requirement for that category as well as the requirements for lesser credit earning ZEV categories, but shall not be used to meet the requirement for a greater credit earning ZEV category, except for discounted PZEV and AT PZEV credits. For example, credits produced from TZEVs may be used to comply with the portion of the requirement that may be met with credits from TZEV, but not with the portion that must be satisfied with credits from ZEVs. These credits may be earned previously by the manufacturer or acquired from another party.

(A) ***Use of Discounted PZEV and AT PZEV Credits and NEV Credits.*** For model years 2018 through 2025, discounted PZEV and AT PZEV credits, and NEV credits may be used to satisfy up to one-quarter of the portion of a manufacturer's requirement that can be met with credits from TZEVs, or, if applicable, the portion of a manufacturer's obligation that may be met with TZEVs specified under subdivision 1962.2(d)(5)(E)2.a.. Intermediate volume manufacturers may fulfill their entire requirement with discounted PZEV and AT PZEV credits, and NEV credits in model years 2018 and 2019. These credits may be earned previously by the manufacturer or acquired from another party. Discounted PZEV and AT PZEV credits may no longer be used after model year 2025 compliance.

(B) ***Use of BEVx Credits.*** BEVx credits may be used to satisfy up to 50% of the portion of a manufacturer's requirement that must be met with ZEV credits.

(C) ***GHG-ZEV Over Compliance Credits.***

1. **Application.** Manufacturers may apply to the Executive Officer, no later than December 31, 2016, to be eligible for this subdivision 1962.2(g)(6)(C), based on the following qualifications:

a. A manufacturer must have no model year 2017 compliance debits and no outstanding debits from all previous model year compliance with sections 1961.1 and 1961.3, and

b. A manufacturer must have no model year 2017 compliance debits and no outstanding debits from all previous model year compliance with section 1962.1, and

c. A manufacturer must submit documentation of its projected product plans to show over compliance with the manufacturer's section 1961.3 requirements by at least 2.0 gCO_2/mile in each model year through the entire 2018 through 2021 model year period, and its commitment to do so in each year.

2. Credit Generation and Calculation. Manufacturers must calculate their over compliance with section 1961.3 requirements for model years 2018 through 2021 based on compliance with the previous model year standard. For example, to generate credits for this subdivision 1962.2(g)(6)(C) for model year 2018, manufacturers would calculate credits based on model year 2017 compliance with section 1961.3.

a. At least 2.0 gCO_2/mile over compliance with section 1961.3 is required in each year and the following equation must be used to calculate the amount of ZEV credits earned for purposes of this subdivision 1962.2(g)(6)(C), and:

[(Manufacturer US PC and LDT Sales) x (gCO_2/mile below manufacturer GHG standard for a given model year)] / (Manufacturer GHG standard for a given model year)

b. Credits earned under section 1961.3(a)(9) may not be included in the calculation of gCO_2/mile credits for use in the above equation in subdivision a.

c. Banked gCO_2/mile credits earned under sections 1961.1 and 1961.3 from previous model years or from other manufacturers may not be included in the calculation of gCO_2/mile credits for use in the above equation in subdivision a.

3. Use of GHG-ZEV Over Compliance Credits. A manufacturer may use no more than the percentage enumerated in the table below to meet either the total ZEV requirement nor the portion of their ZEV requirement that must be met with ZEV credits, with credits earned under this subdivision 1962.2(g)(6)(C).

2018	2019	2020	2021
50%	50%	40%	30%

Credits earned in any given model year under this subdivision 1962.2(g)(6)(C) may only be used in the applicable model year and may not be used in any other model year.

gCO_2/mile credits used to calculate GHG-ZEV over compliance credits under this provision must also be removed from the manufacturer's GHG compliance bank, and cannot be banked for future compliance toward 1961.3.

4. Reporting Requirements. Annually, manufacturers are required to submit calculations of credits for this subdivision 1962.2(g)(6)(C) for the model year, any remaining credits/debits from previous model years under 1961.3, and projected credits/debits for future years through 2021 under 1961.3 and this subdivision 1962.2(g)(6)(C).

If a manufacturer, who has been granted the ability to generate credits under this subdivision 1962.2(g)(6)(C), fails to over comply by at least 2.0 gCO_2/mile in any one year, the manufacturer will be subject to the full ZEV requirements for the model year and future model years, and will not be able to earn credits for any other model year under this subdivision 1962.2(g)(6)(C).

5. If the Executive Officer does not make a determination that a Federal greenhouse gas fleet standard is functionally equivalent to subdivision 1961.3, than this subdivision 1962.2(g)(6)(C) 1. through 4. is unavailable for use by any manufacturer.

(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 next model year by submitting to the Executive Officer a commensurate amount of ZEV credits. The amount of ZEV credits required to be submitted shall be calculated by [i] adding the number of credits from ZEVs produced and delivered for sale in California by the manufacturer for the model year to the number of credits from TZEVs produced and delivered for sale in California by the manufacturer for the model year (for a LVM, not to exceed that permitted under subdivision 1962.2(b)(2)), and [ii] subtracting that total from the number of credits required to be produced and delivered for sale in California by the manufacturer for the model year. BEVx, TZEV, NEV, or converted AT PZEV and PZEV credits are not allowed to be used to fulfill a manufacturer's ZEV deficit; only credits from ZEVs may be used to fulfill a manufacturer's ZEV deficit.

(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 credits and does not make up ZEV deficits within the specified time allowed by subdivision 1962.2(g)(7)(A) 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 deficit is not balanced by the end of the specified time allowed by subdivision 1962.2(g)(7)(A). For the purposes of Health and Safety Code section 43211, the number of vehicles not meeting the state board's standards shall be equal to the manufacturer's credit deficit, rounded to the nearest 1/100th, calculated according to the following equation, provided that the percentage of a manufacturer's ZEV requirement for a given model year that may be satisfied with TZEVs or credit from such vehicles may not exceed the percentages permitted under subdivision 1962.2(b)(2):

(No. of ZEV credits required to be generated for the model year) – (Amount of credits submitted for compliance for the model year)

(h) ***Test Procedures***.

(1) ***Determining Compliance***. The certification requirements and test procedures for determining compliance with this section 1962.2 are set forth in "California Exhaust Emission Standards and Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles and Hybrid Electric Vehicles, in the Passenger Car, Light-Duty Truck and Medium-Duty Vehicle Classes," adopted by the state board on [insert date here], and last amended [insert date here], which is incorporated herein by reference.

(2) ***NEV Compliance.*** The test procedures for determining compliance with subdivision 1962.2(d)(5)(F)1. are set forth in ETA-NTP002 (revision 3) "Implementation of SAE Standard J1666 May 93: Electric Vehicle Acceleration, Gradeability, and Deceleration Test Procedure" adopted on December 1, 2004, and ETA-NTP004 (revision 2) "Electric Vehicle Constant Speed Range Tests" adopted on February 1, 2008

(i) ***ZEV-Specific Definitions.*** The following definitions apply to this section 1962.2.

(1) "Auxiliary power unit" or "APU" means any device that provides electrical or mechanical energy, meeting the requirements of subdivision 1962.2(c)(2), to a BEVx, after the zero emission range has been fully depleted. A fuel fired heater does not qualify under this definition for an APU.

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

(3) "Conventional rounding method" means to increase the last digit to be retained when the following digit is five or greater. Retain the last digit as is when the following digit is four or less.

(4) "Discounted PZEV and AT PZEV credits" means credits earned under section 1962 and 1962.1 by delivery for sale of PZEVs and AT PZEVs, discounted according to subdivision 1962.1(g)(2)(F).

(5) "East Region pool" means the combination of Section 177 states east of the Mississippi River.

(6) “Energy storage device” means a storage device able to provide the minimum power and energy storage capability to enable engine stop/start capability, traction boost, regenerative braking, and (nominal) charge sustaining mode driving capability. In the case of TZEVs, a minimum range threshold relative to certified, new-vehicle range capability is not specified or required.

(7) “Hydrogen fuel cell vehicle” means a ZEV that is fueled primarily by hydrogen, but may also have off-vehicle charge capability.

(8) “Hydrogen internal combustion engine vehicle” means a TZEV that is fueled exclusively by hydrogen.

(9) “Majority ownership situations” means when one manufacturer owns another manufacturer more than 33.4%, for determination of size under CCR Section 1900.

(10) “Manufacturer US PC and LDT Sales” means a manufacturer’s total passenger car and light duty truck (up to 8,500 pounds loaded vehicle weight) sales sold in the United States of America in a given model year.

(11) “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.

(12) “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 DMV.

(13) “Proportional value” means the ratio of a manufacturer’s California applicable sales volume to the manufacturer’s Section 177 state applicable sales volume. In any given model year, the same applicable sales volume calculation method must be used to calculate proportional value.

(14) “Range Extended Battery Electric Vehicle” or “BEVx” means a vehicle powered predominantly by a zero emission energy storage device, able to drive the vehicle for more than 75 all-electric miles, and also equipped with a backup APU, which does not operate until the energy storage device is fully depleted, and meeting requirements in subdivision 1962.2(d)(5)(G).

(15) “Section 177 state” means a state that is administering the California ZEV requirements pursuant to section 177 of the federal Clean Air Act (42 U.S.C. § 7507).

(16) "Transitional zero emission vehicle" or "TZEV" means a vehicle that meet the all criteria of subdivision 1962.2(c)(2) and qualifies for an allowance in subdivision 1962.2(c)(3)(D) or (E).

(17) "West Region pool" means the combination of Section 177 states west of the Mississippi River.

(18) "Zero emission vehicle" or "ZEV" means a vehicle that produces zero exhaust emissions of any criteria pollutant (or precursor pollutant) or greenhouse gas under any possible operational modes or conditions.

(19) "Zero emission vehicle 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 1962.2:

"AER" means all-electric range.
"APU" means auxiliary power unit.
"AT PZEV" means advanced technology partial zero-emission vehicle.
"BEVx" means range extended battery electric vehicle.
"CFR" means Code of Federal Regulations.
"CO_2" means carbon dioxide.
"DMV" means the California Department of Motor Vehicles.
"EAER" means equivalent all-electric range.
"FR" means Federal Register.
"g" means grams.
"HEV" means hybrid-electric vehicle.
"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.
"LVM" means large volume manufacturer.
"MDV" means medium-duty vehicle.
"NMOG" means non-methane organic gases, or the total mass of oxygenated and non-oxygenated hydrocarbon emissions.
"NEV" means neighborhood electric vehicle.
"NOx" means oxides of nitrogen.
"PC" means passenger car.
"PZEV" means partial allowance zero-emission vehicle
"SAE" means Society of Automotive Engineers.
"SULEV" means super-ultra-low-emission-vehicle.
"TZEV" means transitional zero emission vehicle.
"UDDS" means urban dynamometer driving cycle.

"US" means United States of America.
"US06" means the US06 Supplemental Federal Test Procedure
"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 1962.2 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 and TZEVs for the 2018 and subsequent model years; and

(2) Each manufacturer's annual credit balances for 2018 and subsequent years for:

(A) Each type of vehicle: ZEV (minus NEV), BEVx, NEV, TZEV, and discounted PZEV and AT PZEV credits; and

(B) Advanced technology demonstration programs; and

(C) Transportation systems; and

(D) Credits earned under section 1962.2(d)(5)(A), including credits acquired from, or transferred to another party, and the parties themselves.

Note: Authority cited: Sections 39600, 39601, 43013, 43018, 43101, 43104 and 43105, Health and Safety Code. Reference: Sections 38562, 39002, 39003, 39667, 43000, 43009.5, 43013, 43018, 43018.5, 43100, 43101, 43101.5, 43102, 43104, 43105, 43106, 43107, 43204, and 43205.5, Health and Safety Code.

Attachment B-4

FINAL

CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 2018 AND SUBSEQUENT MODEL ZERO-EMISSION VEHICLES AND HYBRID ELECTRIC VEHICLES, IN THE PASSENGER CAR, LIGHT-DUTY TRUCK AND MEDIUM-DUTY VEHICLE CLASSES

Adopted: [insert date here]

[Note: Set forth below are the 2012 amendments to the California zero emission vehicle (ZEV) regulation. This is a newly adopted test procedure, shown without underline as permitted by California Code of Regulations, title 1, section 8.]

As Amended: March 22, 2012
Date of Hearing: January 26-27, 2012

NOTE: This document is incorporated by reference in section 1962.2, title 13, California Code of Regulations (CCR). Additional requirements necessary to complete an application for certification of zero-emission vehicles and hybrid electric vehicles are contained in other documents that are designed to be used in conjunction with this document. These other documents include:

1. “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);

2. “California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles” (incorporated by reference in section 1976(c), title 13, CCR);

3. “California Refueling Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles” (incorporated by reference in section 1978(b), title 13, CCR);

4. OBD II (section 1968, et seq. title 13, CCR, as applicable);

5. “California Environmental Performance Label Specifications for 2009 and Subsequent Model Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles” (incorporated by reference in 1965, title 13, CCR);

6. Warranty Requirements (sections 2037 and 2038, title 13, CCR);

7. “Specifications for Fill Pipes and Openings of Motor Vehicle Fuel Tanks” (incorporated by reference in section 2235, title 13, CCR);

8. Guidelines for Certification of Federally Certified Light-Duty Motor Vehicles for Sale in California (incorporated by section 1960.5, title 13, CCR); and

9. “California Non-Methane Organic Gas Test Procedures,” (incorporated by reference in section 1961(d), title 13, CCR).

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CALIFORNIA EXHAUST EMISSION STANDARDS AND TEST PROCEDURES FOR 2018 AND SUBSEQUENT MODEL ZERO-EMISSION VEHICLES AND 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 2018 and subsequent model-year zero-emission passenger cars, light-duty trucks, and medium-duty vehicles, and 2018 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.

As Amended: March 22, 2012
Date of Hearing: January 26-27, 2012

B. Definitions and Terminology.

1. 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 (CFR) §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" or "AER" means the total miles driven electrically (with the engine off) before the engine turns on for the first time, after the battery has been fully charged.

"All-Electric Range (AER) 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).

"Alternate Continuous Urban Test Schedule" means a series of the following sequence: UDDS, 10 minute key-off hot soak, UDDS, and 10-20 minute key-off hot soak. This alternate procedure may be substituted for the Continuous Urban Test Schedule when the Continuous Urban Test Schedule cannot be performed.

"Alternate Continuous Highway Test Schedule" means a series of the following sequence: HFEDS, 15 second key-on pause, HFEDS, and 10-20 minute key-off hot soak or a 15 second key-on pause. This alternate procedure may be substituted for the Continuous Highway Test Schedule when the Continuous Highway Test Schedule cannot be performed.

"Auxiliary power unit" or "APU" 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. For the purposes of range extended battery electric vehicles, auxiliary power unit means any device that provides electrical or mechanical energy, meeting the requirements of subdivision C.3.2, to a BEVx, after the zero emission range has been fully depleted. A fuel fired heater does not qualify under this definition for an APU.

"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.

As Amended: March 22, 2012
Date of Hearing: January 26-27, 2012

“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.

“Blended off-vehicle charge capable hybrid electric vehicle” means an off-vehicle charge capable hybrid electric vehicle that uses the engine to supplement battery/electric motor power during charge depleting operation.

“Blended operation mode” means an operating mode in which the energy storage state-of-charge decreases, on average, while the vehicle is driven and the engine is used occasionally to support power requests.

“Charge-depleting net energy consumption” means the net electrical energy, E_{cd}, measured in watt-hours consumed by vehicle over the charge depleting cycle range, R_{cdc}. E_{cd} can be expressed as AC or DC watt hours, where appropriate.

“Charge-depleting (CD) mode” means an operating mode in which the energy storage state-of-charge (SOC) may fluctuate but, on average, decreases while the vehicle is driven. 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 depleting actual range” or “R_{cda}” means the distance traveled on the Urban Charge Depleting Test Procedure at which the state-of-charge is first equal to the average state-of-charge of the two consecutive UDDS used to end the Urban Charge Depleting Test Procedure. This range must be reported to the nearest 0.1 miles. (See section F.11.9.)

“Charge depleting actual range, highway” or “R_{cdah}” means the distance traveled on the Highway Charge Depleting Test Procedure at which the state-of-charge is first equal to the average state-of-charge of the HFEDS used to end the Highway Charge Depleting Test Procedure. This range must be reported to the nearest 0.1 miles.

“Charge depleting cycle range” or “R_{cdc}” means the distance traveled on the Urban or Highway Charge Depleting Procedure up to the test cycle prior to where the state-of-charge is above the lower bound state-of-charge tolerance for one test cycle. This range will appear as the sum of a discrete number of test cycle distances. This range shall be reported to the nearest 0.1 miles. (See section F.11.8.)

“Charge-sustaining net energy consumption” means the net electrical energy, Ecs, measured in watt-hours consumed by vehicle during charge sustaining operation. For charge sustaining operation, this number should be ~ 0.

“Charge-sustaining (CS) mode” means an operating mode in which the energy storage SOC may fluctuate but, on average, is maintained at a certain level while the vehicle is driven. 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.

“Continuous Urban Test Schedule” means a repeated series comprised of an Urban Dynamometer Driving Schedules (UDDS), 40 CFR, Part 86, Appendix I, which is incorporated herein by reference; each test is followed by a 10 minute key-off soak period.

“Continuous Highway Test Schedule” means a repeated series comprised of four consecutive key-on Highway Fuel Economy Driving Schedules (HFEDS) with a 15 second key-on pause in-between each HFEDS. If this schedule cannot be performed continuously, a key-off soak up to 30 minutes is permitted after every fourth HFEDS.

"Continuous US06 Test Schedule" means a repeated series of US06 driving schedules (US06) with a key-on idle period of not less than one minute and not greater than two minutes between each US06.

"**Conventional rounding method**" means to increase the last digit to be retained when the following digit is five or greater. Retain the last digit as is when the following digit is four or less.

"**Discounted PZEV and AT PZEV credits**" means credits earned under section 1962 and 1962.1 by delivery for sale of PZEVs and AT PZEVs, discounted according to subdivision C.7.2(f).

"**East Region pool**" means the combination of Section 177 states east of the Mississippi River.

"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.

"**Energy storage device**" means a storage device able to provide the minimum power and energy storage capability to enable engine stop/start capability, traction boost, regenerative braking, and (nominal) charge sustaining mode driving capability. In the case of TZEVs, a minimum range threshold relative to certified, new-vehicle range capability is not specified or required.

"Enhanced AT PZEV" means any model year 2009 through 2011 PZEV that has an allowance of 1.0 or greater per vehicle without multipliers and makes use of a ZEV fuel. Enhanced AT PZEV means Transitional Zero Emission Vehicle.

"Equivalent all-electric range" or "EAER" means the portion of the total charge depleting range attributable to the use of electricity from the battery over the charge depleting range test.

"Fuel cell vehicle" or "FCV" means any vehicle that receives propulsion solely from an onboard fuel cell power system.

"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.

"Grid-connected hybrid electric vehicle" means a hybrid electric vehicle that has the capacity for the battery to be recharged from an off-board source of electricity and has some all-electric range.

"Highway Fuel Economy Driving Schedule" or "HFEDS" means highway fuel economy driving schedule. See 40 CFR Part 600 §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.

"Hybrid fuel cell vehicle" or "HFCV" means any vehicle that receives propulsion energy from both an onboard fuel cell power system and either a battery or a capacitor.

"**Hydrogen fuel cell vehicle**" means a ZEV that is fueled primarily by hydrogen, but may also have off-vehicle charge capability.

"**Hydrogen internal combustion engine vehicle**" means a TZEV that is fueled exclusively by hydrogen.

"Majority ownership situations" means when one manufacturer owns another manufacturer more than 33.4%, for determination of size under CCR Section 1900.

"Manufacturer US PC and LDT Sales" means a manufacturer's total passenger car and light duty truck (up to 8,500 pounds loaded vehicle weight) sales sold in the United States of America in a given model year.

"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 (July 1, 2000), and is certified to zero-emission vehicle standards.

"NIST" means the National Institute of Standards and Technology.

"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. A grid-connected hybrid electric vehicle is one example of an off-vehicle charge capable hybrid electric vehicle.

"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.

"Proportional value" means the ratio of a manufacturer's California applicable sales volume to the manufacturer's Section 177 state applicable sales volume. In any given model year, the same applicable sale volume calculation method must be used to calculate proportional value.

"Partial Zero Emission Vehicle" or "PZEV" means any vehicle that is delivered for sale in California and that qualifies for a partial ZEV allowance of at least 0.2, under section 1962.1.

"Range Extended Battery Electric Vehicle" or "BEVx" means a vehicle powered predominantly by a zero emission energy storage device, able to drive the vehicle for more than 75 all-electric miles, and also equipped with a backup APU, which does not operate until the energy storage device is fully depleted, and meeting requirements in subdivision C.4.5(g),

"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.

"SAE J2572" means the "Recommended Practice for Measuring Fuel Consumption and Range of Fuel Cell and Hybrid Fuel Cell Vehicles Fuelled by Compressed Gaseous Hydrogen," as published by the Society of Automotive Engineers in October, 2008.

"Section 177 State" means a state that is administering the California ZEV requirements pursuant to section 177 of the federal Clean Air Act (42 U.S.C. § 7507).

"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.

"State of Charge (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 E.9 and F.10 of these procedures for tolerance specifications.

"State of Charge (SOC) Criterion" means the state-of-charge criterion that is applied to a 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.

"Transitional Zero Emission Vehicle" or "TZEV" means a PZEV that has an allowance of 1.0 or greater, and makes use of a ZEV fuel.

"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.

"**West Region pool**" means the combination of Section 177 states west of the Mississippi River.

"Zero-emission vehicle" or "**ZEV"** means a vehicle that produces zero exhaust emissions of any criteria pollutant (or precursor pollutant) or greenhouse gas under any possible operational modes or conditions.

"Zero-emission Vehicle Miles Traveled" or "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.

2. Terminology.

	Abbreviation	Units
Charge Depleting Actual Range (urban cycle)	R_{cda}	mi
Charge Depleting to Charge Sustaining Range	R_{cdcs}	mi
Charge Depleting Net Energy Consumption	E_{cd}	wh
Charge Depleting CO_2 Produced	M_{cd}	g/mi
Charge Sustaining CO_2 Produced	M_{cs}	g/mi
Highway Charge Depleting Actual Range	R_{cdah}	mi
Highway Charge Depleting Cycle Range	R_{cdch}	mi
Highway Electric Range Fraction	ERF_h	%
Highway Equivalent All-Electric Range	$EAER_h$	mi
Highway Equivalent All-Electric Range Energy Consumption	$EAEREC_h$	wh/mi
Urban Charge Depleting Cycle Range	R_{cdcu}	mi
Urban Electric Range Fraction	ERF_u	%
Urban Equivalent All-Electric Range	$EAER_u$	mi
Urban Equivalent All-Electric Range scaled to 40 mi limit	$EAER_{u40}$	mi
Urban Equivalent All-Electric Range Energy Consumption	$EAEREC_u$	wh/mi

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C. Zero-Emission Vehicle Standards.

1. ZEV Emission Standard. The Executive Officer shall certify new 2018 and subsequent 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) or greenhouse gas, excluding emissions from air conditioning systems, 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 subdivision C.2.2(c), produced by the manufacturer and delivered for sale in California that must be ZEVs, subject to the conditions in subdivision C.2.2. The ZEV requirement will be based on the annual NMOG production report for the appropriate model year.

Model Year	Credit Percentage Requirement
2018	4.5%
2019	7.0%
2020	9.5%
2021	12.0%
2022	14.5%
2023	17.0%
2024	19.5%
2025 and subsequent	22.0%

(b) *Calculating the Number of Vehicles to Which the Percentage ZEV Requirement is Applied.* For 2018 and subsequent model years, a manufacturer's production volume for the given model year will be based on the three-year average of the manufacturer's volume of PCs and LDTs, produced and delivered for sale in California in the prior second, third, and fourth model year [for example, 2019 model year ZEV requirements will be based on California production volume average of PCs and LDTs for the 2015 to 2017 model years]. This production averaging is used to determine ZEV requirements only, and has no effect on a manufacturer's size determination (eg. three-year average calculation method). In applying the ZEV requirement, a PC or LDT, that is produced by one manufacturer (e.g., Manufacturer A), but is marketed in California by another manufacturer (e.g., Manufacturer B) under the other manufacturer's (Manufacturer B) nameplate, shall be treated as having been produced by the marketing manufacturer (i.e., Manufacturer B).

(1) *[Reserved]*

(2) *[Reserved]*

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(3) A manufacturer may apply to the Executive Officer to be permitted to base its ZEV obligation on the number of PCs and LDTs, produced by the manufacturer and delivered for sale in California that same model year (ie, same model-year calculation method) as an alternative to the three-year averaging of prior year production described above, for up to two model years, total, between model year 2018 and model year 2025. For the same model-year calculation method to be allowed, a manufacturer's application to the Executive Officer must show that their volume of PCs and LDTs produced and delivered for sale in California has decreased by at least 30 percent from the previous year due to circumstances that were unforeseeable and beyond their control.

(c) *[Reserved]*

(d) *Exclusion of ZEVs in Determining a Manufacturer's Sales Volume.* In calculating a manufacturer's applicable sales, using either method described in subdivision C.2.1(b), a manufacturer shall exclude the number of NEVs produced and delivered for sale in California by the manufacturer itself, or by a subsidiary in which the manufacturer has more than 33.4% percent ownership interest.

2.2 Requirements for Large Volume Manufacturers.

(a) *[Reserved]*

(b) *[Reserved]*

(c) *[Reserved]*

(d) *[Reserved]*

(e) *Requirements for Large Volume Manufacturers in 2018 and through 2025 Model Years.* LVMs must produce credits from ZEVs equal to minimum ZEV floor percentage requirement, as enumerated below. Manufacturers may fulfill the remaining ZEV requirement with credits from TZEVs, as enumerated below.

Model Years	Total ZEV Percent Requirement	Minimum ZEV floor	TZEVs
2018	4.5%	2.0%	2.5%
2019	7.0%	4.0%	3.0%
2020	9.5%	6.0%	3.5%
2021	12.0%	8.0%	4.0%
2022	14.5%	10.0%	4.5%
2023	17.0%	12.0%	5.0%
2024	19.5%	14.0%	5.5%

2025	22.0%	16.0%	6.0%

(f) *Requirements for Large Volume Manufacturers in Model Year 2026 and Subsequent.* In 2026 and subsequent model years, a manufacturer must meet a total ZEV credit percentage of 22%. The maximum portion of a manufacturer's credit percentage requirement that may be satisfied by TZEV credits is limited to 6% of the manufacturer's applicable California PC and LDT production volume. ZEV credits must satisfy the remainder of the manufacturer's requirement.

2.3 Requirements for Intermediate Volume Manufacturers. For 2018 and subsequent model years, an intermediate volume manufacturer may meet all of its ZEV credit percentage requirement, under subdivision C.2, with credits from TZEV.

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

2.5 *[Reserved]*

2.6 *[Reserved]*

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

(a) *Increases in California Production Volume.* In 2018 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 (i.e., total production volume exceeds 13,500 vehicles in a three-year period), for three consecutive averages, the manufacturer shall no longer be treated as a small volume manufacturer, and must comply with the ZEV requirements for intermediate volume manufacturers beginning with the next model year after the last model year of the third consecutive average. For example, if (a small volume) Manufacturer A exceeds 4,500 PCs, LDTs, and MDVs for their 2018 – 2020, 2019 – 2021, and 2020 – 2022 model year averages, Manufacturer A would be subject to intermediate volume requirements starting in 2023 model year.

If an intermediate volume manufacturer's average California production volume exceeds 20,000 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 (i.e., total production volume exceeds 60,000 vehicles in a three-year period), for three consecutive averages, the manufacturer shall no longer be treated as an intermediate volume manufacturer and shall comply with the ZEV requirements for large volume manufacturers beginning with the next model year after the last model year of the third consecutive average. For example, if (an intermediate volume) Manufacturer B exceeds 20,000 PCs, LDTs, and MDVs for its 2018 – 2020, 2019 – 2021, and 2020 – 2022 average, Manufacturer B would be subject to large volume manufacturer requirements starting in 2023 model year.

Any new requirement described in the this subdivision will begin with the next model year after the last model year of the third consecutive average when a manufacturer ceases to be a small or intermediate volume manufacturer in 2018 or subsequent years due to the aggregation requirements in majority ownership situations.

(b) *Decreases in California Production Volume.* If a manufacturer's average California production volume falls below 4,500 or 20,000 units of new PCs, LDT1 and 2s, and MDVs, based on the average number of vehicles produced and delivered for sale for the three previous consecutive model years, for three consecutive averages, the manufacturer shall be treated as a small volume or intermediate volume manufacturer, as applicable, and shall be subject to the requirements for a small volume or intermediate volume manufacturer beginning with the next model year. For example, if Manufacturer C falls below 20,000 PCs, LDTs, and MDVs for its 2019 – 2021, 2020 – 2022, and 2021 – 2023 averages, Manufacturer C would be subject to IVM requirements starting in 2024 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. When a manufacturer is simultaneously producing two model years of vehicles at the time of a change of ownership, the basis of determining next model year must be the earlier 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 2019 calendar year occurs and the manufacturer is producing both 2019 and 2020 model year vehicles 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 2020 model year will be based on the production volumes of Manufacturers A and B in the 2017 – 2019 model years. Where the production volume of Manufacturer A must be aggregated with the production volumes of Manufacturers B and C for the 2019 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 2020 model year will be based on the production volumes of Manufacturers A and C in the 2017 – 2019 model years. In either case, the lead time provisions in subdivisions 1962.2(b)(7)(A) and (B) will apply.

3. Transitional Zero Emission Vehicles (TZEV).

3.1 Introduction*.* This subdivision C.3 sets forth the criteria for identifying vehicles delivered for sale in California as TZEVs.

3.2 TZEV Requirements*.* In order for a vehicle to be eligible to receive a ZEV allowance, the manufacturer must demonstrate compliance with all of the following requirements:

(a) *SULEV Standards.* Certify the vehicle to the 150,000-mile SULEV 20 or 30 exhaust emission standards for PCs and LDTs in subdivision 1961.2(a)(1). Bi-fuel, fuel flexible and dual-fuel vehicles must certify to the applicable 150,000-mile SULEV 20 or 30 exhaust emission standards when operating on both fuels. Manufacturers may certify 2018 and 2019 TZEVs to the 150,000-mile SULEV exhaust emission standards for PCs and LDTs in subdivision 1961(a)(1);

(b) *Evaporative Emissions.* Certify the vehicle to the evaporative emission standards in subdivision 1976(b)(1)(G) . Manufacturers may certify 2018 and 2019 TZEVs to the evaporative standards for PCs and LDTs in subdivision 1976(b)(1)(E;

(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 subdivisions 2037(b)(2) and 2038(b)(2) 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 Allowances for TZEVs.

(a) *Zero Emission Vehicle Miles Traveled TZEV Allowance Calculation.* A vehicle that meets the requirements of subdivision C.3.2 and has zero-emission vehicle miles traveled (VMT), as defined by and calculated by this test procedure and measured as equivalent all electric range (EAER) capability will generate allowance according to the following equation:

UDDS Test Cycle Range (R_{cda})	*Allowance*
<10 all electric miles	0.00
≥10 miles range	TZEV Credit = [(0.01) * R_{cda} + 0.30]
>80 miles (credit cap)	1.10

(1) Allowance for US06 Capability. TZEVs with US06 all electric range

capability (AER) of at least 10 miles shall earn an additional 0.2 allowance. US06 test cycle range capability shall be determined in accordance with section E.8 of these test procedures.

(B) *[Reserved]*

(C) *[Reserved]*

(D) *[Reserved]*

(e) *Credit Hydrogen Internal Combustion Engine Vehicles.* A hydrogen internal combustion engine vehicle that meets the requirements of subdivision C.3.2 and has a total range of at least 250 UDDS miles will earn an allowance of 0.75, which may be in addition to allowances earned in subdivision C.3.3(a), and subject to an overall credit cap of 1.25

4. Qualification for Credits From ZEVs.

4.1 *[Reserved]*

4.2 *[Reserved]*

4.3 *[Reserved]*

4.4 *[Reserved]*

4.5 Credits for 2018 and Subsequent Model Years.

(a) *ZEV Credit Calculations*. Credits from a ZEV delivered for sale are based on the ZEV's UDDS all electric range, determined in accordance with these test procedures using the following equation:

ZEV Credit = (0.01) * (UDDS range) + 0.50

(1) A ZEV with less than 50 miles UDDS range will receive zero credits.

(2) Credits earned under this provision C.4.5(a) are be capped at 4 credits per ZEV.

(b) *[Reserved]*

(c) *[Reserved]*

(d) *[Reserved]*

(1) *Provisions for 2018 through 2025 Model Years.* Large volume manufacturers

and intermediate volume manufacturers with credits earned from hydrogen fuel cell vehicles that are certified to the California ZEV standards applicable for the ZEV's model year, delivered for sale and placed in service in California or in a section 177 state, may be counted towards compliance in California and in all section 177 states with the percentage ZEV requirements in subdivision C.2. The credits earned are multiplied by the ratio of a manufacturer's applicable production volume for a model year, as specified in subdivision C.2.1(b), in the state receiving credit to the manufacturer's applicable production volume as specified in subdivision C.2.1(b), for the same model year in California(hereafter, "proportional value"). Credits generated from ZEV placement in a section 177 state will be earned at the proportional value in the section 177 state, and earned in California at the full value specified in subdivision C.4.5(a).

(2) *Optional Section 177 State Compliance Path.*

(A) *Reduced ZEV and TZEV Percentages.* Large volume manufacturers and intermediate volume manufacturers that have fully complied with the optional section 177 state compliance path requirements in subdivision 1962.1(d)(5)(E)3. are allowed to meet ZEV percentage requirements and optional TZEV percentages reduced from the minimum ZEV floor percentages and TZEV percentages in subdivision C.2.2(e) in each section 177 state equal to the following percentages of their sales volume determined under subdivision 1962.2(b)(1)(B:

ZEVs

Model Year	2018	2019	2020	2021
Existing Minimum ZEV Floor	2.00%	4.00%	6.00%	8.00%
Section 177 State Adjustment for Optional Compliance Path	62.5%	75%	87.5%	100%
Minimum Section 177 State ZEV Requirement	1.25%	3.00%	5.25%	8.00%

TZEVs

Model Year	2018	2019	2020	2021
Existing TZEV Percentage	2.50%	3.00%	3.50%	4.00%
Section 177 State Adjustment for Optional Compliance Path	90.00%	100%	100%	100%
New Section 177 State TZEV Percentage	2.25%	3.00%	3.50%	4.00%

Total Percent Requirement

Model Year	2018	2019	2020	2021
New Total Section 177 State Optional Requirements	3.50%	6.00%	8.75%	12.00%

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1. *Trading and Transferring ZEV and TZEV Credits within West Region Pool and East Region Pool.* Manufacturers that have fully complied with the optional section 177 state compliance path requirements in subdivision 1962.1(d)(5)(E)3. may trade or transfer specified model year ZEV and TZEV credits within the West Region pool to meet the same model year requirements in subdivision C.4.5(e)(2)(A) and will incur no premium on their credit values. For example, for a manufacturer to make up a 2019 model year shortfall of 100 credits in State X, the manufacturer may transfer 100 (2019 model year) ZEV credits from State Y, within the West Region pool. Manufacturers that have fully complied with the optional section 177 state compliance path requirements in subdivision 1962.1(d)(5)(E)3. may trade or transfer specified model year ZEV and TZEV credits within the East Region pool to meet the same model year requirements in subdivision C.4.5(e)(2)(A), and will incur no premium on their credit values. For example, for a manufacturer to make up a 2019 model year shortfall of 100 credits in State W, the manufacturer may transfer 100 (2019 model year) ZEV credits from State Z, within the East Region pool.

2. *Trading and Transferring ZEV and TZEV Credits between the West Region Pool and the East Region Pool.* Manufacturers that have fully complied with the optional section 177 state compliance path requirements in subdivision 1962.1(d)(5)(E)3. may trade or transfer specified model year ZEV and TZEV credits to meet the same model year requirements in subdivision C.4.5(e)(2)(A).a. between the West Region pool and the East Region pool; however, any credits traded will incur a premium of 30% of their value. For example, in order for a manufacturer to make up a 2019 model year shortfall of 100 credits in the West Region Pool, the manufacturer may transfer 130 (2019 model year) credits from the East Region Pool. No credits may be traded or transferred to the East Region pool or West Region pool from a manufacturer's California ZEV bank, or from the East Region pool or West Region pool to a manufacturer's California ZEV bank.

(B) *Reporting Requirements.* On an annual basis, by May 1st of the calendar year following the close of a model year, each manufacturer that elects the optional section 177 state compliance path under subdivision 1962.1(d)(5)(E)3 shall submit, in writing, to the Executive Officer and each section 177 state a report, including an itemized list, that indicates where vehicles have been placed within the East Region pool and within the West Region pool. The itemized list shall include the following:

1. The manufacturer's total applicable volume of PCs and LDTs delivered for sale in each section 177 state within the regional pool, as determined under subdivision C.2.1(b).

2. Make, model, vehicle identification number, credit earned, and section 177 state where delivery for sale of each TZEV and ZEV occurred and to meet manufacturer's requirements under subdivision C.4.5(e)(2)(A).

(C) *Failure to Meet Optional Section 177 State Compliance Path Requirements.* A manufacturer that elects the optional section 177 state compliance path subdivision 1962.1(d)(5)(E)3 and does not meet the modified percentages in subdivision C.4.5(e)(2)(A) in a model year or make up their deficit within the specified time and with the specified credits allowed by subdivision C.7.7(a) in all section 177 states of the applicable pool, shall be treated as subject to the ZEV percentage requirements in section C.2 in each section 177 state. The pooling provisions in subdivision C.4.5(e)(2)(A) shall not apply. Any transfers of ZEV or TZEV credits between section 177 states will be null and void if a manufacturer fails to comply, and ZEV or TZEV credits will return to the section 177 state in which the credits were earned. Penalties shall be calculated separately by each section 177 state where a manufacturer fails to make up the ZEV deficits by the end of the 2018 model year.

(D) The provisions of section C shall apply to a manufacturer electing the optional section 177 state compliance path, except as specifically modified by this subdivision C.4.5(e)(2).

(f) *NEVs.* NEVs must meet the following to be eligible for 0.15 credits:

(1) *Specifications.* A NEV earns credit when it meets all the following specifications:

(A) *Acceleration.* The vehicle has a 0-20 mph acceleration of 6.0 seconds or less when operating with a payload of 332 pounds and starting with the battery at a 50% state of charge.

(B) *Top Speed.* The vehicle has a minimum top speed of 20 mph when operating with a payload of 332 pounds and starting with the battery at a 50% state of charge. The vehicle's top speed shall not exceed 25 mph when tested in accordance with 49 CFR 571.500 (68 FR 43972, July 25, 2003).

(C) *Constant Speed Range.* The vehicle has a minimum 25 mile range when operating at constant top speed with a payload of 332 pounds and starting with the battery at 100% state of charge.

(2) *Battery Requirement*. A qualifying NEV must be equipped with sealed, maintenance-free batteries.

(3) *Warranty Requirement*. A NEV drive train, including battery packs, must be covered for a period of at least 24 months. The first 6 months of the NEV warranty

period must be covered by a full warranty; the remaining warranty period may be optional extended warranties (available for purchase) and may be prorated. If the extended warranty is prorated, the percentage of the battery pack's original value to be covered or refunded must be at least as high as the percentage of the prorated coverage period still remaining. For the purpose of this computation, the age of the battery pack must be expressed in intervals no larger than three months. Alternatively, a manufacturer may cover 50 percent of the original value of the battery pack for the full period of the extended warranty.

Prior to allowance approval, the Executive Officer may request that the manufacturer provide copies of representative vehicle and battery warranties.

(5) *NEV Charging Requirements*. A NEV must meet charging connection standard portion of the requirements specified in subdivision 1962.3(c)(2).

(g) *BEVx.* A BEVx must meet the following in order to receive credit, based on its zero emission UDDS range, through subdivision C.4.5(a):

(1) *Emissions Requirements.* BEVxs must meet all TZEV requirements, specified in subdivision C.3.2 (a) through (d).

(2) *APU Operation.* The vehicle’s UDDS range after the APU first starts and enters “charge sustaining hybrid operation” must be less than or equal to the vehicle’s UDDS all-electric test range prior to APU start. The vehicle’s APU cannot start under any user-selectable driving mode unless the energy storage system used for traction power is fully depleted.

(3) *Minimum Zero Emission Range Requirements.* BEVxs must have a minimum of 75 miles UDDS zero emission range.

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 TZEVs in a given model year exceeding the manufacturer’s ZEV requirement set forth in subdivision C.2 shall earn ZEV credits in accordance with this subdivision C.2.

7.2 ZEV Credit Calculations.

(a) *Credits from ZEVs*. The amount of credits earned by a manufacturer in a given model year from ZEVs shall be expressed in units of credits, 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, or, if applicable, requirements specified under subdivision C.4.5(e)(2)(A) for the model year subtracted from the number of ZEVs produced and delivered for sale in California by the manufacturer in the model year.

(b) *Credits from TZEVs.* The amount of credits earned by a manufacturer in a given model year from TZEVs shall be expressed in units of credits, and shall be equal to the total number of TZEVs produced and delivered for sale in California that the manufacturer applies towards meeting its ZEV requirement, or, if applicable, requirements specified under subdivision C.4.5(e)(2)(A) for the model year subtracted from the total number of ZEV allowances from TZEVs produced and delivered for sale in California by the manufacturer in the model year.

(c) *Separate Credit Accounts.* Credits from a manufacturer's ZEVs, BEVxs, TZEVs, and NEVs shall each be maintained in separate accounts.

(d) *Rounding Credits.* ZEV credits and debits shall be rounded to the nearest 1/100th only on the final credit and debit totals using the conventional rounding method.

7.3 ZEV Credits for MDVs and LDTs Other Than LDT1s. Credits from ZEVs and TZEVs classified as MDVs, may be counted toward the ZEV requirement for PCs and LDTs, and included in the calculation of ZEV credits as specified in this subdivision C.7 if the manufacturer so specifies.

7.4 ZEV Credits for Advanced Technology Demonstration Programs.

(a) *[Reserved]*

(b) *ZEVs.* ZEVs, including BEVxs, excluding NEVs, placed in a small or intermediate volume manufacturer's California advanced technology demonstration program for a period of two or more years, may earn ZEV credits even if the vehicle is not "delivered for sale" or registered with the California 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 operated in California. Such a vehicle is eligible to receive the same credit that it would have earned if delivered for sale, and for fuel cell vehicles, 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 up to 25 vehicles per model, per section 177 state, per year under this

7.5 ZEV Credits for Transportation Systems.

(a) *[Reserved]*

(b) *[Reserved]*

(c) *Cap on Use of Transportation System Credits.*

(1) *ZEVs.* Transportation system credits earned or allocated by ZEVs or BEVxs pursuant to subdivision 1962.1 (g)(5), not including any 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, and may be used to satisfy up to one-tenth of a manufacturer's ZEV obligation which must be met with ZEVs, as specified in subdivision C.2.2(e) , or, if applicable, requirements specified under subdivision C.4.5(e)(2)(A).

(2) *TZEVs*. Transportation system credits earned or allocated by TZEVs pursuant to subdivision 1962.1(g)(5), not including all credits earned by the vehicle itself, may be used to satisfy up to one-tenth of the portion of a manufacturer's ZEV obligation that may be met with TZEVs or, if applicable, the portion of a manufacturer's obligation that may be met with TZEVs specified under subdivision C.4.5(e)(2)(A) in any given model year, but may only be used in the same manner as other credits earned by vehicles of that category.

7.6 Use of ZEV Credits. A manufacturer may meet the ZEV requirements in a given model year by submitting to the Executive Officer a commensurate amount of ZEV credits, consistent with subdivision C.2. Credits in each of the categories may be used to meet the requirement for that category as well as the requirements for lesser credit earning ZEV categories, but shall not be used to meet the requirement for a greater credit earning ZEV category, except for discounted PZEV and AT PZEV credits. For example, credits produced from TZEVs may be used to comply with the portion of the requirement that may be met with credits from TZEV, but not with the portion that must be satisfied with credits from ZEVs. These credits may be earned previously by the manufacturer or acquired from another party.

(a) *Use of Discounted PZEV and AT PZEV Credits and NEV Credits.* For model years 2018 through 2025, discounted PZEV and AT PZEV credits, and NEV credits may be used to satisfy up to one-quarter of the portion of a manufacturer's requirement that can be met with credits from TZEVs or, if applicable, the portion of a manufacturer's obligation that may be met with TZEVs specified under subdivision C.4.5(e)(2)(A). Intermediate volume manufacturers may fulfill their entire requirement with discounted PZEV and AT PZEV credits, and NEV credits in model years 2018 and 2019. These credits may be earned previously by the manufacturer or acquired from another party. Discounted PZEV and AT PZEV credits may no longer be used after model year 2025 compliance.

(b) *Use of BEVx Credits.* BEVx credits may be used to satisfy up to 50% of the portion of a manufacturer's requirement that must be met with ZEV credits.

(c) *GHG-ZEV Over Compliance Credits.*

(1) *Application***.** Manufacturers may apply to the Executive Officer, no later than December 31, 2016, to be eligible for this subdivision C.7.6(c), based on the following qualifications:

(A) A manufacturer must have no model year 2017 compliance debits and no outstanding debits from all previous model year compliance with sections 1961.1 and 1961.3, and

(B) A manufacturer must have no model year 2017 compliance debits and no outstanding debits from all previous model year compliance with section 1962.1, and

(C) A manufacturer must submit documentation of its projected product plans to show over compliance with the manufacturer's section 1961.3 requirements by at least 2.0 gCO_2/mile in each model year through the entire 2018 through 2021 model year period.

(2) *Credit Generation and Calculation.* Manufacturers must calculate their over compliance with section 1961.3 requirements for model years 2018 through 2021 based on compliance with the previous model year standard. For example, to generate credits for this subdivision C.7.6(c) for model year 2018, manufacturers would calculate credits based on model year 2017 compliance with section 1961.3.

(A) At least 2.0 gCO_2/mile over compliance with section 1961.3 is required in each year and the following equation must be used to calculate the amount of ZEV credits earned for purposes of this subdivision C.7.6(c):

[(Manufacturer US PC and LDT Sales) x (gCO_2/mile below manufacturer GHG standard for a given model year)] / (Manufacturer GHG standard for a given model year)

(B) Credits earned under section 1961.3(a)(9) may not be included in the calculation of gCO_2/mile credits for use in the above equation in subdivision (A).

(C) Banked gCO_2/mile credits earned under 1961.1 and 1961.3 from previous model years or from other manufacturers may not be included in the calculation of gCO_2/mile credits for use in the above equation in subdivision (A).

(3) *Use of GHG-ZEV Over Compliance Credits*. A manufacturer may use no more than the percentage enumerated in the table below to meet either the total ZEV requirement nor the portion of their ZEV requirement that must be met with ZEV credits, with credits earned under this subdivision C.7.6(c).

2018	**2019**	**2020**	**2021**
50%	50%	40%	30%

Credits earned in any given model year under this subdivision C.7.6(c) may only be used in the applicable model year and may not be used in any other model year.

Credits calculated under this provision must also be removed from the GHG compliance bank, and cannot be banked for future compliance toward section 1961.3.

(4) *Reporting Requirements.* Annually, manufacturers are required to submit calculations of credits for this subdivision C.7.6(c) for the model year, any remaining credits/debits from previous model years under 1961.3, and projected credits/debits for future years through 2021 under 1961.3 and this subdivision C.7.6(c).

If a manufacturer, who has been granted the ability to generate credits under this subdivision C.7.6(c), fails to over comply by at least 2.0 gCO_2/mile in any one year, the manufacturer will be subject to the full ZEV requirements for the model year and future model years, and will not be able to earn credits for any other model year under this subdivision C.7.6(c).

(5) If the Executive Officer does not make a determination that a Federal greenhouse gas fleet standard is functionally equivalent to subdivision 1961.3, than this subdivision C.7.6(c)(1) through (4) is unavailable for use by any manufacturer.

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 next model year by submitting to the Executive Officer a commensurate amount of ZEV credits. The amount of ZEV credits required to be submitted shall be calculated by [i] adding the number of credits from ZEVs produced and delivered for sale in California by the manufacturer for the model year to the number of credits from TZEVs produced and delivered for sale in California by the manufacturer for the model year (for a LVM, not to exceed that permitted under subdivision C.2.2), and [ii] subtracting that total from the number of credits required to be produced and delivered for sale in California by the manufacturer for the model year. BEVx, TZEV, NEV, or converted AT PZEV and PZEV credits are not allowed to be used to fulfill a manufacturer's ZEV deficit; only credits from ZEVs may be used to fulfill a manufacturer's ZEV deficit.

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 credits and does not make up ZEV deficits within the specified time allowed by subdivision C.7.7(a) 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 deficit is not balanced by the end of the specified time allowed by subdivision 1962.2(g)(7)(A). For the purposes of Health and Safety Code section 43211, the number of vehicles not meeting the state board's standards shall be equal to the manufacturer's credit deficit, rounded to the nearest 1/100th, calculated according to the following equation, provided that the percentage of a manufacturer's ZEV requirement for a given model year that may be satisfied with TZEVs or credit from such vehicles may not exceed the percentages permitted under subdivision C.2.2::

(No. of ZEV credits required to be generated for the model year) – (Amount of credits submitted for compliance 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 C 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), TZEVs, AT PZEVs, and PZEVs for the 2018 and subsequent model years; and

(b) Each manufacturer's annual credit balances for 2018 and subsequent years for:

(1) Each type of vehicle: ZEVs (minus NEVs), BEVx, NEV, TZEV, and discounted AT PZEV and PZEV credits; and

(2) Advanced technology demonstration programs; and

(3) Transportation systems; and

(4) Credits earned under section C.4.4(c), including credits acquired from, or transferred to another party, and the parties themselves.

D. Certification Requirements.

1. Durability and Emission Testing Requirements. All ZEVs, excluding Type I.5x and Type IIx vehicles, 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. For off-vehicle charge capable hybrid electric vehicles certifying to section F, the manufacturer shall provide the energy usage in kilowatt hours per mile from the Urban Equivalent All-Electric Range and the Highway Equivalent All-Electric Range.

2.7 For those vehicles 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, and the method used to determine them, as specified in sections E.2 and F.2 of these test procedures.

2.12 Labeling shall conform with the requirements specified in section 1965, title 13, CCR and the "California Environmental Performance Label Specifications for 2009 and Subsequent Model Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Passenger Vehicles" (incorporated by reference therein).

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 When 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.

2.15 For off-vehicle charge capable hybrid electric vehicles certifying to section F, the manufacturer shall provide the Urban Charge Depleting Cycle Range, the Urban Charge Depleting Actual Range, the Charge Depleting to Charge Sustaining Urban

Range, the Highway Charge Depleting Cycle Range, the Highway Charge Depleting Actual Range, the Charge Depleting to Charge Sustaining Highway Range, the Urban Equivalent All-Electric Range, the Highway Equivalent All-Electric Range, the Urban Electric Range Fraction, and the Highway Electric Range Fraction.

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. If a manufacturer updates their annual California production numbers in their ZEV report, the annual NMOG production must also be updated.

E. Determination of NEV Acceleration, Top Speed, and Constant Speed Range

The acceleration and constant speed range for a NEV shall be determined as specified in “Implementation of SAE Standard J1666 May 93: Electric Vehicle Acceleration, Gradeability, and Deceleration Test Procedure,” ETA-NTP002 Revision 3, December 2004, and “Electric Vehicle Constant Speed Range Tests,” ETA-NTP004 Revision 3, February 1, 2008.

As Amended: March 22, 2012
Date of Hearing: January 26-27, 2012

F. Test Procedures for 2018 and Subsequent Model Zero-Emission Vehicles (including Fuel Cell Vehicles and Hybrid Fuel Cell Vehicles) and All 2018 and Subsequent Model Hybrid-Electric Vehicles, Except Off-Vehicle Charge Capable Hybrid Electric Vehicles.

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.” Unless otherwise noted, these requirements shall apply to all ZEVs (including fuel cell vehicles and hybrid fuel cell vehicles) and all HEVs, except off-vehicle charge capable HEVs.

1. Electric Dynamometer. All ZEVs and HEVs must be tested using a 48-inch single roll electric dynamometer meeting the requirements of 40 CFR Subpart B, §86.108-00(b)(2) [October 22, 1996].

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 for Zero-Emission Vehicles (including Fuel Cell Vehicles and Hybrid Fuel Cell Vehicles). All 2012 and subsequent ZEVs shall be subject to the All-Electric Range Test specified below for the purpose of determining the energy efficiency and operating range of the ZEV.

3.1 **Determination of Urban All-Electric Range for Zero-Emission Vehicles.**

3.1.1 **Determination of Urban All-Electric Range for Battery Electric Vehicles.**

(a) **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. Charge time shall not exceed soak time.

(b) At the end of the cold soak period, the vehicle shall be placed or pushed, onto a dynamometer and operated through successive Urban Dynamometer Driving Schedules (UDDS), 40 CFR, Part 86, Appendix I [July 13, 2005], which is incorporated herein by reference. A 10-minute soak shall follow each UDDS.

(c) For vehicles with a maximum speed greater than or equal to the maximum speed on the UDDS, 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) [October 22, 1996], or the manufacturer determines that the test should be terminated for safety reasons, e.g. excessively high battery temperature, abnormally low battery voltage, etc.

(d) For vehicles with a maximum speed less than the maximum speed on the UDDS, 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) [October 22, 1996]. 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 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.

3.1.2 **Determination of Urban All-Electric Range for Fuel Cell Vehicles and Hybrid Fuel Cell Vehicles.**

(a) The urban all-electric range for a fuel cell vehicle and a hybrid fuel cell vehicle shall be determined in accordance with SAE J2572. As an option, a manufacturer may elect to determine the urban all-electric range for a fuel cell vehicle or a hybrid fuel cell vehicle in accordance with section F.3.1.1 above.

3.2 **Determination of Highway All-Electric Range for Zero-Emission Vehicles and Range for Fuel Cell Vehicles and Hybrid Fuel Cell Vehicles.**

3.2.1 **Determination of Highway All-Electric Range for Battery Electric Vehicles.**

(a) **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. Charge time shall not exceed soak time.

(b) At the end of the cold soak period, the vehicle shall be either placed or pushed onto a dynamometer and operated through Continuous Highway Test Schedules of the Highway Fuel Economy Driving Schedule (HFEDS).

(c) For vehicles with a maximum speed greater than or equal to the maximum speed on the HFEDS, 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) [October 22, 1996], or the manufacturer determines that the test should be terminated for safety reasons, e.g. excessively high battery temperature, abnormally low battery voltage, etc.

(d) For vehicles with a maximum speed less than the maximum speed on the HFEDS, 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) [October 22, 1996]. 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 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.

(e) NEVs are exempt from the all-electric range highway test.

3.2.2 **Determination of Highway All-Electric Range for Fuel Cell Vehicles and Hybrid Fuel Cell Vehicles.**

(a) The highway all-electric range for a fuel cell vehicle and a hybrid fuel cell vehicle shall be determined in accordance with SAE J2572. As an option, a manufacturer may elect to determine the highway all-electric range for a fuel cell vehicle or a hybrid fuel cell vehicle in accordance with section F.3.2.1 above.

3.3 **Recording requirements.**

For all battery electric vehicles and hybrid electric vehicles, except off-vehicle charge capable hybrid electric vehicles: Once the vehicle is no longer able to maintain the speed and time requirements specified in F.3.1 or F.3.2 above, the vehicle shall be brought to an immediate stop and the following data shall be 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;
(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; and
(e) Measured AC and DC watt hours and amp hours shall be reported to the nearest hundredths of a kilowatt hour and tenths of an amp hour.

Battery charging shall begin within 1 hour after terminating the All-Electric Range Test.

3.4 **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 for normal driving conditions prior to the commencement of the test. The driving schedule speed and time tolerances specified in F.3.1 or F.3.2 shall not be exceeded due to the operation of the regenerative braking system.

3.5 **Measurement Accuracy**. For battery electric vehicles, the overall error in voltage and current recording instruments shall be NIST traceable and accurate to ±1% of the maximum value of the variable (AC/DC volts and amps) being measured. Suggested equipment: amp meter/power meter capable of sampling voltage and current. Voltage and current shall be sampled at a minimum rate of 20 hz.

3.6 **Watt Hour Calculation for Battery Electric Vehicles.**

DC energy (watt-hours) shall be calculated as follows

DC energy = $\int v(t) * i(t)\, dt$
Wherev = vehicle DC main battery pack voltage
i = vehicle DC main battery pack current

AC energy (in watt-hours) shall be calculated as follows

AC energy = $\int v(t) * i(t)\, dt$ in watt-hours
Wherev = AC instantaneous voltage
i = AC instantaneous current

3.7 **Charger Requirements for Battery Electric Vehicles.**

The standard charging apparatus (or equivalent) normally furnished with or specified for the vehicle shall be used for charging during vehicle testing.

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 for Vehicles Other Than ZEVs.

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^{o}F and 86^{o}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 to obtain a grams per mile value.

6. Urban Emission Test Provisions for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Off-Vehicle Charge Capable Hybrid Electric Vehicles.

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" with the following supplemental requirements:

6.1.1 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.

6.1.2 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.

6.1.3 After setting battery state-of-charge, the hybrid electric vehicle shall be pushed or towed to a work area for the initial fuel drain and fill according to section III.D.1.4. of the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles."

6.1.4 Following the initial fuel drain and fill, the vehicle shall complete an initial soak period of a minimum of 6 hours. After completing the soak period, 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.

6.1.5 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 in section G.10 would be satisfied for the dynamometer procedure (section F.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 the second soak period of 12 to 36 hours.

(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 Urban Dynamometer Procedure for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Off-Vehicle Charge Capable Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §86.135-00 [October 22, 1996] with the following revisions. References to §86.110-94 shall mean §86.110-94 as last amended June 30, 1995.

6.2.1 Amend subparagraph (a).

Overview. The dynamometer run shall consist of two tests, a “cold” start test, after a second fuel drain and fill and a 12 to 36 hour soak period performed pursuant to the provisions of the “California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles” 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.

For all UDDS tests, the exhaust emissions are diluted with ambient air in the dilution tunnel as shown in Figure B94-5 and Figure B94-6 (§86.110-94). As an alternative, the bag mini-diluter may be used in-lieu of the constant volume sampling (CVS) method for exhaust emission measurement as described below. 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). Part 1065 of the CFR may be used as an optional particulate sampling method. Continuous proportional samples of gaseous emissions are collected for analysis during each test. For hybrid electric vehicles with 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 that are not "off-vehicle charge capable," and are equipped with petroleum-fueled diesel-cycle auxiliary power units (optional for natural gas-fueled, liquefied petroleum gas-fueled, and alcohol-fueled diesel-cycle vehicles), THC is sampled and analyzed continuously pursuant to the provisions of §86.110-94. 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 alcohol-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 alcohol-fueled auxiliary power units, alcohol 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 Subparagraphs (b) through (c). [No change.]

6.2.3 Subparagraph (d). [No change.]

6.2.4 Subparagraphs (e) through (g). [No change.]

6.2.5 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.

6.2.6 Subparagraph (i). [No change.]

6.3 Urban Dynamometer Test Run, Gaseous and Particulate Emissions for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Off-Vehicle Charge Capable Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §86.137-96 [March 24, 1993] with the following revisions:

6.3.1 Amend subparagraph (a): *General*. The dynamometer run shall consist of two tests, a "cold" start test, after a second fuel drain and fill and a 12 to 36 hour soak period performed pursuant to the provisions of the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles" and a "hot" start test following the cold start test by 10 minutes. 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 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 vehicle is allowed to stand on the dynamometer during the 10 minute time period between each test.

6.3.2 Amend subparagraph (b) as follows.

6.3.2.1 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 alcohol exhaust sample, the formaldehyde exhaust sample, the dilution air sample bag, the alcohol 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.

6.3.2.2 Delete subparagraph (b)(13).

6.3.2.3 Amend subparagraph (b)(14): Turn the vehicle off 2 seconds after the end of the last deceleration (at 1,369 seconds).

6.3.2.4 Amend subparagraph (b)(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 alcohol 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 alcohol 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.

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6.3.2.5 Amend subparagraph (b)(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.

6.3.2.6 Delete subparagraph (b)(19).

6.3.2.7 Delete subparagraph (b)(20).

6.3.2.8 Amend subparagraph (b)(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 in section G.10.

6.3.2.9 Amend subparagraph (b)(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."

6.4 Calculations - Exhaust Emissions for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Off-Vehicle Charge Capable Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §86.144-94 [July 13, 2005] with the following revisions:

6.4.1 Amend subparagraph (a): For light-duty vehicles and light duty trucks:

$$Y_{wm} = 0.43 * \left(\frac{Y_c}{D_c}\right) + 0.57 * \left(\frac{Y_h}{D_h}\right)$$

Where:

(1) Y_{wm} = Weighted mass emissions of each pollutant, i.e., THC, CO, THCE, NMOG, 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.

6.4.2 Subparagraphs (b) through (e). [No change.]

6.5 Calculations - Particulate Emissions for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Off-Vehicle Charge Capable Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §86.145-82 [November 2, 1982] with the following revisions. References to §86.110-94 shall mean §86.110-94 as last amended June 30, 1995.

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:

$$M_p = 0.43 * \left(\frac{M_{pc}}{D_c}\right) + 0.57 * \left(\frac{M_{ph}}{D_h}\right)$$

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.

6.5.2 Subparagraph (b). [No change.]

7. Highway Emission Test Provisions for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Off-Vehicle Charge Capable Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §600.111-08 [December 27, 2006] with the following revisions.

7.1 Subparagraph (a). [not applicable - delete]

7.2 Amend subparagraph (b) as follows:

7.2.1 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. Alcohol and formaldehyde samples are collected and individually analyzed for alcohol-fueled vehicles.

7.2.2 Amend subparagraph (b)(7)(i): The dynamometer procedure shall consist of two cycles of the Highway Fuel Economy Driving Schedule (§600.109(b)) separated by 15 seconds of idle. The first cycle of the Highway Fuel Economy Driving Schedule is driven to precondition the test vehicle and the second is driven for the fuel economy measurement.

7.2.3 Amend subparagraph (b)(7)(iii): Only one exhaust sample and one background sample shall be collected and analyzed for THC (except diesel hydrocarbons which are analyzed continuously), CO, CO_2, and NO_x. Alcohol and formaldehyde samples (exhaust and dilution air) are collected and analyzed for alcohol-fueled vehicles.

7.2.4 Add subparagraph(b)(7)(v): 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.

7.2.5 Amend subparagraph (b)(9)(v): Operate the vehicle over one HFEDS preconditioning cycle according to the dynamometer driving schedule specified in §600.109-08(b) [December 27, 2006]. 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.

7.2.6 Amend subparagraph (b)(9)(vi): 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.

7.2.7 Add subparagraph (b)(9)(viii): 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 in section F.10 is satisfied. If the SOC criterion is not satisfied, then repeat dynamometer test run from subparagraph (b)(9)(vi) and (b)(9)(vii). A total of three highway emission tests shall be allowed to satisfy the SOC criterion.

(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.

7.2.8 Delete subparagraph (b)(10).

7.3 Delete subparagraphs (c) through (e).

8. SFTP Emission Test Provisions for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Off-Vehicle Charge Capable Hybrid Electric Vehicles.

8.1 US06 Vehicle Preconditioning

To be conducted pursuant to 40 CFR §86.132-00 [October 22, 1996] with the following revisions.

8.1.1 Subparagraphs (a) through (m). [No change.]

8.1.2 Amend subparagraph (n): Aggressive Driving Test (US06) Preconditioning.

8.1.2.1 Amend subparagraph (1) as follows: If the US06 test follows the exhaust emission urban, highway, 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. For vehicles that allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at according to the following conditions:

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.

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.

8.1.2.1.1 Subparagraphs (i) through (iv). [No change.]

8.1.2.2 Subparagraph (2). [No change.]

8.1.3 Subparagraph (o). [No change.]

8.2 US06 Emission Test.

To be conducted pursuant to 40 CFR §86.159-08 [December 27, 2006] 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 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 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. The US06 cycle after the preconditioning cycle shall be used to calculate emissions and shall meet the state-of-charge net tolerances as calculated in section F.9.

8.2.2 Amend subparagraph (b) as follows.

8.2.2.1 Amend subparagraph (b)(2): Position the test vehicle on the dynamometer and restrain.

8.2.3 Subparagraph (c). [No change.]

8.2.4 Amend subparagraph (d): Practice runs over the prescribed driving schedule may be performed at test point to permit sampling system adjustment.

8.2.5 Subparagraph (e). [No change.]

8.2.6 Amend subparagraph (f) as follows.

8.2.6.1 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.

8.2.6.2 Amend subparagraph (f)(2)(ix): At the conclusion of the US06 emission test, one of the following conditions shall apply:

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(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 in section F.10 is satisfied. If the SOC criterion is not satisfied, then repeat dynamometer test run from subparagraph (f)(2)(i) without the preconditioning cycle. A total of three US06 emission tests shall be allowed to satisfy the SOC criterion.

(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 [October 22, 1996] with the following revisions.

8.3.1 Subparagraphs (a) through (n). [No change.]

8.3.2 Amend subparagraph (o): *Air Conditioning Test (SC03) Preconditioning*.

8.3.2.1 Amend subparagraph (1) as follows: 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. 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:

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.

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.

8.3.2.1.1 Subparagraphs (i) and (ii). [No change.]

8.3.2.2 Subparagraphs (2) through (3). [No change.]

8.4 SC03 Emission Test.

To be conducted pursuant to 40 CFR §86.160-00 [December 8, 2005] 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 simulate testing in an environmental test cell (see §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^{o}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 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 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. The SC03 cycle after the preconditioning cycle shall be used to calculate emissions and shall meet the state-of-charge net tolerances as calculated in section ~~E~~F.~~-~~9.

8.4.2 Amend subparagraph (b) as follows.

8.4.2.1 Amend subparagraph (b)(2): Position the test vehicle on the dynamometer and restrain.

8.4.3 Amend subparagraph (c) as follows.

8.4.3.1 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 (d) as follows.

8.4.4.1 Amend subparagraph (d)(10): At the conclusion of the SC03 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 in section F.10 is satisfied. If the SOC criterion is not satisfied, then turn off the cooling fan(s), allow the vehicle to soak in the ambient conditions of paragraph (c)(5) of this section for 10 ± 1 minutes, and repeat the dynamometer test run from subparagraph (d). Up to three SC03 emission tests shall be attempted to satisfy the SOC criterion.

(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 the vehicle two 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 the vehicle two seconds after the end of the last deceleration.

8.4.5 Subparagraph (e). [No change.]

9. State-of-Charge Net Change Tolerances for All Hybrid Electric Vehicles, Except Hybrid Fuel Cell Vehicles and Off-Vehicle Capable Hybrid Electric Vehicles.

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:

$$(\text{Amp-hr}_{\text{final}})_{\text{max}} = (\text{Amp-hr}_{\text{initial}}) + 0.01 * \left(\frac{NHV_{fuel} * m_{fuel}}{V_{system} * K_1}\right)$$

$$(\text{Amp-hr}_{\text{final}})_{\text{min}} = (\text{Amp-hr}_{\text{initial}}) - 0.01 * \left(\frac{NHV_{fuel} * m_{fuel}}{V_{system} * K_1}\right)$$

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Where:

(Amp-hr_{final})$_{max}$ = Maximum allowed Amp-hr stored in battery at the end of the test

(Amp-hr_{final})$_{min}$ = Minimum allowed Amp-hr stored in battery at the end of the test

(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} = Open circuit voltage (OCV) that corresponds to the SOC of the target SOC during charge sustaining operation. This value shall be submitted for testing purposes, and it shall be subject to confirmation by the Air Resources Board.

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:

$$(rpm_{final})_{max} = \sqrt{rpm_{initial}^2 + 0.01 * \frac{(2 * NHV_{fuel} * m_{fuel})}{I * K_3}}$$

$$(rpm_{final})_{min} = \sqrt{rpm_{initial}^2 - 0.01 * \frac{(2 * NHV_{fuel} * m_{fuel})}{I * K_3}}$$

Where:

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$(rpm_{final})_{max}$ = 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

$rpm^2_{initial}$ = 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, $\frac{4\pi^2}{3600\sec^2 - rpm^2}$

I = Rated moment of inertia of the flywheel, in kg-m^2

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G. Test Procedures for 2018 and Subsequent Model Off-Vehicle Charge Capable Hybrid Electric Vehicles.

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," unless otherwise noted.

1. Electric Dynamometer.

All off-vehicle charge capable HEVs must be tested using a 48-inch single roll electric dynamometer meeting the requirements of 40 CFR Subpart B, §86.108-00(b)(2) [October 22, 1996].

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. General Testing Requirements.

3.1 **Recording requirements.**

For off-vehicle charge capable hybrid electric vehicles: The following data shall be recorded for all tests and for each individual test cycle therein, except for the 20°F and 50°F tests, conducted in accordance with section G.8:

(a) mileage accumulated during the All-Electric Range portion of the test, where applicable;

(b) Net DC energy from the battery that was expended during the test (may be reported as the total DC battery energy output and the total DC battery energy input);

(c) AC energy required to fully charge the battery after a charge depleting or charge sustaining test from the point where electricity is introduced from the electric outlet to the battery charger;

(d) DC energy required to fully charge the battery after a charge depleting or charge sustaining test from the point where electricity is introduced from the battery charger to the battery;

(e) Net DC amp-hrs from the battery that was expended during the test (may be reported as the total DC amp-hrs output and the total DC amp-hrs input); and

(f) Measured AC and DC watt hours and amp hours shall be reported to the nearest hundredths of a kilowatt hour and tenths of an amp hour.

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3.2 **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 for normal driving conditions prior to the commencement of the test. The driving schedule speed and time tolerances specified in this section G shall not be exceeded due to the operation of the regenerative braking system.

3.3 **Measurement Accuracy**. The overall error in voltage and current recording instruments shall be NIST traceable and accurate to ±1% of the maximum value of the variable (AC/DC volts and amps) being measured. Suggested equipment: amp meter/power meter capable of sampling voltage and current. Voltage and current shall be sampled at a minimum rate of 20 hz.

3.4 **Watt Hour Calculation.**

DC energy (watt hours) shall be calculated as follows

DC energy = $\int v(t) * i(t)\, dt$
Wherev = vehicle DC main battery pack voltage
i = vehicle DC main battery pack current

AC energy (in watt-hours) shall be calculated as follows

AC energy = $\int v(t) * i(t)\, dt$ in watt-hours
Wherev = AC instantaneous voltage
i = AC instantaneous current

3.5 **Charger Requirements**

The standard charging apparatus (or equivalent) normally furnished with or specified for the vehicle shall be used for charging during vehicle testing.

4. 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^{o}F and 86^{o}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 to obtain a grams per mile value.

5. Urban Test Provisions for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

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.

The criteria certification emissions for the Urban test shall be the worst case emissions of NMOG, CO, NOx, and PM from either the charge depleting or charge sustaining tests. The sum of NMOG + NOx emissions shall constitute the worst case for the urban charge sustaining or charge depleting modes of operation.

Vehicles with more than one mode of operation of the auxiliary power unit (e.g., economy mode, performance mode, etc.) for a given charge depleting or charge sustaining test cycle must be tested in the mode(s) which represents the worst case emissions of the auxiliary power unit. Confirmatory testing may also be performed in any mode of operation to ensure compliance with emission standards.

5.1 Vehicle Preconditioning.

To be conducted pursuant to the “California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles” with the following supplemental requirements:

5.1.1 For 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 vehicle to operate the auxiliary power unit for the maximum possible cumulative amount of time during the preconditioning drive.

5.1.2 For vehicles that allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at the lowest level allowed by the manufacturer.

5.1.3 After setting battery state-of-charge, the vehicle shall be pushed or towed to a work area for the initial fuel drain and fill according to section III.D.1.4 of the “California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles.”

5.1.4 Following the initial fuel drain and fill, the vehicle shall complete an initial soak period of a minimum of 6 hours.

5.1.5 After completing the soak period, the vehicle shall be pushed or towed into position on a dynamometer and preconditioned.

5.1.6 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.

5.1.7 For the charge depleting range test and the charge sustaining emission test, the preconditioning cycle shall be the UDDS. The vehicle must be in charge sustaining operation during the preconditioning drive. To determine charge sustaining operation, the vehicle must meet the SOC criterion in section ~~F~~G.10 from the start to the end of the two consecutive UDDSs. As an option, charge sustaining operation can be achieved for a single UDDS if data is provided showing that charge sustaining operation can consistently be maintained over one UDDS. The vehicle must meet the SOC criterion in section ~~F~~G.10 from the start to the end of a single UDDS. Alternative procedures may be used to determine charge sustain operation for the precondition drive if the alternate procedure demonstrates charge sustaining operation based on section ~~F~~G.10 and is approved in advance by the Executive Officer of the Air Resources Board.

5.1.8 A fuel drain and fill shall be performed pursuant to the provisions of the “California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles.”

5.1.9 The vehicle shall be soaked for 12-36 hours. During this soak period, canister preconditioning shall be performed pursuant to the provisions of the “California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles.”

5.1.10 For the urban charge depleting range test, the highway charge depleting range test, and the cold start US06 range test, charge the vehicle to full state-of-charge as specified by the vehicle manufacturer. The vehicle must be turned off during charging and charge time shall not exceed soak time.

5.2 Urban Dynamometer Procedure for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §86.135-00 [October 22, 1996] with the following revisions. References to §86.110-94 shall mean §86.110-94 as last amended June 30, 1995.

5.2.1 Amend subparagraph (a).

Overview. The charge depleting range test dynamometer run shall consist of a series of charge depleting UDDSs, each followed by a 10 minute key-off hot soak period until charge sustaining operation is achieved for two consecutive UDDSs. To determine charge sustaining operation, the vehicle must meet the SOC criterion in section ~~F~~G.10 from the start of the first UDDS until the end of the second UDDS. As an option, charge sustaining operation may be achieved for a single UDDS if data is provided showing that charge sustaining operation can consistently be maintained over one UDDS. To determine charge sustaining operation, in this case, the vehicle shall meet SOC criterion in section ~~F~~G.10 from the start to the end of a single UDDS. Emissions are measured for all UDDSs when the auxiliary power unit is operating.

The vehicle shall be turned off and 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. At the end of this cold soak period, the vehicle shall be placed or pushed onto a dynamometer.

The charge sustaining emission test dynamometer run shall consist of two consecutive UDDSs with a 10 minute key-off hot soak in between. Vehicle emissions shall be measured over two UDDSs during charge sustaining operation, and the vehicle must meet the SOC criterion in section ~~F~~G.10 from the start of the first UDDS until the end of the second UDDS.

Vehicle charging shall be initiated within three hours after either the charge depleting range test or the charge sustaining emission test pursuant to section G.5.4.2 or G.5.4.3, as applicable. During charging, all requirements in section G.3 must be met, and energy consumption shall be calculated pursuant to the requirements in section G.11.7.

For all exhaust emission tests, the exhaust emissions are diluted with ambient air in the dilution tunnel as shown in Figure B94-5 and Figure B94-6 (§86.110-94). As an alternative, the bag mini-diluter may be used in-lieu of the constant volume sampling (CVS) method for exhaust emission measurement as described below. A dilution tunnel is not required for testing vehicles waived from the requirement to measure particulates. For UDDSs, particulate samples are collected on filters for weighing during each UDDS. Each sample plus backup is collected during each UDDS (including shutdown). Part 1065 of the CFR may be used as an optional particulate sampling method. Continuous proportional samples of gaseous emissions are collected for analysis during each UDDS. For vehicles with Otto-cycle auxiliary power units, the composite samples collected in bags are analyzed for THC, CO, CO_2, CH_4 and NO_x. For vehicles with petroleum-fueled diesel-cycle auxiliary power units (optional for natural gas-fueled, liquefied petroleum gas-fueled, and alcohol-fueled diesel-cycle vehicles), THC is sampled and analyzed continuously pursuant to the provisions of §86.110-94. Parallel samples of the dilution air are similarly analyzed for THC, CO, CO_2, CH_4 and NO_x. For vehicles with natural gas-fueled, liquefied petroleum gas-fueled, and alcohol-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 vehicles with alcohol-fueled auxiliary power units, alcohol 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.

5.2.2 Subparagraphs (b) through (c). [No change.]

5.2.3 Subparagraph (d). [No change.]

5.2.4 Subparagraphs (e) through (g). [No change.]

5.2.5 Amend subparagraph (h): The driving distance, as measured by counting the number of dynamometer roll or shaft revolutions, shall be determined for all charge depleting and exhaust emission tests. The revolutions shall be measured on the same roll or shaft used for measuring the vehicle's speed.

5.2.6 Subparagraph (i). [No change.]

5.3 Urban Dynamometer Test Run, Gaseous and Particulate Emissions for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §86.137-96 [March 24, 1993] with the following revisions:

5.3.1 Amend subparagraph (a): *General*. The dynamometer run shall consist of a series of UDDSs, after a second fuel drain and fill and a 12 to 36 hour soak period performed pursuant to the provisions of the "California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles." 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 vehicle is allowed to stand on the dynamometer during the 10 minute time period between each UDDS.

5.3.2 Amend subparagraph (b) as follows.

5.3.2.1 Amend subparagraph (b)(9): Start the gas flow measuring device, direct the sample flow into the exhaust sample bag, the alcohol exhaust sample, the formaldehyde exhaust sample, the dilution air sample bag, the alcohol dilution air sample and the formaldehyde dilution air sample, 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.

5.3.2.2 Delete subparagraph (b)(13).

5.3.2.3 Subparagraph (b)(14). [No change.]

5.3.2.4 Amend subparagraph (b)(15): Five seconds after the vehicle is shutdown, simultaneously turn off the gas flow measuring device and particulate sample pump. 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 UDDS. Obtain alcohol 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 alcohol 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.

5.3.2.5 Amend subparagraph (b)(18): Repeat the steps in paragraphs (b)(2) through (b)(17) of this section for the hot start UDDS. The steps 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 UDDS.

5.3.2.6 Delete subparagraph (b)(19).

5.3.2.7 Delete subparagraph (b)(20).

5.3.2.8 Amend subparagraph (b)(21): As soon as possible, transfer the particulate filters to the weighing chamber for post-test conditioning, if applicable. For vehicles undergoing a cold start charge sustaining test, a valid test shall satisfy the SOC criterion in section ~~F~~G.10.

5.3.2.9 Amend subparagraph (b)(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."

5.4 Determination of Urban All-Electric Range and Urban Equivalent All-Electric Range for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

5.4.1 The **Urban All-Electric Range** shall be shall be defined as the distance that the vehicle is driven from the start of Urban Charge Depleting Range Test until the internal combustion engine first starts.

5.4.2 **Urban Charge Depleting Range Test.**

(i) **Vehicle preconditioning.** The vehicle shall be preconditioned according to G.5.1.

(ii) **Dynamometer run.** At the end of the cold soak period, the vehicle shall be placed or pushed, onto a dynamometer and operated through the Continuous Urban Test Schedule until the SOC Net Change Tolerances (specified in section ~~F~~G.10 of these test procedures) that indicate charge sustaining operation are met for two consecutive UDDSs, or a single UDDS if data is provided showing that charge sustaining operation can consistently be maintained in one UDDS. If there are no charge depleting hot start cycles, then use the next hot start cycle (after the cold start cycle) in the test sequence for the purpose of determining hot start emissions. For this case (no charge depleting hot start cycle), the manufacturer may optionally add one additional hot start cycle.

The Alternative Continuous Urban Test Schedule may be substituted for the Continuous Urban Test Schedule if the test facility is unable to perform the Continuous Urban Test Schedule. Refer to sections G.5.5, G.5.6, and G.11, for calculations of urban exhaust emissions, urban particulate emissions, and equivalent all-electric range, respectively. Emissions are measured for all test cycles when the auxiliary power unit is operating. For each test cycle for which emissions were not measured, the manufacturer must validate that the auxiliary power unit did not turn on at any time during the test cycle.

(iii) **Vehicle charging after testing.** Vehicle charging shall begin within three hours after either the charge depleting range test or the charge sustaining emission test, and the vehicle shall be charged to the manufacturer specified full state-of-charge. During charging, all applicable requirements in G.3 must be met, and energy consumption shall be calculated pursuant to the requirements in section G.11.7.

5.4.3 **Urban Charge Sustaining Emission Test.** The Urban Charge Sustaining Emission Test is conducted cold, and after charge sustaining operation has been reached, or an optional charge sustaining test mode has been activated, and no subsequent charge has been performed.

(i) **Vehicle preconditioning.** If the Urban Charge Sustaining Emission Test is performed within 36 hours after the Urban Charge Depleting Range Test, the vehicle shall be preconditioned pursuant to section ~~F~~G.5.1.9. If the Urban Charge Sustaining Emission Test is performed more than 36 hours after the Urban Charge Depleting Range Test, the vehicle shall be preconditioned pursuant to section G.5.1, except for vehicle charging. Sections G.5.1.1 through G.5.1.4 may be omitted if previously performed.

(ii) **Dynamometer run.** At the end of the cold soak period, the vehicle shall be placed or pushed onto a dynamometer, and two UDDSs shall be performed during charge sustaining operation, each separated by a 10 minute key-off hot soak period. The vehicle must meet the SOC criterion in section G.10 from the start of the first UDDS until the end of the second UDDS. If the SOC criterion is not satisfied, the test shall be stopped, the vehicle cold soak shall be conducted again, and the dynamometer test run shall be conducted again.

(iii) **Vehicle charging after testing.** If the vehicle was not charged after the Urban Charge Depleting Range Test, then vehicle charging shall begin within three hours after the Urban Charge Sustaining Emission Test and the vehicle shall be charged to the manufacturer specified full state-of-charge. During charging, all requirements in G.3 must be met, and energy consumption shall be calculated pursuant to the requirements in section G.11.7.

5.5 Calculations - Urban Exhaust Emissions for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §86.144-94 [July 13, 2005] with the following revisions:

5.5.1 Amend subparagraph (a):

Gaseous Emissions – Urban Charge Depleting Range Test.

For light-duty vehicles and light duty trucks:

$$Y_{wm} = 0.43 * \left(\frac{Y_c}{D_c}\right) + 0.57 * \left(\frac{\Sigma Y_n}{\Sigma D_n}\right)$$

Where:

Y_{wm} = Weighted mass emissions of each pollutant, i.e., THC, CO, THCE, NMOG, NMHCE, CH_4, NOx, or CO_2, in grams per vehicle mile.

Y_c = Mass emissions as calculated from the cold start UDDS, in grams per test.

D_c = The measured driving distance from the cold start UDDS, in miles.

n = number of hot start UDDSs in Charge Depleting operation
If there are no charge depleting hot start cycles, then use the next hot start cycle (after the cold start cycle) in the test sequence for the purpose of determining hot start emissions. For this case (no charge depleting hot start cycle), the manufacturer may optionally add one additional hot start cycle for an n=2.

Gaseous Emissions – Urban Charge Sustaining Emission Test.

For light-duty vehicles and light-duty trucks:

$$Y_{wm} = 0.43 * \left(\frac{Y_c}{D_c}\right) + 0.57 * \left(\frac{Y_h}{D_h}\right)$$

Where:

Y_{wm} = Weighted mass emissions of each pollutant, i.e., THC, CO, THCE, NMOG, NMHCE, CH_4, NO_x, or CO_2, in grams per vehicle mile.

Y_c = Mass emissions as calculated from the cold start UDDS, in grams per test.

Y_h = Mass emissions as calculated from the hot start UDDS, in grams per test.

D_c = The measured driving distance from the cold start UDDS, in miles.

D_h = The measured driving distance from the hot start UDDS, in miles.

5.5.2 Subparagraphs (b) through (e). [No change.]

5.6 Calculations - Urban Particulate Emissions for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §86.145-82 [November 2, 1982] with the following revisions. References to §86.110-94 shall mean §86.110-94 as last amended June 30, 1995.

5.6.1 Amend subparagraph (a):

Particulate Emissions – Urban Charge Depleting Range Test.

The final reported test results for the mass particulate (M_p) in grams/mile shall be computed as follows:

$$M_p = 0.43 * \left(\frac{M_{pc}}{D_c}\right) + 0.57 * \left(\frac{\Sigma M_{pn}}{\Sigma D_n}\right)$$

Where:

M_{pc} = Mass of particulate determined from the cold start UDDS, in grams per vehicle mile. (See §86.110-94 for determination.)

D_c = The measured driving distance from the cold start UDDS, in miles.

n = number of hot start UDDSs in Charge Depleting operation
If there are no charge depleting hot start cycles, then use the next hot start cycle (after the cold start cycle) in the test sequence for the purpose of determining hot start emissions. For this case (no charge depleting hot start cycle), the manufacturer may optionally add one additional hot start cycle for an n=2.

Particulate Emissions – Urban Charge Sustaining Emission Test.

The final reported test results for the mass particulate (M_p) in grams/mile shall be computed as follows:

$$M_p = 0.43 * \left(\frac{M_{pc}}{D_c}\right) + 0.57 * \left(\frac{M_{ph}}{D_h}\right)$$

Where:

M_{pc} = Mass of particulate determined from the cold start UDDS, in grams per vehicle mile. (See §86.110-94 for determination.)
M_{ph} = Mass of particulate determined from the hot start UDDS, in grams per vehicle mile. (See §86.110-94 for determination.)
D_c = The measured driving distance from the cold start UDDS, in miles.
D_h = The measured driving distance from the hot start UDDS, in miles.

5.6.2 Subparagraph (b). [No change.]

5.6.3 **Equivalent All-Electric Range** shall be calculated in accordance with section G.11 of these test procedures.

6. Highway Test Provisions for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

Vehicles with more than one mode of operation of the auxiliary power unit (e.g., economy mode, performance mode, etc.) for a given charge depleting or charge sustaining test cycle must be tested in the mode(s) which represents the worst case emissions of the auxiliary power unit. Confirmatory testing may also be performed in any mode of operation to ensure compliance with emission standards.

The third emission test HFEDS of the Highway Charge Sustaining Test shall be used to calculate highway NOx emissions and must be within the SOC criterion in section G.10. As an option, the manufacturer may perform the Highway Charge Sustaining Test with two emission test HFEDSs provided that the second HFEDS meets the SOC criterion in section G.10. In this case, the second HFEDS shall be used to calculate emissions.

Highway NOx emissions may be determined from the HFEDS in the Highway Charge Depleting Range Test that demonstrates charge sustaining operation.

6.1 Vehicle Preconditioning.

If the Highway Charge Depleting Range Test is performed within 36 hours after completion of either the Urban Charge Depleting Range Test or the Urban Charge Sustaining Emission Test, the vehicle shall be preconditioned pursuant to sections G.5.1.9 through G.5.1.10, without canister preconditioning. If the Highway Charge Depleting Range Test is performed more than 36 hours after completion of either the Urban Charge Depleting Range Test or the Urban Charge Sustaining Emission Test, the vehicle shall be preconditioned pursuant to section G.5.1, without canister preconditioning. Sections G.5.1.1 through G.5.1.4 may be omitted if previously performed.

If the Highway Charge Sustaining Emission Test is performed within 36 hours after completion of either the Urban Charge Depleting Range Test, the Urban Charge Sustaining Emission Test, or the Highway Charge Depleting Range Test, the vehicle shall be preconditioned pursuant to section G.5.1.9 without canister preconditioning. If the Highway Charge Sustaining Emissions Test is performed more than 36 hours after completion of either the Urban Charge Depleting Range Test, the Urban Charge Sustaining Emission Test, or the Highway Charge Depleting Range Test, the vehicle shall be preconditioned pursuant to section G.5.1 without canister precondition and vehicle charging. Sections G.5.1.1 through G.5.1.4 may be omitted if previously performed.

6.2 Highway Dynamometer Procedure for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

To be conducted pursuant to 40 CFR §600.111-08 [December 27, 2006] with the following revisions. This section G.6.2 shall apply during both charge sustaining and charge depleting operation.

6.2.1 Subparagraph (a). [n/a]

6.2.2 Amend subparagraph (b) as follows:

6.2.2.1 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. Alcohol and formaldehyde samples are collected and individually analyzed for alcohol-fueled vehicles.

6.2.2.2 Replace subparagraph (b)(6) with: Cold soak: The vehicle shall be stored at an ambient temperature not less than 68°F (20°C) and not more than 86^{o}F (30^{o}C) for 12 to 36 hours. At the end of the cold soak period, the vehicle shall be placed or pushed onto a dynamometer.

6.2.2.3 Amend subparagraph (b)(7)(i): The Highway Charge Sustaining Emission Test is conducted cold, and after charge sustaining operation has been reached, or an optional charge sustaining test mode has been activated, and no subsequent charge has been performed.

At the end of the cold soak period, the vehicle shall be placed or pushed onto a dynamometer. A cold start HFEDS followed by three emission measurement HFEDSs, separated by a 15 second key-on hot soak period, shall be performed. The vehicle must meet the SOC criterion in section G.10 for the third emission measurement HFEDS. As an option the manufacturer may perform two emission measurement HFEDSs in lieu of three emission measurement HFEDSs, if the SOC criterion is satisfied for the second emission measurement HFEDS.   If the SOC criterion is not satisfied, the test shall be stopped, and the procedure shall be repeated starting at section G.6.2.2.2.

6.2.2.4 Amend subparagraph (b)(7)(iii): One exhaust sample and one background sample per each HFEDS shall be collected and analyzed for THC (except diesel hydrocarbons which are analyzed continuously), CO, CO_2, and NO_x. Alcohol and formaldehyde samples (exhaust and dilution air) are collected and analyzed for alcohol-fueled vehicles.

6.2.2.5 Add subparagraph (b)(7)(v): For 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 vehicle to operate the auxiliary power unit for the maximum possible cumulative amount of time during the HFEDS preconditioning cycle. For vehicles that allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at the lowest level allowed by the manufacturer.

6.2.2.6 Amend subparagraph (b)(9)(v): Operate the vehicle over the continuous highway test schedule, consisting of repeated HFEDSs according to the dynamometer driving schedule specified in §600.109-08(b) [December 27, 2006]. 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.

6.2.2.7 Amend subparagraph (b)(9)(vi): When the vehicle reaches zero speed between each HFEDS, the driver has 17 seconds to prepare for the HFEDS emission measurement cycle of the test. During the idle period, one of the following conditions shall apply:

(a) For vehicles that do not allow the auxiliary power unit to be manually activated, the vehicle shall remain turned on during the idle period.

(b) For 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.

6.2.2.8 Add subparagraph (b)(9)(viii): At the conclusion of the HFEDS emission test, the following conditions shall apply: For 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 in section F.10 is satisfied. If the SOC criterion is not satisfied, then repeat the dynamometer test run from subparagraph (b)(9)(vi) and (b)(9)(vii). Up to three highway emission tests shall be allowed to satisfy the SOC criterion.

6.2.2.9 Delete subparagraph (b)(10).

6.2.3 Delete subparagraphs (c) through (e).

6.3 Determination of Highway All-Electric Range and Highway Equivalent All-Electric Range for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

6.3.1 The **Highway All-Electric Range** shall be defined as the distance that the vehicle is driven from the start of test until the internal combustion engine starts.

6.3.2 **Highway Charge Depleting Range Test.**

(i) **Vehicle preconditioning.** The vehicle shall be preconditioned pursuant to section G.6.1.

(ii) **Dynamometer run.** At the end of the cold soak period, the vehicle shall be placed or pushed, onto a dynamometer and operated through the Continuous Highway Test Schedule until the State–of-Charge Net Change Tolerances (specified in section G.10 of these test procedures) that indicate charge sustaining operation is met for one HFEDS. The Alternative Continuous Highway Test Schedule may be substituted for the Continuous Highway Test Schedule if the test facility is unable to perform the Continuous Highway Test Schedule. Refer to section G.11, for calculations of highway exhaust emissions and equivalent all-electric range, respectively. Emissions are measured for all test cycles when the auxiliary power unit is operating. For each test cycle for which emissions were not measured, the manufacturer must validate that the auxiliary power unit did not turn on at any time during the test cycle.

(iii) **Vehicle charging after testing.** Vehicle charging shall begin within three hours after the Highway Charge Depleting Range Test and the vehicle shall be charged to the manufacturer specified full state-of-charge. During charging, all applicable requirements in section G.3 must be met, and energy consumption shall be calculated according to the requirements in section G.11.7. If the manufacturer provides supplemental data demonstrating that the energy required to charge the vehicle from highway charge sustaining operation to full charge is equivalent (within ± 1% of the AC energy) to the energy required to charge the vehicle from urban charge sustaining operation to full charge, then the energy required to charge the vehicle from urban charge sustaining operation to full charge may be used to determine highway energy consumption pursuant to section G.11.7. Data shall be approved in advance by the Executive Officer of the Air Resources Board.

6.3.3 **Highway Charge Sustaining Emission Test.** The Highway Charge Sustaining Emission Test is conducted cold, and after charge sustaining operation has been reached, or an optional charge sustaining test mode has been activated, and no subsequent charge has been performed:

(i) **Vehicle preconditioning.** The vehicle shall be preconditioned pursuant to section G.6.1.

(ii) **Dynamometer run.** At the end of the cold soak period, the vehicle shall be placed or pushed onto a dynamometer. A cold start HFEDS followed by three emission measurement HFEDSs, separated by a 15 second key-on hot soak period, shall be performed. The vehicle must meet the SOC criterion in section G.10 for the third emission measurement HFEDS. As an option, the manufacturer may perform two emission measurement HFEDSs in lieu of three emission measurement HFEDSs, if the SOC criterion is satisfied for the second HFEDS. If the SOC criterion is not satisfied, the test shall be stopped, and the procedure shall be repeated starting at section G.6.3.3.

6.3.4 **Equivalent All-Electric Range** shall be calculated in accordance with section G.11 of these test procedures.

7. SFTP Emission Test Provisions for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

Vehicles with more than one mode of operation of the auxiliary power unit (e.g., economy mode, performance mode, etc.) for a given charge depleting or charge sustaining test cycle must be tested in the mode(s) which represents the worst case emissions of the auxiliary power unit. Confirmatory testing may also be performed in any mode of operation to ensure compliance with emission standards.

7.1 US06 Vehicle Preconditioning.

To be conducted pursuant to 40 CFR §86.132-00 [October 22, 1996] with the following revisions. This section G.1 shall apply during charge sustaining operation or at an optional charge sustaining test mode that has been activated, if no subsequent charge has been performed.

7.1.1 Subparagraphs (a) through (m). [No change.]

7.1.2 Amend subparagraph (n) *Aggressive Driving Test (US06) Preconditioning*. as follows:

7.1.2.1 Amend subparagraph (1) as follows: If the US06 test follows the exhaust emission urban, highway, 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. For vehicles that allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at the lowest level allowed by the manufacturer, and the auxiliary power unit shall be manually activated at the beginning of and operated throughout the US06 preconditioning cycle.

7.1.2.1.1 Subparagraphs (i) through (iv). [No change.]

7.1.2.2 Subparagraph (2). [No change.]

7.1.3 Subparagraph (o). [No change.]

7.2 US06 Emission Test.

To be conducted pursuant to 40 CFR §86.159-08 [December 27, 2006] with the following revisions. This section 7.2 shall apply during charge sustaining operation or at an optional charge sustaining test mode that has been activated, if no subsequent charge has been performed.

7.2.1 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 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 vehicles with Otto-cycle auxiliary power units, the composite samples collected in bags are analyzed for THC, CO, CO_2, CH_4 and NO_x. For vehicles with 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. The US06 cycle after the preconditioning cycle shall be used to calculate emissions and shall meet the state-of-charge net tolerances as calculated in section G.10.

7.2.2 Amend subparagraph (b) as follows.

7.2.2.1 Amend subparagraph (b)(2): Position the test vehicle on the dynamometer and restrain.

7.2.3 Subparagraph (c). [No change.]

7.2.4 Amend subparagraph (d): Practice runs over the prescribed driving schedule may be performed at test point to permit sampling system adjustment.

7.2.5 Subparagraph (e). [No change.]

7.2.6 Amend subparagraph (f) as follows.

7.2.6.1 Amend subparagraph (f)(2)(i): Immediately after completion of the 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 vehicles that do not allow the auxiliary power unit to be manually activated, the vehicle shall remain on during the idle period.

(ii) For 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.

7.2.6.2 Amend subparagraph (f)(2)(ix): At the completion of the test US06 cycle, determine if the SOC criterion in section G.10 is satisfied. If the SOC criterion is not satisfied, then repeat the dynamometer test run from subparagraph (f)(2)(i), without the preconditioning cycle. Up to three US06 emission tests shall be allowed to satisfy the SOC criterion. The idle period between multiple test cycles shall not to be less than one minute and not greater than two minutes. For the final test cycle, turn off the vehicle two seconds after the end of the last deceleration. During the idle period between multiple test cycles, one of the following conditions shall apply:

(i) For vehicles that do not allow the auxiliary power unit to be manually activated, the vehicle shall remain on during the idle period.

(ii) For 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.

7.3 SC03 Vehicle Preconditioning.

To be conducted pursuant to 40 CFR §86.132-00 [October 22, 1996] with the following revisions. This section 7.3 shall apply during charge sustaining operation or at an optional charge sustaining test mode that has been activated, if no subsequent charge has been performed.

7.3.1 Subparagraphs (a) through (n). [No change.]

7.3.2 Amend subparagraph (o): *Air Conditioning Test (SC03) Preconditioning*.

7.3.2.1 Amend subparagraph (1) as follows: If the SC03 test follows the exhaust emission urban, highway, 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. For vehicles that allow manual activation of the auxiliary power unit, battery state-of-charge shall be set at the lowest level allowed by the manufacturer, and the auxiliary power unit shall be manually activated at the beginning of and operated throughout the SC03 preconditioning cycle.

7.3.2.1.1 Subparagraphs (i) and (ii). [No change.]

7.3.2.2 Subparagraphs (2) through (3). [No change.]

7.4 SC03 Emission Test.

To be conducted pursuant to 40 CFR §86.160-00 [December 8, 2005] with the following revisions. This section 7.4 shall apply during charge sustaining operation or at an optional charge sustaining test mode that has been activated, if no subsequent charge has been performed. References to §86.162-03 shall mean §86.162-03 as adopted October 22, 1996.

7.4.1 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 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 simulate testing in an environmental test cell (see §86.162-03 (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^oF 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 vehicles with Otto-cycle auxiliary power units, the composite samples collected in bags are analyzed for THC, CO, CO_2, CH_4 and NO_x. For vehicles with 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. The SC03 cycle after the preconditioning cycle shall be used to calculate emissions and shall meet the state-of-charge net tolerances as calculated in section G.10.

7.4.2 Amend subparagraph (b) as follows.

7.4.2.1 Amend subparagraph (b)(2): Position the test vehicle on the dynamometer and restrain.

7.4.3 Amend subparagraph (c) as follows.

7.4.3.1 Amend subparagraph (c)(9): Start vehicle (with air conditioning system also running). If the auxiliary power unit of the 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.

7.4.4 Amend subparagraph (d) as follows.

7.4.4.1 Amend subparagraph (d)(10): At the conclusion of the SC03 emission test, one of the following conditions shall apply:

(i) For vehicles that do not allow the auxiliary power unit to be manually activated and are charge-sustaining over the SC03 test, record the battery state-of-charge to determine if the SOC criterion in section G.10 is satisfied. If the SOC criterion is not satisfied , then turn off the engine and the cooling fan(s), allow the vehicle to soak in the ambient conditions of paragraph (c)(5) of this section for 10 ± 1 minutes, and repeat the dynamometer test run from subparagraph (d). Up to three SC03 emission tests shall be attempted to satisfy the SOC criterion.

(ii) For vehicles that allow the auxiliary power unit to be manually activated, turn off the vehicle two seconds after the end of the last deceleration.

7.4.5 Subparagraph (e). [No change.]

7.5 Optional Cold Start US06 Range Test.

7.5.1 **Cold soak and vehicle charging.** 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 battery shall be charged to a full state-of-charge. The vehicle must be turned off during charging. Charge time shall not exceed soak time.

7.5.2 At the end of the cold soak period, the vehicle shall be placed or pushed onto a dynamometer, and shall be driven on a continuous US06 test cycle until either:

(a) the auxiliary power unit starts, or
(b) the vehicle can no longer meet the speed trace limits of the US06 driving schedule as specified in CFR 86 Appendix I to within 2 mph higher than the highest point on the trace within 1 second for the upper limit or within 2 mph lower than the lowest point on the trace within 1 second for the lower limit.

When either of these conditions is met, the test shall be ended. The range for this test, in miles, shall be the distant driven from the start of the test to when condition (a) or (b) is met. Emission sampling is not required for this test.

8. 50°F and 20°F Test Provision for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

50 °F testing shall be conducted pursuant to section ~~F~~G.5 with the modifications in Part II, Section C of the "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Year Passenger Cars, Light Duty Trucks, and Medium Duty Vehicles" and the additional following revisions.

20 $^{\circ}$F testing shall be conducted pursuant to section G.5 and shall include the temperature provisions in 40 CFR Part 86 Subpart C - Emission Regulations for 1994 and Later Model Year Gasoline-Fueled New Light-Duty Vehicles, New Light-Duty Trucks and New Medium-Duty Passenger Vehicles; Cold Temperature Test Procedures.

For 50 $^{\circ}$F and 20 $^{\circ}$F charge depleting testing, vehicle charging, prior to emissions testing, shall be performed during the soak period at 50 $^{\circ}$F and 20 $^{\circ}$F, respectively.

8.1 To satisfy test requirements for the 50°F emission test, the vehicle shall be tested in the worst case (NMOG + NOx) of the urban charge depleting range test or urban charge sustaining emission test as defined in section ~~F~~G.5. To satisfy test requirements for the 20°F emission test, the vehicle shall be tested in the worst case (CO) of the urban charge depleting range test or urban charge sustaining emission test as defined in section ~~F~~G.5. For the 20°F and 50°F emission tests, the vehicle is not required to meet SOC net tolerances.

8.2 If the worst case for emissions is charge sustaining operation, the vehicle shall be preconditioned, and one of the following two emission test options must be performed.

(i) A three phase test that includes phase one as the first 505 seconds of the UDDS, phase two as 506 seconds to the end of the UDDS, a 10 minute key-off soak period, and phase three the first 505 seconds of the UDDS. The first two phases test shall be counted as the first UDDS and the second and third phases will constitute the second UDDS. Emission weighting is as follows:

$$Y_{wm} = 0.43*\left(\frac{Y_1 + Y_2}{D_1 + D_2}\right) + 0.57*\left(\frac{Y_2 + Y_3}{D_2 + D_3}\right)$$

Where:

Y_{wm} = Weighted mass emissions of each pollutant, i.e., THC, CO, THCE, NMOG, NMHCE, CH_4, NO_x, or CO_2, in grams per vehicle mile.

Y_1 = Mass emissions as calculated from phase one of the three phase test.

Y_2 = Mass emissions as calculated from phase two of the three phase test.

Y_3 = Mass emissions as calculated from phase three of the three phase test.

D_1 = The measured driving distance from phase one of the three phase tests, in miles.

D_2 = The measured driving distance from phase two of the three phase tests, in miles.

D_3 = The measured driving distance from phase three of the three phase tests, in miles.

(ii) A two phase test that includes phase one as a UDDS, a 10 minute key-off soak period, and phase two as a UDDS. Emission weighting for the four phase test will follow the procedure outlined in section G.5.5.1.

8.3 If measurement of worst case emissions requires the urban charge depleting range test to be performed, the vehicle shall be preconditioned and fully charged. The continuous urban test schedule shall then be performed. The UDDS, in which the auxiliary power unit first starts, shall be the cold UDDS. Emissions shall be sampled according to one of the options in section G.8.2. For the three phase test option, if the auxiliary power unit starts in phase two of the UDDS, phase one emissions are considered zero for emission calculation purposes. Emissions are weighted according to section G.8.2.

9. Additional Provisions.

9.1 Confirmatory testing may be performed on all tests to establish if higher emissions occur at different states-of-charge in charge depleting mode. This is to ensure that cold start and other emissions standards are not exceeded at other operating SOCs.

9.2 Confirmatory testing may be performed on the US06 test or the manufacturer may provide data to show that potential cold start off-cycle emissions are controlled to the extent that they are controlled for the UDDS.

9.3 Confirmatory testing may be performed on vehicles equipped with an optional charge sustaining operation mode selector with selector set to simulate charge sustaining operation or in actual charge sustaining operation in accordance with section F of these test procedures.

9.4 For an example of an off-vehicle charge capable hybrid electric vehicle with all-electric range and blended operation that has charge depleting actual range and charge depleting cycle range, please see section I, Figure 1.

9.5 For an example of charge depleting to charge sustaining range with and without transitional range and end of test conditions, please see section I, Figure 2.

9.6 When determining the SOC tolerance during testing, the current drive cycle may be aborted if the SOC tolerance is met for previous drive cycle.

9.7 If the manufacturer determines there is insufficient fuel to run the subsequent test, the manufacturer may perform a fuel drain and fill or add fuel pursuant to the provisions of the “California Evaporative Emission Standards and Test Procedures for 2001 and Subsequent Model Motor Vehicles.”

10. State-of-Charge Net Change Tolerances.

10.1 For vehicles that use a battery as an energy storage device, the following state-of-charge net change tolerance shall apply:

$$(\text{Amp-hr}_{final})_{max} = (\text{Amp-hr}_{initial}) + 0.01 * \left(\frac{NHV_{fuel} * m_{fuel}}{V_{system} * K_1} \right)$$

$$(\text{Amp-hr}_{final})_{min} = (\text{Amp-hr}_{initial}) - 0.01 * \left(\frac{NHV_{fuel} * m_{fuel}}{V_{system} * K_1} \right)$$

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}	=	Open circuit voltage (OCV) that corresponds to the SOC of the target SOC during charge sustaining operation. This value shall be submitted for testing purposes, and it shall be subject to confirmation by the Air Resources Board.

An alternate state-of-charge net tolerance may be used if shown to be technically necessary and if approved in advance by the Executive Officer of the Air Resources Board.

10.2 For 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

$V^2_{initial}$ = 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

10.3 For vehicles that use an electro-mechanical flywheel as an energy storage device, the following state-of-charge net change tolerance shall apply:

$$(rpm_{final})_{max} = \sqrt{rpm^2_{initial} + 0.01 * \frac{(2 * NHV_{fuel} * m_{fuel})}{I * K_3}}$$

$$(rpm_{final})_{min} = \sqrt{rpm^2_{initial} - 0.01 * \frac{(2 * NHV_{fuel} * m_{fuel})}{I * K_3}}$$

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

$rpm^2_{initial}$ = 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, $\frac{4\pi^2}{3600\sec^2 - rpm^2}$

I = Rated moment of inertia of the flywheel, in kg-m^2

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11. Calculations – Equivalent All-Electric Range for Off-Vehicle Charge Capable Hybrid Electric Vehicles.

11.1 Charge Depleting CO_2 Produced means the cumulative tailpipe CO_2 emissions produced, M_{cd}, in grams per mile during the charge depleting cycle range.

$$M_{cd} = \Sigma Y_i$$

where:

Y_i = The sum of the CO_2 grams per mile in the charge depleting mode from each test cycle (UDDS or HFEDS)

i = Number (UDDS or HFEDS) of the test over the charge depleting cycle range, R_{cdc}

11.2 Charge Sustaining CO_2 Produced - urban means the cumulative tailpipe CO_2 emissions produced, M_{cs}, in grams per mile, during the cold start charge sustaining urban test.

$$M_{cs} = Y_c + Y_h * \left[\frac{(R_{cdcu} - D_c)}{D_c} \right]$$

where:

R_{cdcu} = Urban Charge Depleting Cycle Range, in miles

D_c = The measured driving distance from the cold start UDDS, in miles

Y_c = Grams per mile CO_2 emissions as calculated from the cold start UDDS

Y_h = Grams per mile CO_2 emissions as calculated from the hot start UDDS

11.3 Charge Sustaining CO_2 Produced - highway means the grams per mile tailpipe CO_2 emissions produced, M_{cs}, during the cold start charge sustaining highway test.

$$M_{cs} = \left(\frac{R_{cdch}}{D_h} \right) * Y_h$$

where:

R_{cdch} = Highway Charge Depleting Cycle Range, in miles

D_h = The measured driving distance from the hot start HFEDS, in miles

Y_h = Grams per mile emissions as calculated from the hot start HFEDS

11.4 Urban Equivalent All-Electric Range ($EAER_u$) shall be calculated as follows:

$$EAER_u = \left(\frac{M_{cs} - M_{cd}}{M_{cs}}\right) * R_{cdcu}$$

where:

M_{cs} is as defined in G.11.2.
M_{cd} is as defined in G.11.1, using the UDDS test cycle.

11.5 Highway Equivalent All-Electric Range ($EAER_h$) shall be calculated as follows:

$$EAER_h = \left[\frac{M_{cs} - M_{cd}}{M_{cs}}\right] * R_{cdch}$$

where:

M_{cs} is as defined in G.11.3.
M_{cd} is as defined in G.11.1, using the HFEDS test cycle.
R_{cdch} is as defined in G.11.3

11.6 Electric Range Fraction (%).

The Electric Range Fraction means fraction of the total miles driven electrically (with the engine off) for blended operation hybrid electric vehicles.

The Urban Electric Range Fraction (ERF_u) is calculated as follows:

$$ERF_u\ (\%) = \left(\frac{EAER_u}{R_{cda}}\right) * 100$$

The Highway Electric Range Fraction (ERF_h) is calculated as follows:

$$ERF_h\ (\%) = \left(\frac{EAER_h}{R_{cdah}}\right) * 100$$

11.7 Equivalent All-Electric Range Energy Consumption.

The Urban Equivalent All-Electric Range Energy Consumption ($EAEREC_u$) shall be calculated as follows:

$$EAEREC_u \text{ (wh/mi)} = \frac{E_{cd}}{EAER_u}$$

where:

E_{cd} = Total electrical energy used to fully charge the vehicle battery from an external power source after the charge depleting test has been completed. This shall be calculated for both AC and DC energy.

The Highway Equivalent All-Electric Range Energy Consumption ($EAEREC_h$) shall be calculated as follows:

$$EAEREC_h \text{ (wh/mi)} = \frac{E_{cd}}{EAER_h}$$

where:

E_{cd} = Total electrical energy used to fully charge the vehicle battery from an external power source after the charge depleting test has been completed. This shall be calculated for both AC and DC energy.

11.8 The Urban Charge Depleting Cycle Range, R_{cdcu}, (see section H for an illustration of R_{cdcu}) shall be defined as the distance traveled on the Urban Charge Depleting Procedure up to the UDDS prior to where the state-of-charge is above the lower bound state-of-charge tolerance for one test cycle given by:

$$(\text{Amp-hr}_{final})_{min} = (\text{Amp-hr}_{initial}) - 0.01 * \left(\frac{NHV_{fuel} * m_{fuel}}{V_{system} * K_1} \right)$$

Where:

$(\text{Amp-hr}_{final})_{min}$	=	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}	=	Open circuit voltage (OCV) that corresponds to the SOC of the target SOC during charge sustaining operation. This value shall be submitted for testing purposes, and it shall be subject to confirmation by the Air Resources Board.

11.9 The Charge Depleting Actual Range, R_{cda}, shall be defined as the range at which the state-of-charge is first equal to the average state-of-charge of the one or two UDDSs used to end the Urban Charge Depleting Test. This range must be reported to the nearest 0.1 miles. For an illustration of R_{cda} see section I.

11.10 The Charge Depleting to Charge Sustaining Urban Range shall be defined as the distance driven in miles from the start of the Urban Charge Depleting Test through the UDDS preceding the one or two UDDSs used to end the Urban Charge Depleting Test.

11.11 The Highway Charge Depleting Cycle Range, R_{cdch}, shall be defined as the sum of the distance traveled on the Highway Charge Depleting Test up to the HFEDS prior to where the state-of-charge is above the lower bound state-of-charge tolerance for one test cycle given by:

$$(\text{Amp-hr}_{\text{final}})_{\text{min}} = (\text{Amp-hr}_{\text{initial}}) - 0.01 * \left(\frac{NHV_{fuel} * m_{fuel}}{V_{system} * K_1} \right)$$

Where:

$(\text{Amp-hr}_{\text{final}})_{\text{min}}$	=	Minimum allowed Amp-hr stored in battery at the end of the test
$(\text{Amp-hr}_{\text{initial}})$	=	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}	=	Open circuit voltage (OCV) that corresponds to the SOC of the target SOC during charge sustaining operation. This value shall be submitted for testing purposes, and it shall be subject to confirmation by the Air Resources Board.

11.12 The Charge Depleting to Charge Sustaining Highway Range shall be defined as the distance driven in miles from the start of the Highway Charge Depleting Test through the HFEDS preceding the final HFEDS.

11.13 The Urban Equivalent All Electric Range for vehicles with an urban charge depleting actual range greater than 40 miles, $EAER_{u40}$, is determined through the following equation:

$$EAER_{u40} \text{ (miles)} = \left(\frac{ERF_u \times 40\,mi}{100} \right)$$

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12. The Calculations of the Combined Green House Gas Regulatory Rating of Off-vehicle Charge Capable Hybrid Electric Vehicles

12.1 The combined Greenhouse Gas (GHG) emissions value is determined by the following equation.

$$GHG_{PHEV,\ combined} = 0.55 * (GHG_{urban}) + 0.45 * (GHG_{highway}) \qquad \text{(Eq. 1)}$$

12.2 The urban GHG emissions value for off-vehicle charge capable hybrid electric vehicles is calculated using the following equations.

12.2.1 The urban GHG emissions value is determined by the following equation.

$$GHG_{urban} = \sum_{i=1}^{N_{urban}} (UF_i) * (\frac{Y_{CD.i}}{D_i} + GHG_{cd.AC.i}) - \sum_{i=1}^{N_{urban}} (UF_i) * G_{upstream} + (1 - \sum_{i=1}^{N_{urban}} (UF_i)) * (Y_{cs.urban})$$

(Eq. 2)

Where,

GHG_{urban}	= Rated urban GHG emissions for PHEV, in gCO_2e/mile
i	= Number of charge-depleting urban test cycle
N_{urban}	= Total number of urban test cycles in charge depleting to charge sustaining range (R_{cdtcs})
UF_i	= Utility factor for urban test cycle i
$Y_{CD.i}$	= Mass emissions of CO_2 in grams per vehicle mile, for the "i"th test in the charge depleting test
$D_{.i}$	= Distance of the "i"th urban test cycle, in miles.
$GHG_{cd.AC.i}$	= Rated GHG emissions for test cycle i, in gCO_2e/mile
$Y_{cs.urban}$	= Weighted mass emissions of CO_2 in grams/mi of the charge sustaining test.
$G_{upstream}$	= Gasoline upstream factor = $0.25 * GHG_{target}$.

12.2.2 The Charge Depleting to Charge Sustaining Range (R_{cdtcs}) is the total number of cycles driven at least partially in charge depleting mode times the cycle distance. Cycles meets charge sustaining criterion are not included in the R_{cdtcs}. The R_{cdtcs} includes the transitional cycle, where the vehicle may have operated in both depleting and sustaining modes.

12.2.3 The utility factors for urban and highway cycles are provided in the following table.

Utility factors for each PHEV drive cycle test with charge-depletion operation

Test cycle number	Test cycle utility factor	
	Urban, UF_i	Highway, UF_j
1	0.176	0.233
2	0.141	0.172
3	0.112	0.127
4	0.091	0.095
5	0.074	0.071
6	0.059	0.054
7	0.049	0.041
8	0.039	0.032
9	0.033	0.025
10	0.027	0.020
11	0.023	0.017
12	0.019	0.013

12.2.4 This charge-depleting GHG rate from electricity use in each test cycle is defined by the following equation:

$$GHG_{cd.AC.i} = GHG_{grid} * E_{cd.AC.i} \qquad \text{(Eq. 3)}$$

Where,

$GHG_{cd.AC.i}$ = Rated GHG emissions for charge-depleting PHEV, in gCO_2e/mile
$E_{cd.AC.i}$ = Urban or highway charge depleting electricity use, in kWh/mile
GHG_{grid} = Lifecycle California electricity GHG intensity, 270 gCO_2e/kWh

12.2.5 The urban or highway charge depleting electricity use is defined by the following formula:

$$E_{cd.AC.i} = \frac{E_{cd.DC.i}}{\sum_{i=1}^{N} E_{cd.DC.i}} * E_{cd.AC.total} \qquad \text{(Eq. 4)}$$

Where,

N = Total number of test cycles in the charge depleting to charge sustaining range (R_{cdtcs}) of the urban or highway charge depleting test.
$E_{cd.AC.i}$ = AC kWh consumed in the "i"th cycle of the charge depleting test.
$E_{cd.DC.i}$ = Depleted DC energy for the "i"th cycle in the charge depleting test. It is defined in section F.3.4 of these test procedures.
$E_{cd.AC.total}$ = Charge-depleting net AC energy consumption is determined according to section F.3.4 of these test procedures.

12.2.6 The $Y_{cs.urban}$, which is the weighted CO_2 mass emissions of the charge-sustaining test, is determined by the following equation, which can be found in section F.5.5 of these test procedures.

$$Y_{CS.Urban} = 0.43 * \frac{Y_C}{D_C} + 0.57 * \frac{Y_H}{D_H} \qquad \text{(Eq. 5)}$$

Where,

$Y_{CS.Urban}$ = Weighted mass emissions of CO_2 in grams/mi of the charge sustaining test.

Y_C = Mass emissions as calculated from the cold start UDDS, in grams per cycle.

Y_H = Mass emissions as calculated from the hot start UDDS, in grams per cycle.

D_C = The measured driving distance from the cold start UDDS, in miles.

D_H = The measured driving distance from the hot start UDDS, in miles.

12.3 The highway GHG emissions value for off-vehicle charge capable hybrid electric vehicles is calculated using the following equation.

$$GHG_{highway} = \sum_{j=1}^{N_{highwayn}} (UF_j\} * (\frac{Y_{CD.j}}{D_j} + GHG_{cd.AC.j}) - \sum_{j=1}^{N_{highway}} (UF_i) * G_{upstream} + (1 - \sum_{j=1}^{N_{highway}} (UF_j)) * (Y_{cs.highway})$$

(Eq. 7)

Where,

$GHG_{highway}$= Rated highway GHG emissions for PHEV, in gCO_2e/mile

j = Number of charge-depleting highway test cycle

$N_{highway}$ = Total number of highway test cycles in charge depleting to charge sustaining range (R_{cdtcs})

UF_j = Utility factor for highway test cycle j (see Table 1)

$Y_{CD.j}$ = Mass emissions of CO_2 in grams per vehicle mile, for the "j"th test in the charge depleting test

D_j = Distance of the HFEDS cycle, in miles.

$GHG_{cd.AC.j}$ = Rated GHG emissions for test cycle j, in gCO_2e/mile (see Eq. 3)

$Y_{cs.highway}$ = Mass emissions of CO_2 in grams/mi of the highway charge sustaining emission test, which can be found in section F.6.3.3 of these test procedures.

$G_{upstream}$ = Gasoline upstream factor $0.25 * GHG_{target}$

H. Off-Vehicle Charge Capable Hybrid Electric Vehicle Exhaust Emission Test Sequence.

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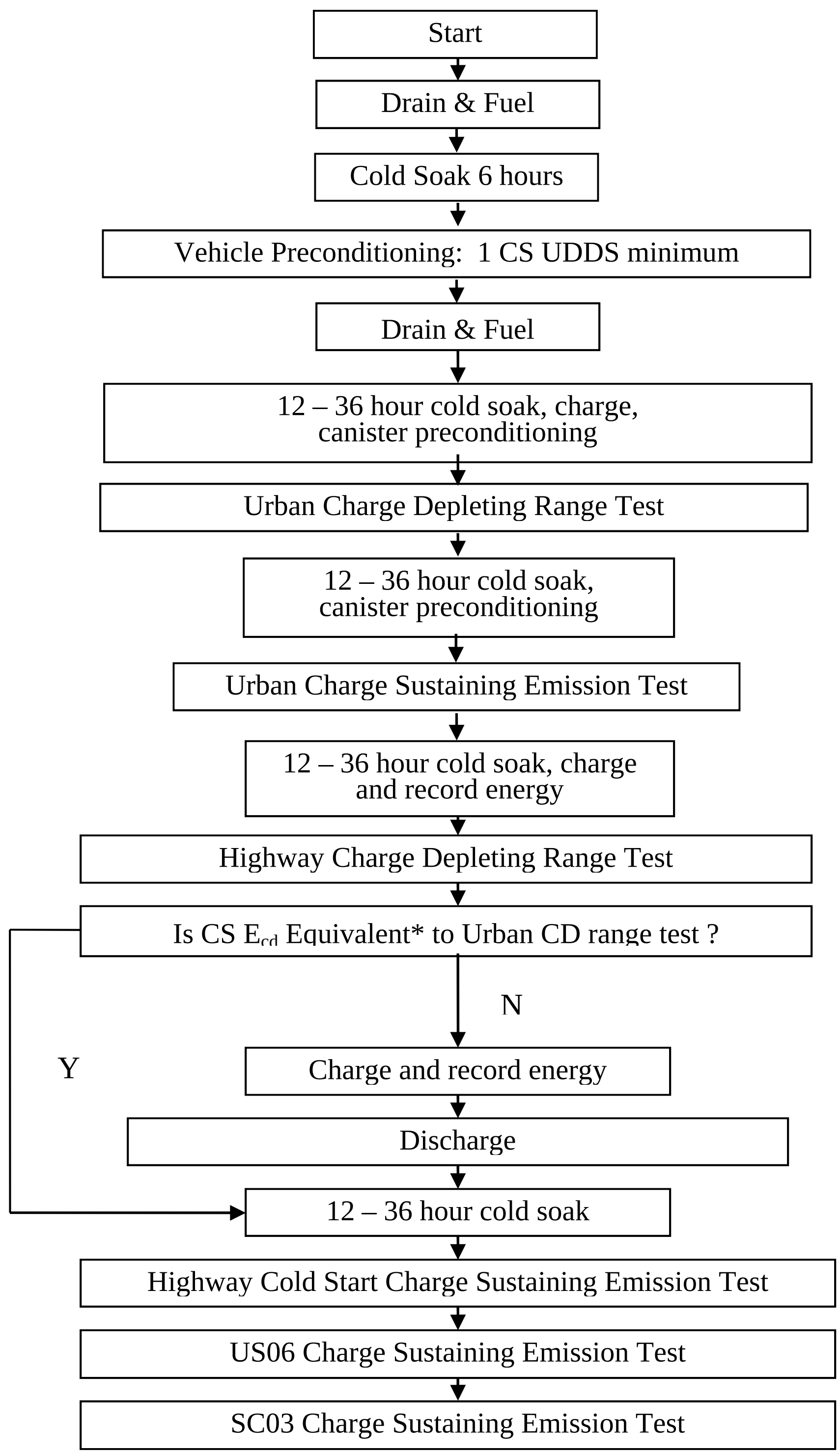
Off-Vehicle Charge Capable HEV Exhaust Emissions Test Sequence

* Equivalent to within ± 1% of AC energy used to charge battery to full state of charge



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I. Examples of Off-Vehicle Charge Capable Hybrid Electric Vehicle Terminology.

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Example of an Off-Vehicle Charge Capable HEV with AER and Blended Operation Undergoing the Urban Charge Depleting Range Test

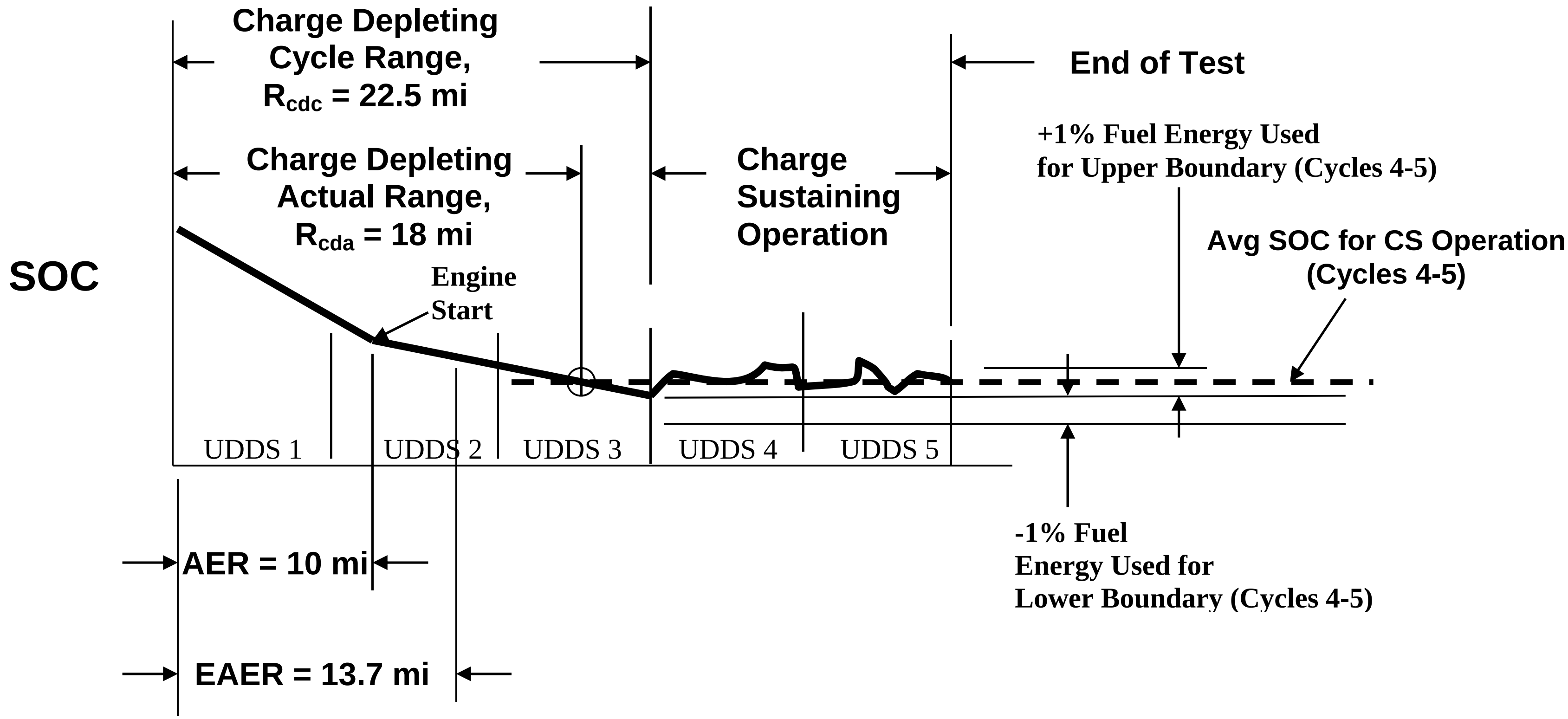

Figure 1

Attachment B-5

FINAL REGULATION ORDER

Zero Emission Vehicle Regulation: Electric Vehicle Charging Requirements

Title 13, California Code of Regulations

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Appendix A-5
FINAL REGULATION ORDER

Amend and Renumber section 1962.2, title 13, California Code of Regulation (CCR), to read as follows:

[Note: Set forth below are the 2012 amendments to the electric vehicle charging requirements. The text of the amendments is shown in underline to indicate additions and ~~strikeout~~ to indicate deletions, compared to the preexisting regulatory language.]

§ 1962.~~2.~~3. Electric Vehicle Charging Requirements

(a) *Applicability*. This section applies to (1) all battery electric vehicles, range extended battery electric vehicles, except for model year 2006 through 2013 neighborhood electric vehicles, that qualify for ~~1.0 or greater~~ ZEV credit under section 1962.1and 1962.2, ~~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 1962.1 and 1962.2 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*.

(1) Beginning with the 2006 model year, all vehicles identified in subsection (a) must be equipped with a conductive charger inlet ~~port~~ and charging system which meets all the specifications applicable to AC Level 1 and Level 2 charging contained in Society of Automotive Engineers (SAE) Surface Vehicle Recommended Practice SAE J1772 REV ~~NOV 2001~~ JAN 2010, SAE Electric Vehicle and Plug in Hybrid Electric Vehicle Conductive Charge Coupler, which is incorporated herein by reference. All such vehicles must also be equipped with an on-board charger with a minimum output of 3.3 ~~kilovolt amps.~~kilowatts, or, sufficient power to enable a complete charge in less than 4 hours.

(2) A manufacturer may apply to the Executive Officer for approval to use an alternative to the AC inlet described in subsection (c)(1), provided that the following conditions are met:

(A) each vehicle is supplied with a rigid adaptor that would enable the vehicle to meet all of the remaining system and on-board charger requirements described in subsection (c)(1); and

(B) the rigid adaptor and alternative inlet must be tested and approved by a Nationally Recognized Testing Laboratory (NRTL).

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 38562, 39002, 39003, 39667, 43000, 43009.5, 43013, 43018, 43018.5, 43100, 43101, 43101.5, 43102, 43104, 43105, 43106, 43107, 43204 and 43205.5, Health and Safety Code.

Attachment C

FINAL REGULATION ORDER

Clean Fuels Outlets

Amend sections 2300, 2302, 2303, 2303.5, 2304, 2307 2308, 2309, 2311, 2311.5, 2313, 2314, 2315, 2316 and 2318; repeal of sections 2306, 2310, 2312 and 2317; and proposed adoption of section 2306.1., title 13, California Code of Regulation (CCR), to read as follows:

[Note: Set forth below are the 2012 amendments to the Clean Fuels Program regulation. The text of the amendments as proposed during both the 45-day and 15-day comment periods is shown in underline to indicate additions and ~~strikeout~~ to indicate deletions, compared to the preexisting regulatory language.

Chapter 8. Clean Fuels Outlets ~~Program~~

§ 2300. Definitions.

(a) The following definitions apply to Chapter 8.

~~(1) "Affiliate" means any person who owns or controls, is owned or controlled by, or is under common ownership and control with, another person.~~

~~(2)~~(1) "CEC" means the State Energy Resources, Conservation and Development Commission.

~~(3)~~(2) "Clean alternative fuel" and "clean fuel" mean~~s~~ any fuel used as the certification fuel in a ~~low~~zero-emission vehicle~~, other than the primary gasoline or diesel fuel used in exhaust emission certification testing pursuant to the ARB's "California Exhaust Emission Standards and Test Procedures for 1988 Through 2000 Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles" as incorporated by reference in Title 13, California Code of Regulations, section 1960.1, or "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles" as incorporated by reference in Title 13, California Code of Regulations, section 1961~~.

~~(4) "CNG" means compressed natural gas.~~

~~(4.13)~~ (3)"Compliance year" means:
(A) regarding determinations made in calendar year 2012 pursuant to section 2303, the twelve month period from May 1, 2015, through April 30, 2016; or
(B) for all subsequent years, the twelve~~12~~ month period running from ~~May 1 through April 30.~~January 1 through December 31.

(4~~.7~~) "Dedicated clean fuel vehicle" means a ~~low~~zero-emission vehicle designed and engineered to be operated solely on a clean alternative fuel.~~, and not on gasoline or any mixture of gasoline and the clean alternative fuel.~~

(5) "Designated clean fuel" means a~~ny~~ clean alternative fuel as determined by the Executive Officer pursuant to section 2303(a).~~ other than electricity.~~
Designated clean fuel does not include electricity unless the Board concludes, based on the analysis conducted pursuant to section 2302(c), that public charging infrastructure for electric vehicles should be incorporated into this regulation.

(6) "Distribute" means to physically transfer from a production or importation facility and irrevocably release into commerce for use as a motor vehicle fuel in California.

(7) "Distributor" has the same meaning as defined in section 20999 of the Business and Professions Code.

~~(8) "Dual-fuel vehicle" means any motor vehicle that is engineered and designed to be capable of operating on gasoline, and on liquified petroleum gas, CNG or liquiefied natural gas.~~

~~(9)~~(8) "Executive ~~o~~Officer" means the ~~e~~Executive ~~o~~Officer of the Air Resources Board, or his or her designee.

~~(10)~~(9) "Fleet operator" means, for any given calendar year, the operator in that year of fifteen or more ~~low~~zero-emission vehicles that are certified on a particular designated clean fuel and that are under common ownership or operation in California.

(10~~.3~~) "Fleet vehicle" means one of fifteen or more ~~low~~zero-emission vehicles that are certified on a particular designated clean fuel and that are under common ownership or operation in California.

~~(11) "Flexible-fuel vehicle" means any alcohol-fueled motor vehicle that is engineered and designed to be operated using any gasoline-alcohol mixture or blend.~~

~~(12)~~(11) "Franchise," "franchisor," and "franchisee" have the same meaning as defined in section 20999 of the Business and Professions Code.

(12~~.1~~) “Gasoline” means finished gasoline and gasoline blendstocks.

~~(13) "Gasoline supplier" means any person, including affiliates of such person, who produces gasoline for use in California or imports gasoline into California.~~

~~(14)~~(13) "Import" means to bring motor vehicle~~-~~fuel into California for the first time for use in motor vehicles in California.

(14) “Importer” means any person who first accepts delivery of gasoline in California.

~~(15) "Liquid designated clean fuel" means any designated clean fuel that is dispensed into motor vehicles in liquid form.~~

~~(16) "Low-emission vehicle" means any vehicle certified to the transitional low-emission vehicle, low-emission vehicle, ultra-low-emission vehicle, super ultra-low emission vehicle, or zero-emission vehicle standards established in Title 13, California Code of Regulations, sections 1960.1 or 1961.~~

~~(17)~~(15) "Major breakdown" means an unforeseeable mechanical or electrical failure ~~off CNG~~ of clean fuel dispensing equipment which cannot in the exercise of reasonable diligence be repaired in 72 hours or less.

(16) “Major refiner/importer of gasoline” and “refiner/importer” mean a position holder who is also a producer of gasoline in California or importer of gasoline into California, and their total gasoline production and imports amounts to 500 million gallons or more for the calendar year, as determined from State Board of Equalization Motor Vehicle Fuel Distribution Reports used by the Board of Equalization to assess motor vehicle fuel taxes at the terminal rack.

(17) “Market share” is the value that represents the percent of gasoline production and imports made by a major refiner/importer of gasoline as determined pursuant to section 2306.1.

~~(19)~~(18) "Minor breakdown" means an unforeseeable mechanical or electrical failure of clean fuel~~CNG~~ dispensing equipment which can in the exercise of reasonable diligence be repaired in 72 hours or less.

~~(20)~~(19) "Non-retail facility" means any establishment at which a designated clean fuel is supplied or offered for supply to motor vehicles, but is not supplied or offered to the general public.

~~(21) "Owner/lessor" means:~~
~~(A) In the case of a retail gasoline outlet which is owned, leased or controlled by a franchisor, and which the franchisee is authorized or permitted, under the franchise, to employ in connection with the sale of gasoline, the franchisor.~~

~~(B) In the case of a retail gasoline outlet which is owned, leased or controlled by a refiner or a distributor, and is operated by the refiner or distributor or his agent, the refiner or distributor.~~

~~(C) In the case of all other retail gasoline outlets, the owner of the retail gasoline outlet.~~

(20) “Position holder” (per section 7332 of the Revenue and Taxation Code) includes any person that holds the inventory position in the motor vehicle fuel, as reflected on the records of the terminal operator. A person holds the inventory position in motor vehicle fuel when that person has a contractual agreement with the terminal operator for the use of storage facilities and terminaling services at a terminal with respect to the motor vehicle fuel. "Position holder" includes a terminal operator that owns motor vehicle fuel in its terminal.

~~(22) "Primary designated clean fuel" means a designated clean fuel for which a substitute fuel has been proposed or designated pursuant to section 2317.~~

~~(23) "Produce" means, in the case of any liquid motor vehicle fuel, to convert in California liquid compounds which do not constitute the fuel into the fuel.~~

(21) “Producer” means the person who owns the fuel when it is supplied from the facility at which it was produced.

~~(24)~~(22) "Quarter" means the three month calendar quarters January-March, April-June, July-September, and October-December.

(23) “Rack” means a mechanism for delivering motor vehicle fuel from a refinery or terminal into a truck, trailer, railroad car, or other means of non bulk transfer.

~~(25)~~(24) "Refiner" has the same meaning as defined in section 20999 of the Business and Professions Code.

~~(26) "Refinery" means a facility that produces gasoline by means that include distilling petroleum.~~

~~(27)~~(25) "Selected retail clean fuel outlet" means a specific retail clean fuel outlet which is equipped to store and dispense a designated clean fuel in order to comply with section 2302.

~~(28)~~(26) "Retail clean fuel outlet" means an establishment which is equipped to dispense a designated clean fuel to motor vehicles and at which the designated clean fuel is sold or offered for sale to the general public for use in motor vehicles without the required use of a key or card key and without the need to establish an account.

~~(29)~~(27)"Retail gasoline outlet" means any establishment at which gasoline is sold or offered for sale to the general public for use in motor vehicles.

(28) “Terminal” means a motor vehicle fuel storage and distribution facility that is supplied by pipeline or vessel, and from which motor vehicle fuel may be removed at a rack. “Terminal” includes a fuel production facility where motor vehicle fuel is produced and stored and from which motor vehicle fuel may be removed at a rack.

~~(31) "Vehicle conversion" means a modification of a gasoline or diesel fueled vehicle, not certified to a low-emission vehicle standard, to a vehicle which uses a designated clean fuel and which is capable of meeting low-emission vehicle exhaust emissions standards as demonstrated either by installation of an ARB-approved conversion system that achieves such low-emission standards or by individual vehicle testing~~

(29) “Zero emission vehicle” and “ZEV” mean a vehicle that produces zero exhaust emissions of any criteria pollutant (or precursor pollutant) under any and all possible operational modes and conditions.

NOTE: Authority cited: Sections 39600, 39601, 39667, 43013, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975). Reference: Sections 39000, 39001, 39002, 39003, 39500, 39515, 39516, 39667, 43000, 43013, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975).

§ 2302. Equipping Retail Gasoline Outlets or Other Outlets to Dispense Designated Clean Fuels.

(a) ~~Any~~ Each major refiner/importer of gasoline ~~person who is the owner/lessor of an operating retail gasoline outlet~~ shall, for each designated clean fuel, establish ~~equip~~ at least the required minimum number for each compliance year, as determined in accordance with section 2307(d), of ~~his or her retail gasoline outlets in the state, or of other outlets in the state, so that the outlets are~~ retail clean fuel outlets for the designated clean fuel. The required minimum number of retail clean fuel outlets for each compliance year shall apply to the entire compliance year. The requirements of this section shall apply at all times during which a refiner/importer meets the definition of a “major refiner/importer of gasoline” in section 2300(a). ~~person is an owner/lessor of an operating retail gasoline outlet. The requirements of this section shall in any case be deemed satisfied with regard to a designated clean fuel if all of the owner/lessor's operating retail gasoline outlets are equipped as retail outlets for the designated clean fuel.~~

(b) In the case of any designated clean fuel which is in gaseous form, the dispensing equipment required by this section shall be designed ~~for a minimum of four hours of high volume operation per day.~~to satisfy the following minimum criteria:

(1) Dispense gaseous fuel upon request to bring on-board vehicle storage tanks to a full (at least 95 percent) state of charge and be able to fill a seven (7) kilogram on-board storage tank in seven (7) minutes or less;

(2) For gaseous hydrogen, satisfy the fueling protocols specified in the Society of Automotive Engineers standard J2601,“Fueling Protocols for Light Duty Gaseous Hydrogen Surface Vehicles”; and

(3) Satisfy the requirements for selected retail clean fuel outlets set forth in section 2309(b).

~~For all retail gasoline outlets or other that are claimed by the owner/lessor to be equipped in order to satisfy the requirements of this section, the owner/lessor shall notify the operator in writing that the outlet is so equipped.~~

(c) In the case of electricity used for transportation, the Board shall, within two calendar years following the adoption of these regulatory amendments, determine if requirements for electricity used for transportation and vehicle charging infrastructure for full-function battery electric vehicles and plug-in hybrid electric vehicles should be incorporated into this regulation based on the following:

(1) An evaluation of the development and usage of workplace and public charging infrastructure to determine:

(A) how pricing affects customer charging preferences in terms of frequency of use of home, workplace and public chargers;

(B) how incentives, such as free charging, free parking, preferential parking, and other factors, affect the use of workplace and public chargers;

(C) the level of current and future private market investment in public charging infrastructure;

(D) whether additional public charging infrastructure will increase [i] electric vehicle miles traveled by electric vehicles and plug-in hybrids, or [ii] the sale of battery electric vehicles and plug-in hybrid vehicles, and to what extent; and

(E) the potential environmental impact of increased daytime charging at public charging stations especially during peak electricity demand periods.

(2) If the evaluation conducted pursuant to section 2302(c)(1) concludes that additional public charging infrastructure is needed, public charging locations and types of chargers will be assessed to determine which combinations of locations and charger types (i.e., Level 2 or DC fast chargers) have the highest likelihood of use by plug-in electric vehicles drivers. This assessment will include detailed discussion of environmental and economic impacts and benefits associated with the different public charging scenarios.

(3) A report summarizing the results of the assessment and assessment conducted pursuant to 2302(c)(1) and (2) will be completed and include:

(A) recommendations for locations and types of additional public chargers;

(B) environmental and economic impacts associated with the installation, operation, maintenance and use of recommended public chargers;

(C) interaction with other ARB regulations pertaining to emissions of greenhouse gases, criteria pollutants, and toxic air contaminants; and

(D) next steps including but not limited to recommendations for whether a charging infrastructure mandate is warranted, and if so, timeline for a regulatory proposal.

NOTE: Authority cited: Sections 39600, 39601, 39667, 43013, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975). Reference: Sections 39000, 39001, 39002, 39003, 39500, 39515, 39516, 39667, 43000, 43013, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975).

§ 2303. Determination of Total Projected Maximum Volumes of Designated Clean Fuels.

The ~~e~~Executive ~~o~~Officer shall determine the total projected maximum volume of each designated clean fuel for each compliance year, at least ~~fourteen~~ twenty-eight months before the start of the compliance year, in accordance with this section.

(a) *Identification of designated clean fuels*.
The Executive Officer shall determine which clean alternative fuels are designated as clean fuels. The ~~e~~Executive ~~o~~Officer shall determine ~~what~~which designated clean fuels are expected to be used as the certification fuel in zero~~low~~ emission vehicles in the compliance year. This determination shall be based on registration records of the Department of Motor Vehicles and projected production estimates submitted by motor vehicle manufacturers to the ~~e~~Executive ~~o~~Officer pursuant to ~~the "California Exhaust Emission Standards and Test Procedures for 1988 Through 2000 Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles" as incorporated by reference in Title 13, California Code of Regulations, section 1960.1,and~~the “California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles,” as incorporated by reference in Title 13, California Code of Regulations, section 1961, and the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles," as incorporated by reference in Title 13, California Code of Regulations, section 1961.2.

(b) *Estimation of number of designated clean fuel vehicles*.

(1) For each designated clean fuel identified pursuant to section 2303(a), the ~~e~~Executive ~~o~~Officer shall make an estimate of the number of ~~low~~zero-emission vehicles certified on the fuel for each calendar year. The estimate shall be the sum of:

[i] the number of ~~low~~zero-emission vehicles certified on the fuel that vehicle manufacturers have projected to be produced in the corresponding model year

for which calculations are being made and the two prior model years for sale in California;

[ii] for determinations made in calendar year 2012, one-sixth of the number of model year 2012 zero-emission vehicles certified on the fuel that vehicle manufacturers project to produce. For determinations made in calendar year 2013 and later, one~~-sixth~~ third of the number of ~~low~~zero-emission vehicles certified on the fuel that vehicle manufacturers project to produce for the model year that is three~~two~~ years prior to the compliance year for which the calculations are being made; and

[iii] for determinations made in calendar year 2012, the number of zero-emission vehicles certified on the fuel that are registered with the Department of Motor Vehicles through August 31, 2012. For determinations made in calendar 2013 and later, the number of ~~low~~zero-emission vehicles certified on the fuel that are registered with the Department of Motor Vehicles through May 31~~July 30~~ of the year ~~two~~ three years prior to the compliance year for which the estimates are being made.

(2) The vehicle manufacturers' projections used for the estimates made under this section 2303(b) shall be the reports of projected production data air basin-specific vehicle deployment plans submitted by motor vehicle manufacturers to the ~~e~~Executive ~~o~~Officer pursuant to the ~~"California Exhaust Emission Standards and Test Procedures for 1988 Through 2000 Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles" as incorporated by reference in Title 13, California Code of Regulations, section 1960.1, or~~ "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles" as incorporated by reference in Title 13, California Code of Regulations, section 1961, or the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles" as incorporated by reference in Title 13, California Code of Regulations, section 1961.2.

(c) *Determination of total projected maximum volumes of designated clean fuel*. Total projected maximum volume (TPMV) calculations detailed in this section shall be performed for designated clean fuel vehicles projected to be placed within the boundaries of an air basin when the trigger level requirement for that air basin is met pursuant to 2303.5(a). TPMV calculations shall be performed considering designated clean fuel vehicles projected to be placed anywhere in California when the statewide trigger level requirement is met pursuant to 2303.5(a). ~~For each designated clean fuel identified pursuant to section 2303(a), the executive officer shall estimate the total projected maximum volume (TPMV) of the designated clean fuel for the year.~~ The ~~total projected maximum volume~~TPMV for each designated clean fuel shall be the sum of the maximum demand volumes (MXDV) calculated by model year and vehicle class (passenger car, light-duty truck, or medium-duty vehicle). The following equation shall be used to calculate total projected maximum volumes for an air basin and statewide:

$$TPMV = \sum_{\text{Model year (y)}} \left[\sum_{\text{vehicle class (i)}} MXDV\ (\text{vehicle class } i, \text{ model year } y) \right]$$

Where:

TPMV is the total projected maximum volume (gasoline equivalent gallons per year for a liquid fuel and ~~therms~~kilograms per year for a gaseous fuel) for a particular clean fuel.

MXDV is the maximum demand volume for a particular clean fuel within vehicle class *i* and model year *y* as calculated below.~~in the next paragraph of text.~~

Model year y is, in turn, each vehicle model year since and including ~~1994~~2000.

Vehicle class i is, in turn, each of three classes of vehicles: passenger cars (PC), light-duty trucks (LDT) or medium-duty vehicles (MDV).

Maximum demand volume for a designated clean fuel (for a given model year and vehicle class within an air basin or statewide) shall equal the number of vehicles (as determined in section 2303(b)) in a particular vehicle class certified on a particular fuel, multiplied by the average miles travelled per year per vehicle by those vehicles, divided by the average fuel economy of those vehicles.

The following equation shall be used to calculate ~~maximum demand volumes~~MXDVs:

$$MXDV\ (\text{vehicle class i, model year y}) = \frac{\textit{(number of vehicles certified on fuel) x (AMT per vehicle)}}{\textit{(average fuel economy)}}$$

Where:

MXDV is the maximum demand volume (gasoline equivalent gallons per year for a liquid fuel and ~~therms~~kilograms per year for a gaseous fuel) for a particular clean fuel within vehicle class *i* and model year *y*.

Vehicle class i is one of three possible classes of vehicles--passenger cars (PC), light-duty trucks (LDT) or medium-duty vehicles (MDV).

Model year y is, in turn, each vehicle model year since and including ~~1994~~2000.

Number of vehicles certified on fuel shall be determined pursuant to section 2303(b), and shall be calculated separately for vehicles of the same model year and vehicle class (PC, LDT, MDV).

AMT per vehicle is the average vehicle miles traveled per year per ~~low~~zero-emission vehicle, based on annual mileage accrual rates for motor vehicles for a specific model year and vehicle class derived from the current version of the ARB's EMFAC emission inventory model and other reasonably available relevant information.

Average fuel economy represents the estimated fuel economy in miles per gasoline equivalent gallon (mpg) (or miles per ~~therm~~kilogram in the case of gaseous fuels) of ~~low~~zero-emission vehicles of the same model year and vehicle class. The average fuel economy estimates shall be determined by the ~~e~~Executive ~~o~~Officer based on the fuel economy estimates provided by the vehicle manufacturers pursuant to the ~~"California Exhaust Emission Standards and Test Procedures for 1988 Through 2000 Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles" and the~~ "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles," and the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles," which are incorporated by reference in Title 13, California Code of Regulations, sections ~~1960.1 and~~ 1961 and 1961.2, and on other reasonably available relevant information.

(d) [RESERVED] ~~*Characterization of certain dual-fuel or flexible-fuel vehicles.* Any dual-fuel or flexible-fuel vehicle which is certified to meet, while operated on gasoline or diesel fuel, low-emission vehicle standards at least as stringent as the most stringent low-emission vehicle standards to which the vehicle is certified while operated on a fuel other than gasoline shall not be included in the determination pursuant to section 2303(b) of the number of low-emission vehicles certified on a designated clean fuel.~~

NOTE: Authority cited: Sections 39600, 39601, 39667, 43013, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975). Reference: Sections 39000, 39001, 39002, 39003, 39500, 39515, 39516, 39667, 43000, 43013, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975).

§ 2303.5. Identification of Designated Clean Fuels Projected to Reach the Trigger Level In a Particular Year.

(a) *The trigger level requirement.*

(1) *Number of designated clean fuel vehicles necessary to trigger a retail clean fuel outlet requirement.* There shall be no retail clean fuel outlets for a designated clean fuel required in a compliance year unless the ~~statewide~~ number of ~~low~~zero-emission vehicles projected by the ~~e~~Executive ~~o~~Officer for that fuel in accordance with section 2303(b) is 10,000 or greater within the boundaries of an air basin and 20,000 or greater statewide, after discounting the number of fleet vehicles by 75 percent or a smaller discount factor determined in accordance with section 2303.5(a)(2).

(2) *Reducing the discount factor for fleet vehicles.* The discount factor for fleet vehicles is intended to reflect the approximate percentage of clean fuel that will be dispensed to the fleet vehicles from facilities other than retail clean fuel outlets in the compliance year for which the trigger determination is being made. If the ~~e~~Executive ~~o~~Officer determines, based on the reports filed pursuant to section 2313 and on any other relevant reasonably available information, that a specified lower percentage of the clean fuel dispensed to the fleet vehicles will likely be dispensed from facilities other than retail clean fuel outlets, the ~~e~~Executive ~~o~~Officer shall discount the number of fleet vehicles by that specified lower percentage.

(b) *Yearly projections regarding the trigger level.*
For each compliance year, the ~~e~~Executive ~~o~~Officer shall identify any designated clean fuel(s) he or she projects will for the first time be the fuel for a sufficient number of ~~low~~zero-emission vehicles to reach the trigger level set forth in section 2303.5(a). At least ~~sixteen~~ thirty-one months before the start of the compliance year, the ~~e~~Executive ~~o~~Officer shall notify interested parties of the fuel or fuels identified, and shall make available a summary of the information and analysis relied upon, including the fleet discount factor applied. The notification shall also identify any other designated clean fuel that the ~~e~~Executive ~~o~~Officer projects will miss the trigger level by no more than 30 percent, with the information and analysis relied upon being made available. The notice shall be provided to trade associations representing gasoline refiners, distributors and retailers, representative environmental groups, and any person who has requested in writing to receive such notices.

(c) *Requests to revise trigger level projections.*
Any interested party may request in writing that the ~~e~~Executive ~~o~~Officer revise the trigger determination or fleet discount factor for any designated clean fuel, and may submit any relevant information supporting a revised determination. In order to be considered by the ~~e~~Executive ~~o~~Officer, the written request and supporting information must be received no more than 30 days after issuance of the notice. The ~~e~~Executive ~~o~~Officer shall consider any requests that are ~~timely~~ submitted in a timely manner, and shall issue his or her final trigger determination and fleet discount factor no less than ~~fourteen~~ twenty-nine months before the start of the compliance year in question.

NOTE: Authority cited: Sections 39600, 39601, 39667, 43013, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975). Reference: Sections 39000, 39001, 39002, 39003, 39500, 39515, 39516, 39667, 43000, 43013, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975).

§ 2304. Determination of Total and Additional Number of Retail Clean Fuel Outlets Required for Each Designated Clean Fuel in Each Year.

The ~~e~~Executive ~~o~~Officer shall, for each designated clean fuel, determine the total number of retail clean fuel outlets required for each compliance year, and the total number of additional retail clean fuel outlets required for the first time in the compliance year, in accordance with this section. The Executive Officer shall make these determinations for an air basin when the trigger level requirement for that air basin is met pursuant to 2303.5(a), and for the state when the statewide trigger level requirement is met pursuant to 2303.5(a). The ~~e~~Executive ~~o~~Officer shall make the determinations at least ~~fourteen~~ twenty months before the start of the compliance year.

(a) *Determination of total number of retail clean fuel outlets required for each designated clean fuel in each year*.
The ~~e~~Executive ~~o~~Officer shall determine for each designated clean fuel the total number of retail clean fuel outlets that shall be required for that designated fuel in each compliance year, ~~calculated as follows~~using the following formula:

(1) *Formula for calculating required number of clean fuel outlets*.
Except as otherwise provided in this section 2304(a), the total number of clean fuel outlets that shall be required for each designated clean fuel for each compliance year shall be calculated as follows:

$$\text{Required Clean Fuel Outlets} = \frac{\text{Total Projected Maximum Clean Fuel Volume} - \text{Discounted Clean Fuel Volume for Fleet Vehicles} \;\cancel{+\ \text{Total Clean Fuel Volume From Vehicle Conversions}}}{\text{Clean Fuel Throughput Volume per Station}}$$

Where:

Total Projected Maximum Clean Fuel Volume shall be determined in accordance with the procedures set forth in section 2303(c).

Discounted Clean Fuel Volume for Fleet Vehicles means the total volume of the designated clean fuel (adjusted to gasoline volumes on an energy equivalent basis for liquid fuels) estimated to be used in fleet vehicles during the compliance year, multiplied by the discount factor determined pursuant to section 2303.5(a) for the designated clean fuel for the compliance year in which the retail clean fuel outlet trigger was reached. This figure shall be determined by the ~~e~~Executive ~~o~~Officer using the methodology in section 2303(c), the reports filed pursuant to section 2313 and any other relevant reasonably available information.

~~*Total Clean Fuel Volume from Vehicle Conversions* means the total amount of the designated clean fuel (adjusted to gasoline volumes on an energy equivalent basis) for each vehicle class from conversions. This figure shall be determined by the executive officer based on information provided by the Department of Motor Vehicles and on any other relevant reasonably available information.~~

Clean Fuel Throughput Volume Per Station ~~for liquid fuel~~ shall be 300,000 gasoline equivalent gallons per year for ~~each~~ liquid designated clean fuel and 146,000 kilograms per year for hydrogen. ~~, except that once more than five percent of all retail gasoline outlets are required to be equipped to dispense a particular liquid clean fuel, the clean fuel throughput volume per station shall be 600,000 gasoline equivalent gallons for purposes of calculating the number of required retail clean fuel outlets in excess of five percent of all retail gasoline outlets. For gaseous fuel, the clean fuel throughput volume per station shall be 400,000 therms per year.~~

(2) *~~e~~Executive ~~o~~Officer adjustments to the number of required retail clean fuel outlets*.

(A) [RESERVED] ~~*Reducing projected clean fuel volume to reflect the volume of gasoline used in dual-fuel or flexible-fuel vehicles*. For each year, the executive officer shall determine for each designated clean fuel the percentage of the low-emission vehicles identified for the year pursuant to section 2303(b) that will be dual-fuel or flexible-fuel vehicles. The executive officer shall further determine the approximate percentage of the fuel used during the year in these dual-fuel or flexible-fuel vehicles that will be gasoline rather than the designated clean fuel and multiply that percentage by 0.85. The executive officer shall then discount the "Total Projected Maximum Clean Fuel Volume" attributed to these vehicles in the section 2304(a)(1) equation by the adjusted percentage. The determinations are to be based on the information sources identified in section 2303(a) and on any other relevant reasonably available information.~~

(B) Change to the discount for fleet vehicles. If the ~~e~~Executive ~~o~~Officer determines pursuant to section 2303.5(a)(2) that the discount factor applied to the calculation of the Clean Fuel Volume for Fleet Vehicles in the equation in section 2304(a)(1) does not accurately reflect the approximate percentage of clean fuel that will be dispensed to the fleet vehicles from facilities other than retail clean fuel outlets projected ~~18~~thirty-one months from the start of the compliance year for which the number of required clean fuel outlets is being determined, he or she shall revise the discount factor so that it is an accurate reflection of that percentage. The determination shall be based on reports filed

pursuant to section 2313 and on any other relevant reasonably available information.

(C) *Reducing the number of required retail clean fuel outlets to reflect certain preexisting outlets*.

1. For each compliance year, the ~~e~~Executive ~~o~~Officer shall determine for each designated clean fuel the number of retail clean fuel outlets that [i] are owned or leased by persons who are not ~~owners/lessors of any retail gasoline outlets~~major refiner/importers of gasoline, [ii] have a design capacity as set forth in section 2302(b) where applicable, [iii] satisfy the provisions of section 2309(b), and [iv] certify that they will~~are~~ operate~~ing~~ throughout the compliance year ~~as of fifteen months before the start of the year~~ for which the determination is being made.

2. For each compliance year, the ~~e~~Executive ~~o~~Officer shall reduce the total number of required clean fuel outlets required for each designated clean fuel, as determined pursuant to sections 2304(a)(1)~~, (a)(2)(A)~~ and (a)(2)(B) by the number of retail clean fuel outlets determined in accordance with section 2304(a)(2)(C)1.~~.~~ The ~~e~~Executive ~~o~~Officer shall notify the ~~owner/lessor~~refiner/importer responsible for ~~of~~ each retail clean fuel outlet included in the determinations made pursuant to this section 2304(a)(2), and no such outlet may be constructively allocated pursuant to section 2308.

3. If the terms of a Memorandum of Agreement (MOA) regarding hydrogen clean fuel outlets contain the elements specified below in Sections 2304(a)(2)(C)3 (i – v), and if the MOA has been signed by the regulated parties themselves (refiners/importers and automobile manufacturers) or an authorized representative, then the required number of hydrogen retail clean fuel outlets under this section shall be zero and shall remain zero until such time that the specified elements are no longer met. All other aspects of this Chapter 8 remain in full effect. The required elements to be included in the signed MOA are:

(i) Establish overarching Goal of achieving 100 operating hydrogen retail clean fuel outlets meeting specifications and performance criteria described in Section 2302(b) and Section 2309(b);

(ii) Secure public and voluntary private funding to support installation and operation of hydrogen clean fuel outlets;

(iii) Establish specific timeline and milestones by which progress and success or failure is measured;

(iv) Assign roles and responsibilities that ensure parties will contribute toward meeting the milestones established above; and

(v) Establish feedback and reporting mechanisms that ensure parties to the MOA are accountable to the terms of the MOA, and that information regarding progress in meeting the terms of the MOA is publically available.

Whenever it is determined that an element of the signed MOA is no longer met, the signers of the MOA shall first be given written notice and thirty days to satisfy the element in question. If the element of the MOA in question is not satisfied within thirty days of the notice, CARB shall then provide written notice to the signers, regulated refiners/importers, and the public that the provisions of Section 2304(a)(2)(C)3 no longer apply. This written notice shall specify the refiner/importer's required minimum number of hydrogen clean fuel outlets to be established no more than twenty eight months after the date of the notice.

(D) *Notification regarding any adjustments*. If the ~~e~~Executive ~~o~~Officer makes an adjustment pursuant to section 2304(a)(2)~~(A),~~ (B) or (C) for a given compliance year, he or she shall notify interested parties of the adjustment and the underlying basis for the adjustment, at least twenty-eight~~fourteen~~ months before the start of the compliance year. The notice shall be provided to trade associations representing gasoline refiners, distributors and retailers, representative environmental groups, and any person who has requested in writing to receive such notices.

(E) *Requests to revise the ~~e~~Executive ~~o~~Officer 's adjustments*. Any interested party may request in writing that the ~~e~~Executive ~~o~~Officer revise the adjustments, and may submit any relevant information supporting revised determinations. In order to be considered by the ~~e~~Executive ~~o~~Officer, the written request and supporting information must be received no more than ~~30~~thirty days after issuance of the notice. The ~~e~~Executive ~~o~~Officer shall consider any requests that are timely submitted, and shall issue his or her final determinations no less than twenty-six~~twelve~~ months before the start of the compliance year in question. At the same time, the ~~e~~Executive ~~o~~Officer shall make any resulting modifications to the determinations and notifications made pursuant to sections 2304(b), 2306.1 and 2307.

(F) *Adjusting the required number of outlets based on updated auto manufacturer reports*. Twenty months before the start of the year in question, the Executive Officer may adjust the final number of required outlets. The basis for this adjustment will be the projected production estimates submitted annually by the motor vehicle manufacturers to the Executive Officer twenty one months prior to the year in question. If an adjustment pursuant to this subdivision is deemed necessary, the Executive Officer will notify interested parties within thirty days of that determination.

(b) *Determination of total number of additional clean fuel outlets required each year for each designated clean fuel*.
For each year, the ~~e~~Executive ~~o~~Officer shall determine, for each designated clean fuel, the total number of additional retail clean fuel outlets required for the first time to be in place in that compliance year. This figure shall be determined by subtracting the total number of required retail clean fuel outlets determined in accordance with section 2304(a) for the previous compliance year~~, from the total number of required clean fuel outlets determined in accordance with 2304(a) for the previous year~~, from the total number of required clean fuel outlets determined in accordance with 2304(a) for the compliance year for which the calculations are being made.

NOTE: Authority cited: Sections 39600, 39601, 39667, 43013, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975). Reference: Sections 39000, 39001, 39002, 39003, 39500, 39515, 39516, 39667, 43000, 43013, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975).

§ 2306. ~~Identification of Affected Owner/Lessors Required to Equip Additional Retail Clean Fuel Outlets Each Year.~~

~~For each year, at least fourteen months before the start of the year, the executive officer shall identify for each designated clean fuel the affected retail gasoline outlet owner/lessors who will be required to equip retail gasoline outlets or other retail outlets to dispense that fuel. An affected station owner/lessor is any person who is the owner/lessor of a number of retail gasoline outlets equal to or greater than the minimum ownership level (MOL) for the year, calculated as follows:~~

~~MinimumOwnership Level (MOL) =~~

~~Number of Non-Clean Fuel Retail Outlets……………..~~

~~Sum of the Numbers of Additional Retail Clean Fuel Outlets for All Designated Clean Fuels~~

~~Where:~~

~~*Number of Non-Clean Fuel Retail Outlets* is calculated by subtracting the sum of the required retail clean fuel outlets determined in accordance with section 2304(a) for all designated clean fuels for the previous year, from the total number of retail gasoline outlets statewide estimated by the executive officer based on the reports submitted pursuant to section 2312 and other reasonably available relevant information.~~

~~*Sum of the Numbers of Additional Retail Clean Fuel Outlets for All Designated Clean Fuels* is the sum of the total additional number of clean fuel outlets calculated for the year for each designated clean fuel in accordance with section 2304(b).~~

~~The executive officer shall round the result of the calculation for minimum ownership level to the nearest integer.~~

~~NOTE: Authority cited: Sections 39600, 39601, 39667, 43013, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975). Reference: Sections 39000, 39001, 39002, 39003, 39500, 39515, 39516, 39667, 43000, 43013, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975).~~

§ 2306.1. Determination of Market Share for Each Major Refiner/Importer of Gasoline

For each year, at least twenty-nine months before the start of the compliance year, the Executive Officer shall calculate each refiner/importer of gasoline's market share expressed in percent as follows:

Market share$_i$ = *Production and imports of major refiner/importer of gasoline$_i$*
Sum of gasoline production and imports

Where: P*roduction and imports of major refiner/importer of gasoline$_i$* equals the total gallons of gasoline recorded in the State Board of Equalization's Motor Vehicle Fuel Distribution reports for refiner/importer *i* for the two most recent consecutive calendar years for which complete reports are available.

Sum of gasoline production and imports equals the total gallons of gasoline recorded in the State Board of Equalization's Motor Vehicle Fuel Distribution reports for all of the major refiner/importers of gasoline for the two most recent consecutive calendar years for which complete reports are available.

NOTE: Authority cited: Sections 39600, 39601, 39667, 43013, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975). Reference: Sections 39000, 39001, 39002, 39003, 39500, 39515, 39516, 39667, 43000, 43013, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975).

§ 2307. Allocation Among ~~Affected Owner/Lessors~~ Major Refiner/Importers of Gasoline of the Total Number of Retail Clean Fuel Outlets.

For each year, the ~~e~~Executive ~~o~~Officer shall, for each designated clean fuel, make the determinations set forth in this section.

(a) *Allocation among affected ~~owner/lessors~~major refiner/importer of gasoline of the number of additional retail clean fuel outlets for each year*.
For each compliance year, the ~~e~~Executive ~~o~~Officer shall determine the number of additional retail clean fuel outlets that each major refiner/importer of gasoline ~~affected owner/lessor of retail gasoline outlets~~ is required for the first time to have in place~~ in the state~~. This number shall be calculated, for each designated clean fuel, by multiplying the ~~owner/lessor's~~refiner/importer's market share ~~number of non-clean fuel retail gasoline outlets~~ (determined in accordance with section 2306.1~~52307(b)~~) by the ~~clean fuel fraction~~number of new clean fuel outlets (determined in accordance with section 2304(b)~~7(c)~~), rounded to the nearest integer using conventional rounding. If the resulting number is less than 0.5~~zero~~, the number shall be adjusted to zero.

(b) [RESERVED] ~~*Determination of an owner/lessor's number of non-clean fuel retail gasoline outlets.*~~

~~The executive officer shall determine an owner/lessor's number of non-clean fuel retail gasoline outlets by subtracting the sum of the owner/lessor' s total required minimum number of retail clean fuel outlets for all designated clean fuels in the preceding year as determined pursuant to section 2307(d), from the owner/lessor' s total number of retail gasoline outlets (based on reports submitted pursuant to section 2312 and other reasonably available relevant information).~~

(c) <u>[RESERVED]</u> ~~*Determination of clean fuel fraction*.~~
~~For each designated clean fuel, the executive officer shall calculate the clean fuel fraction for each designated clean fuel as follows:~~

~~Clean Fuel Fraction =~~
~~Total Number of Retail Clean Fuel Retail Outlets~~
~~Number of Non-Clean Fuel Outlets Owned by All Affected Owner/Lessors~~

~~Where:~~

~~*Total Additional Number of Retail Clean Fuel Outlets* is the total number of additional retail clean fuel outlets required for the year for the particular clean fuel in accordance with section2304(b).~~

~~*Number of Non-Clean Fuel Outlets Owned by All Affected Owner/Lessors* is calculated by subtracting the sum of the required retail outlets determined in accordance with section 2304(a) for all clean fuels from the sum of the number of retail gasoline outlets owned or leased by all of the affected owners and lessors estimated by the executive officer based on the reports submitted pursuant to section 2312 and other reasonably available relevant information.~~

(d) *Determination of each ~~owner/lessor~~<u>major refiner/importer of gasoline</u>'s total required minimum number of retail clean fuel outlets for each clean fuel for each year*.
For each year, each ~~owner/lessor~~<u>refiner/importer</u>'s required minimum number of retail clean fuel outlets for each designated clean fuel~~ in the state~~ shall consist of the number of additional retail clean fuel outlets that the <u>refiner/importer</u> ~~owner/lessor~~ is required for the first time to have in place in the <u>compliance</u> year as determined in accordance with section 2307(a), added to the sum of the numbers of additional retail clean fuel outlets required of the <u>refiner/importer</u> ~~owner/lessor~~ for the first time in each of the previous <u>compliance</u> years as determined in accordance with section 2307(a). The required minimum number of a~~n owner/lessor~~<u>refiner/importer</u>'s retail clean fuel outlets for each designated clean fuel in a <u>compliance</u> year shall not be less than the required minimum number of such outlets for the previous <u>compliance</u> year<u>.</u>~~,~~ <u>For example, if a refiner/importer is not required to equip new outlets in the compliance year for which the calculations are being made, but has previously been required to equip a total of fifteen retail clean fuel outlets, that refiner/importer is required to</u>

maintain a minimum of fifteen retail clean fuel outlets during the compliance year for which the calculations are being made. ~~except that~~ However, there shall be no required minimum number of outlets for a designated clean fuel in any compliance year for which the number of vehicles estimated by the ~~e~~Executive ~~o~~Officer pursuant to section 2303(b) is less than 10,000 within an air basin and 20,000 statewide.

(e) *Notification of ~~owner/lessors~~refiner/importers*.
At least twenty-eight~~fourteen~~ months before the start of each compliance year, the ~~e~~Executive ~~o~~Officer shall notify each affected refiner/importer~~owner/lessor~~ in writing of the ~~owner/lessor~~refiner/importer's required minimum number of clean fuel outlets for each designated clean fuel for the compliance year. The written notification shall include a detailed analysis of how the number was derived.

(f) If the total number of required additional outlets is adjusted and reduced pursuant to section 2304(a)(2)(F), nineteen months prior to each compliance year, the Executive Officer shall notify each affected refiner/importer in writing of their adjusted required minimum number of clean fuel outlets for the compliance year. The written notification shall include a detailed analysis of how the number was derived.

NOTE: Authority cited: Sections 39600, 39601, 39667, 43013, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975). Reference: Sections 39000, 39001, 39002, 39003, 39500, 39515, 39516, 39667, 43000, 43013, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975).

§ 2308. Constructive Allocation of Retail Clean Fuel Outlets

(a) Any ~~owner/lessor of a retail gasoline outlet, and any~~ person who is the owner or ~~/~~lessor of a retail clean fuel outlet ~~which is not a retail gasoline outlet~~, may constructively allocate one or more retail clean fuel outlets to ~~the owner/lessor of a retail gasoline outlet~~ a major refiner/importer of gasoline, for purposes of demonstrating compliance with the requirements in section 2302, as long as the requirements of this section are met.

(b) Any agreement to constructively allocate a retail clean fuel outlet pursuant to this section shall be in writing. The constructive allocation shall be in ~~calendar~~ compliance year increments, and shall not cover less than one ~~calendar~~ compliance year. The agreement shall be executed before the start of the first compliance year of constructive allocation covered by the agreement.

(c) A retail clean fuel outlet may not be constructively allocated unless it meets any applicable dispensing capacity requirements set forth in section 2302(b).

(d) ~~If the retail clean fuel outlet being constructively allocated is not a retail gasoline outlet, t~~The person making the constructive allocation shall obtain prior approval from the ~~e~~Executive ~~o~~Officer. The ~~e~~Executive ~~o~~Officer shall approve the constructive allocation if s/he determines that the facility is adequately accessible for fueling motor vehicles by the general public with the designated clean fuel.

(e) Any person who constructively allocates a retail clean fuel outlet for a designated clean fuel shall ~~be deemed to be the owner/lessor of that retail clean fuel outlet and shall~~ be subject to the requirements of sections 2309(b)~~ and (c)(1)~~ during the period covered by the constructive allocation agreement.

(f) The owner or ~~/~~lessor of any retail clean fuel outlet which is constructively allocated shall notify the operator in writing that it is claimed to be equipped in order to satisfy the requirements of section 2302, as applicable.

(g) Any person who constructively allocates a retail clean fuel outlet to a~~n~~ ~~owner/lessor~~a major refiner/importer of gasoline shall submit a report to the ~~e~~Executive ~~o~~Officer ~~by January 10~~ at least sixty days prior to the start of each compliance year covered by the constructive allocation agreement. The report shall be executed in California under penalty of perjury and shall contain the following information:~~.~~

(1) The name, address and telephone number of the person making the constructive allocation.

(2) The street address of each retail clean fuel outlet constructively allocated, the type of designated clean fuel dispensed at the outlet, the business interest in the outlet of the person making the constructive allocation, and the brand, trade, or other name under which the business at the outlet is conducted.

(3) For each constructively allocated retail clean fuel outlet, the name and address of the ~~owner/lessor~~refiner/importer to whom the outlet was constructively allocated, and the starting and ending dates of the constructive allocation.

(4) The name of the operator of the retail clean fuel outlet.

(h) Any ~~owner/lessor~~refiner/importer who receives a constructive allocation of a retail clean fuel outlet shall submit a report to the ~~e~~Executive ~~o~~Officer ~~by January 10~~at least sixty days prior to the start of each compliance year covered by the constructive allocation agreement. The report shall be executed in California under penalty of perjury and shall contain the following information:~~.~~

(1) The name, address and telephone number of the ~~owner/lessor~~ refiner/importer.

(2) The street address of each retail clean fuel outlet constructively allocated, the type of designated clean fuel dispensed at the outlet, and the brand, trade, or other name under which the business at the outlet is conducted.

(3) For each constructively allocated retail clean fuel outlet, the name and address of the person constructively allocating the outlet, and the starting and ending dates of the constructive allocation.

(4) A copy of the executed constructive allocation agreement.

NOTE: Authority cited: Sections 39600, 39601, 39667, 43013, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975). Reference: Sections 39000, 39001, 39002, 39003, 39500, 39515, 39516, 39667, 43000, 43013, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975).

§ 2309. Responsibilities of ~~Owner/Lessors~~Refiner/Importers of Selected Retail Clean Fuel Outlets.

Any retail clean fuel outlet that was equipped to dispense a designated clean fuel and received funding from the State to do so prior to January 1, 2015, shall be deemed to satisfy the criteria detailed below.

(a) *Locations of required clean fuel outlets.*

(1) For each designated clean fuel, in determining the locations of required retail clean fuel outlets, a~~n~~ a refiner/importer~~owner/lessor~~ shall provide a reasonable geographical dispersion of the outlets and place the outlets in locations that are reasonably near the existing and anticipated areas of operation of ~~low~~zero-emission vehicles that operate on the designated clean fuel, and are convenient to drivers of such vehicles. ~~Any retail clean fuel outlet that was equipped to dispense a designated clean fuel as part of the CEC's California Methanol Fuel Demonstration Program shall be deemed to satisfy these criteria.~~

(2) At least twenty-two~~eight~~ months before the start of each compliance year ~~(by April 30 of the previous year)~~, each ~~owner/lessor~~major refiner/importer of gasoline who has received a notification pursuant to section 2307(e) indicating that ~~s/he~~ he or she will be required to have in place additional retail clean fuel outlets for that compliance year shall submit to the ~~e~~Executive ~~o~~Officer proposed locations for such outlets and optional locations equal to at least ~~20~~40 percent of ~~off~~ the proposed locations, identified by street address, ZIP code, and Universal Transverse Mercator (UTM) coordinates. The submittal shall include any outlets that are or may be constructively allocated to the ~~owner/lessor~~refiner/importer pursuant to section 2308.

Following submittal, the ~~owner/lessor~~refiner/importer shall consult with designees of the ~~e~~Executive ~~o~~Officer ~~, and with the CEC's executive officer or his or her designees,~~ on the optimal locations for new retail clean fuel outlets. Designees of the Executive Officer may employ modeling tools to establish and evaluate fuel infrastructure scenarios.

(3) The ~~owner/lessor~~refiner/importer shall notify the ~~e~~Executive ~~o~~Officer of the final locations of all new retail clean fuel outlets for the compliance year, no later than eighteen~~five~~ months before the start of the compliance year ~~(by July 31)~~. This notification may include adjustments made pursuant to sections 2304(a) and 2307(f).

(b) *Requirements ~~regarding facilities at~~for selected retail clean fuel outlets ~~at retail gasoline outlets~~.*
For each selected clean fuel outlet equipped to satisfy the requirements of section 2302, the refiner/importer shall ensure that the requirements of this section are met.

(1) Locate the designated clean fuel dispensers in a location that is readily accessible and visible to customers upon entering the station. Any active dispenser equipped prior to January 1, 2015 to dispense a designated clean fuel as part of the Board's Hydrogen Highway program funding and the CEC's Renewable Fuel and Vehicle Technology Program shall be deemed to satisfy this criterion.

(2) Ensure that a commercially reasonable quantity of the designated clean fuel is available at the outlet and offer the fuel for sale to the public. However, a refiner/importer shall not be liable for failure to comply with this requirement if the operator demonstrates he or she was unable to comply because of unforeseeable occurrences such as an earthquake or flood, and act of war or an act by a public enemy, a civil disorder or riot, the expropriation or confiscation of facilities or property, or the operation of law.

(3) Provide that hydrogen fuel dispensers satisfy all requirements of the Society of Automotive Engineers Standard J2601 "Fueling Protocols for Light Duty Gaseous Hydrogen Surface Vehicles."

(4) Ensure that the designated clean fuel dispensers are well marked and clearly identified with regard to the type of fuel.

(5) Display on the premises a sign which discloses that the clean fuel outlet offers the designated clean fuel for sale, and which is clearly visible from the street or highway adjacent to the outlet, provided that the signage is displayed in a manner consistent with applicable local ordinances.

(6) Ensure that the designated clean fuel dispensers are available for public use during normal business hours without the required use of a key or cardkey.

(7) Ensure that a customer is able to pay for his or her fuel purchase without establishment of an account with the outlet owner or operator.

(8) Maintain lighting which keeps the designated clean fuel dispenser area reasonably well-illuminated when the outlet operates at night.

(9) Prominently display directions on use of the clean fuel dispensing equipment.

(10) Maintain the designated clean fuel dispensing equipment in good operating condition.

~~Each owner/lessor of a selected retail clean fuel outlet at a retail gasoline outlet shall, with respect to each such outlet:~~

~~(1) Locate the designated clean fuel dispenser(s) in a location substantially as accessible and visible to a customer entering the station as are the gasoline dispensers, and providing substantially the same convenience of ingress and egress as exists for the gasoline dispensers at the outlet; provided that any dispenser equipped prior to January 1, 1993 to dispense a designated clean fuel as part of the CEC' s California Methanol Fuel Demonstration Program shall be deemed to satisfy this criterion.~~

~~(2) Ensure that the designated clean fuel dispensers are substantially as well marked and as clearly identified as the gasoline dispensers with regard to the type of fuel.~~

~~(3) Maintain lighting which keeps the designated clean fuel dispenser area substantially as well-illuminated as the gasoline dispensing area when the outlet operates at night.~~

~~(4) Ensure that customers using designated clean fuel dispensers will have, within the same service mode (e.g. self serve or full serve), substantially the same access to services and facilities such as canopy coverage, air and water, vending, and restrooms as do customers purchasing gasoline, unless the owner/lessor has, in the preceding 12 months, demonstrated to the satisfaction of the executive officer that providing such a service or facility is prohibited by local ordinance or applicable safety codes.~~

~~(5) Prominently display directions on use of the clean fuel dispensing equipment.~~

~~(6) Maintain the designated clean fuel dispensing equipment in good operating condition.~~

(c) [RESERVED] ~~*Requirements regarding facilities at selected clean fuel outlets at which gasoline is not offered to the public*.~~
~~Each owner/lessor of a selected retail clean fuel outlet at which gasoline is not offered to the public shall, with respect to each such outlet:~~

~~(1) Locate the designated clean fuel dispenser(s) in a location that is readily accessible from main streets and highways.~~

~~(2) Ensure that the designated clean fuel dispensers are available for public use during normal business hours without the use of a key or cardkey.~~

~~(3) Ensure that a customer is able to pay for his or her fuel purchase without establishment of an account with the outlet owner or operator.~~

~~(4) If the outlet is operated after dark, maintain commercially reasonable lighting levels to provide user safety.~~

~~(5) Prominently display directions on use of the clean fuel dispensing equipment.~~

(d) *Requirements regarding supply of designated clean fuels to selected retail clean fuel outlets*.

(1) [RESERVED]~~Whenever the operator of a selected retail clean fuel outlet requests that the owner/lessor of the outlet provide for the delivery, within a specified time not less than 72 hours from the request, of specified commercially reasonable quantities of the designated clean fuel to the outlet on commercially reasonable terms, the owner/lessor shall be jointly liable with the operator for any violations at the outlet of section 23l0(a)(1) starting with the requested time of delivery and ending with the next delivery of commercially reasonable quantities of the clean fuel to the outlet, unless the owner/lessor does one of the following: [i] supplies the specified quantity of designated clean fuel to the outlet, within the specified time, on commercially reasonable terms, or~~
~~[ii] identifies a third party willing to supply, within the specified time, the specified quantity of designated clean fuel to the outlet on commercially reasonable terms.~~

~~However, an owner/lessor's failure to satisfy the conditions set forth in [i] and [ii] shall not result in liability under this section if the owner/lessor demonstrates that s/he was prevented from satisfying the conditions by a natural disaster such as an earthquake or flood, an act of war or an act by a public enemy, a civil disorder or riot, the expropriation or confiscation of facilities or property, or the operation of law.~~

(2) Whenever ~~an owner/lessor~~a refiner/importer is required to submit a notification regarding final outlet locations to the ~~e~~Executive ~~o~~Officer pursuant to section 2309(a)(3), the notification shall include a description of the means by which the ~~owner/lessor~~refiner/importer intends to comply with section 2309~~(c)(1)~~(b). The description shall include, but need not be limited to, [i] a description of any facility that is or will be owned or leased by the ~~owner/lessor~~refiner/importer for the production or importation of the designated clean fuel, including the throughput capacity of such facility; [ii] the identities of any third parties with whom the ~~owner/lessor~~refiner/importer has or plans to have

contracts to supply the designated clean fuel, and the minimum volumes of the designated clean fuel subject to such contracts; [iii] if the ~~owner/lessor~~ refiner/importer will not have a designated clean fuel production or import facility, or a contract for supply of the fuel, a description of the manner in which ~~supply of~~ the designated clean fuel will be supplied ~~arranged~~; [iv] a description, including location and capacity, of any facilities that are or will be owned or leased by the ~~owner/lessor~~refiner/importer for the loading of the designated clean fuel into tank cars, vessels, or tank trucks; ~~and~~ [v] the identities of any parties with whom the ~~owner/lessor~~refiner/importer has, or plans to have, contracts for the delivery of the designated clean fuel to the retail clean fuel outlets, and the facilities from which such parties will make such deliveries; and [vi] the identities of any parties with whom the refiner/importer has, or plans to have, contracts for the operation and maintenance of the retail clean fuel outlet.

(e) *Annual reports regarding compliance with section 2302*.

(1) For each ~~calendar~~ compliance year, each ~~owner/lessor~~refiner/importer who is required to equip one or more ~~retail gasoline~~ outlets as ~~a~~ retail clean fuel outlets shall submit to the ~~e~~Executive ~~o~~Officer ~~by January 10~~at least sixty days prior to the start of the compliance year a report containing the information set forth below regarding compliance with section 2302. The information shall be categorized by each designated clean fuel. The reports shall be executed in California under penalty of perjury~~.~~, and shall include the following:

(A) The street address of each ~~of the owner/lessor' s~~ retail ~~gasoline~~ outlet~~s~~ claimed by the refiner/importer to be equipped as a retail clean fuel outlet to satisfy the requirements of section 2302.

(B) For each such outlet, the type of designated clean fuel dispensed at the outlet, the brand, trade, or other name under which the business at the outlet is conducted, and the name of the operator of the outlet.

NOTE: Authority cited: Sections 39600, 39601, 39667, 43013, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975). Reference: Sections 39000, 39001, 39002, 39003, 39500, 39515, 39516, 39667, 43000, 43013, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975).

§ 2310. [RESERVED] ~~Responsibilities of Operators of Selected Retail Clean Fuel Outlets.~~

~~(a) The operator of a selected retail clean fuel outlet equipped to dispense gasoline shall, whenever gasoline is offered for sale at the outlet, do all of the following with respect to the designated clean fuel(s) that the outlet is equipped to dispense:~~

~~(1) Store a commercially reasonable quantity of the designated clean fuel at the outlet and offer the fuel for sale to the public, during the same hours that gasoline~~

~~is offered for sale. However, an operator shall not be liable for failure to comply with this section 23l0(a)(1) if the operator demonstrates s/he was unable to comply because of a natural disaster such as an earthquake or flood, and act of war or an act by a public enemy, a civil disorder or riot, the expropriation or confiscation of facilities or property, or the operation of law.~~

~~(2) Maintain the designated clean fuel dispensing equipment in good operation conditions.~~

~~(3) Keep the designated clean fuel dispenser area substantially as well-illuminated as the gasoline dispensing area during nighttime operation.~~

~~(4) Keep the designated clean fuel dispenser area and pad substantially as clean as the gasoline dispenser area and pad.~~

~~(b) The operator of a selected retail clean fuel outlet not equipped to dispense gasoline to the general public shall do all of the following with respect to the designated clean fuel(s) that the outlet is equipped to dispense:~~
~~(1) Maintain reasonable access to the clean fuel dispensing equipment.~~

~~(2) Maintain the designated clean fuel dispensing equipment in good operating condition.~~

~~(3) Provide a payment option that does not require the purchaser to establish an account with the operator.~~

~~(c) The operator of any selected retail clean fuel outlet shall do all of the following with respect to the designated clean fuel(s) that the outlet is equipped to dispense:~~

~~(1) If the designated clean fuel dispensers are at any time in a consumer self-service mode, post at all times in a conspicuous and convenient location directions illustrating the use of the dispensing equipment.~~

~~(2) Display on the premises a sign which discloses that the clean fuel outlet offers the designated clean fuel for sale, and which is clearly visible from the street or highway adjacent to the outlet, provided that the operator shall not be required to display a sign in a manner inconsistent with applicable local ordinances.~~

~~(3) Conspicuously post, on the designated clean fuel dispenser, the price of the clean fuel volume that provides the energy provided by a gallon of gasoline. This price shall be calculated for liquid fuels by multiplying the price of a volumetric gallon of the fuel by the values in the table below. In the case of CNG, the price shall be posted as 1.18 multiplied by the price of one therm of compressed natural gas.~~

~~Fuel~~	~~Price Multiplier~~
~~Gasoline~~	~~1.00~~
~~LPG~~	~~1.27~~
~~Methanol (MI00)~~	~~2.08~~
~~M85~~	~~1.79~~
~~Ethanol (EI00)~~	~~1.54~~
~~E85~~	~~1.43~~

~~NOTE: Authority cited: Sections 39600, 39601, 39667, 43013, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975). Reference: Sections 39000, 39001, 39002, 39003, 39500, 39515, 39516, 39667, 43000, 43013, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975).~~

§ 2311. Relief from Liability Caused by Breakdowns of Clean Fuel~~CNG~~ Dispensing Equipment.

(a) A~~n owner/lessor or operator~~ refiner/importer or their contractor responsible for ~~of~~ a selected clean fuel outlet equipped to dispense gaseous hydrogen ~~CNG~~ shall not be liable for violations of sections 2302~~,~~ or 2309(b)~~ or 2310(a)~~ resulting from a minor breakdown if:

(1) The refiner/importer or their contractor designated pursuant to section 2309(d)(2)~~owner/lessor or operator~~ reports the breakdown to the ~~e~~Executive ~~o~~Officer within ~~4~~24 hours of the time the person knows or reasonably should know of the breakdown, including the time, location, and nature of the breakdown;

(2) The equipment is repaired as quickly as possible in the exercise of reasonable diligence, in no case in more than 72 hours;

(3) Within 24~~12~~ hours of repair of the equipment, the refiner/importer or their contractor~~owner/lessor or operator~~ reports to the ~~e~~Executive ~~o~~Officer that the repairs have been completed, and describes the corrective measures, if any, taken to avoid breakdowns in the future; and

(4) The refiner/importer or their contractor ~~owner/lessor or operator~~ is able to demonstrate that the breakdown did not result from inadequate or improper maintenance, operator error, or other reasons within the control of the refiner/importer or their contractor ~~owner/lessor or operator~~.

(b) A~~n~~ refiner/importer or their contractor responsible for ~~owner/lessor or operator of~~ a selected clean fuel outlet equipped to dispense gaseous hydrogen~~CNG~~ shall not be liable for violations of sections 2302~~,~~ or 2309(b) ~~or 2310(a)~~ resulting from a major breakdown if the refiner/importer or their contractor~~owner/lessor or operator~~:

(1) Reports the breakdown to the ~~e~~Executive ~~o~~Officer within ~~4~~24 hours of the time the person knows or reasonably should know of the breakdown, including the time, location, and nature of the breakdown;

(2) Within 7 days of the breakdown, submits to the ~~e~~Executive ~~o~~Officer ~~is~~in writing a report that:

(A) Demonstrates to the reasonable satisfaction of the ~~e~~Executive ~~o~~Officer that the breakdown did not result from inadequate or improper maintenance, operator error, or other reasons within the reasonable control of the refiner/importer or their contractor~~ownerl/lessor or operator~~; and

(B) Identifies a plan reasonably detailing how the hydrogen~~CNG~~ dispensing equipment will be repaired or replaced as soon as possible with the exercise of reasonable diligence, including a final completion date no later than two~~six~~ months following the date of the breakdown; and

(3) Completes the repair or replacement [i] by the final completion date identified in the submitted plan, or [ii] by such earlier completion date designated by the ~~e~~Executive ~~o~~Officer, within 14 days of receipt of the plan, as reasonably feasible based on review of the plan.

NOTE: Authority cited: Sections 39600, 39601, 39667, 43013, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975). Reference: Sections 39000, 39001, 39002, 39003, 39500, 39515, 39516, 39667, 43000, 43013, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975).

§ 2311.5. Notification by Executive Officer of Reporting Obligations.

For each year starting with 2013~~02~~, the ~~e~~Executive ~~o~~Officer shall determine whether there is a substantial possibility that the 10,000 vehicle trigger within an air basin or the 20,000 statewide vehicle trigger level in section ~~2304~~2303.5(a)(1) will for the first time be reached for one or more designated clean fuels. The ~~e~~Executive ~~o~~Officer shall identify any such designated clean fuel at least thirty-four~~22~~ months before the start of the compliance year. The ~~e~~Executive ~~o~~Officer shall then take prompt and reasonable steps to provide notice of the identified fuel and applicable reporting obligations to: (1) all owners and ~~/~~lessors of retail gasoline outlets, (2) all zero emission vehicle fleet operators, ~~and~~ (3) all persons engaged in the business of distributing the identified fuel for use in motor vehicles, and (4) all major refiner/importers of gasoline.

NOTE: Authority cited: Sections 39600, 39601, 39667, 43013, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975). Reference: Sections 39000, 39001, 39002, 39003, 39500, 39515, 39516, 39667, 43000, 43013, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975).

§ 2312. [RESERVED] ~~Reports by Owner/Lessors of Retail Gasoline Outlets~~.

~~(a) Once the executive officer has identified a designated clean fuel under section 2311.5, by July 31 of the year the identification was made and by July 31 of every year thereafter, each owner/lessor of a retail gasoline outlet shall report to the executive officer the total number of retail gasoline outlets in the state of which the person is the owner/lessor, the street address of the retail gasoline outlet, and the owner/lessor's business interest in the outlet.~~

NOTE: Authority cited: Sections 39600, 39601, 39667, 43013, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975). Reference: Sections 39000, 39001, 39002, 39003, 39500, 39515, 39516, 39667, 43000, 43013, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975).

§ 2313. Reports by Fleet Operators.

Once the ~~e~~Executive ~~o~~Officer has identified a particular designated clean fuel under section 2311.5, every fleet operator shall, for any calendar year in which the fleet operator reasonably expects to operate fleet vehicles certified on a designated clean fuel, supply the following information to the ~~e~~Executive ~~o~~Officer, at least thirty-two~~eighteen~~ months (by ~~June~~ April 30) before the start of the calendar year:

(1) The expected number of ~~low~~zero-emission vehicles in the fleet to be operated in the year that will be certified on a designated clean fuel, categorized by designated clean fuel.

(2) The total volume of each designated clean fuel expected to be used by the vehicles in the year.

(3) The total volume of designated clean fuel expected to be supplied to the fleet operator's ~~low~~zero-emission vehicles during the year from the fleet operator's own dispensing facilities and from facilities that are not retail clean fuel outlets.

(4) The actual vehicle miles traveled for the prior 12 month period and the estimated vehicle miles travelled for the year in question.

(5) The extent to which operations using the designated clean fuel would be expanded due to increased availability of the designated clean fuel at retail clean fuel outlets.

NOTE: Authority cited: Sections 39600, 39601, 39667, 43013, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975). Reference: Sections 39000, 39001, 39002, 39003, 39500, 39515, 39516, 39667, 43000, 43013, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975).

§ 2314. Reporting Requirements for Persons Who Produce and Distribute Designated Clean Fuels for Use in Motor Vehicles.

Starting the with the beginning of the compliance year after the Executive Officer ~~the executive officer~~ identifies a particular designated clean fuel under section 2311.5, each person who in a quarter produces and/or distributes a designated clean fuel for use in motor vehicles shall within 45 days after the end of the quarter, submit to the ~~e~~Executive ~~o~~Officer a report containing the following information for each designated clean fuel:

(1) The volume of the designated clean fuel that was produced by the person and that was distributed in the quarter for use in motor vehicles.

(2) The volume of the designated clean fuel that was imported by the person and that was distributed in the quarter for use in motor vehicles.

(3) The volume of designated clean fuel distributed to each retail facility that the producer or distributor supplies designated clean fuel to.

NOTE: Authority cited: Sections 39600, 39601, 39667, 43013, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975). Reference: Sections 39000, 39001, 39002, 39003, 39500, 39515, 39516, 39667, 43000, 43013, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975).

§ 2315. Determination of Violations.

(a) *Violations of section 2302.*
At any time that a~~n~~ refiner/importer~~owner/lessor~~ fails to have equipped the number of clean fuel ~~retail gasoline~~ outlets required to be equipped ~~by section 2302 to be equipped to be a retail clean fuel outlet~~ for a designated clean fuel, the refiner/importer will be deemed to be in violation of section 2302 and subject to the penalty described in Health and Safety Code sections 43027 and 43028. ~~owner/lessor shall be deemed to have sold or supplied gasoline to motor vehicles in violation of these regulations. For each day that the owner/lessor violates section 2302, the first ten motor vehicles fueled at one of the owner/lessor's retail gasoline outlets shall be deemed to have been unlawfully fueled for each retail gasoline~~ Each day, or portion of a day, that the refiner/importer violates section 2302 for each outlet not equipped as required will be deemed a separate violation when assessing the penalties described in Health and Safety Code sections 43027 and 43028. If a~~n~~ refiner/importer~~owner/lessor~~ claims to comply with the requirements of section 2302 on the basis of retail clean fuel outlets constructively allocated pursuant to section 2308, such facilities shall not satisfy the refiner/importer's~~owner/lessor's~~ obligations if the requirements in section 2308 for constructive allocation are not met.

(b) *Violations of section 2309(b).*
~~Whenever the owner/lessor of a selected retail clean fuel outlet violates section 2309(b) with respect to the outlet, the gasoline sold or supplied by the owner/lessor~~ Whenever the refiner/importer fails to satisfy the requirements of section 2309(b) at a clean fuel outlet required to be equipped to satisfy the

requirements of section 2302, the refiner/importer is in violation of these regulations and subject to the penalties described in Health and Safety Code sections 43027 or 43028 as applicable. Each day, or portion of a day, that the refiner/importer violates section 2309(b) at a specific outlet shall be deemed a separate violation when assessing the penalties described in Health and Safety Code sections 43027 and 43028. ~~For each day that the owner/lessor violates section 2309(b) with respect to a selected retail clean fuel outlet, the first five motor vehicles fueled that day at the outlet with gasoline shall be deemed to have been unlawfully fueled by the owner/lessor.~~

(c) [RESERVED] ~~*Violations of section 2310.*~~
~~Whenever the operator of a selected retail clean fuel outlet violates section 2310 with respect to the outlet, the gasoline sold or supplied at the outlet shall be deemed to have been sold or supplied by the operator violates section 2310, the first five motor vehicles fueled that day with gasoline at the outlet shall be deemed to have been unlawfully fueled by the operator.~~

(d) *Violations of section 2303(b)(2).*
Whenever a motor vehicle manufacturer fails to deliver for sale or lease the projected number of designated clean fuel vehicles it submitted to the Executive Officer pursuant to the "California Exhaust Emission Standards and Test Procedures for 2001 and Subsequent Model Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles " as incorporated by reference in Title 13, California Code of Regulations, section 1961, and the "California 2015 and Subsequent Model Criteria Pollutant Exhaust Emission Standards and Test Procedures and 2017 and Subsequent Model Greenhouse Gas Exhaust Emission Standards and Test Procedures for Passenger Cars, Light-Duty Trucks and Medium-Duty Vehicles" as incorporated by reference in Title 13, California Code of Regulations, section 1961.2, that motor vehicle manufacturer will be deemed to have violated Health and Safety Code section 42402.4 upon the requisite showing of the manufacturer's knowledge of the falsity of the information submitted and the intent to deceive. The penalty as described in Health and Safety Code section 42402.4 will be assessed during the first quarter of the calendar year following the compliance year for which the Executive Officer made the determination pursuant to sections 2304 and 2307 and motor vehicle manufacturer projections, that additional retail clean fuel outlets were required. No penalty will be assessed under Health and Safety Code section 42402.4 if the motor vehicle manufacturer delivers for sale or lease at least 80 percent of their projected number of vehicles during the calendar year the following compliance year for which the Executive Officer made the determination pursuant to sections 2304 and 2307 that additional retail clean fuel outlets were required.

NOTE: Authority cited: Sections 39600, 39601, 39667, 42402.4, 43013, 43018, 43027, 43028 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975). Reference: Sections 39000, 39001, 39002, 39003, 39500, 39515, 39516, 39667, 42402.4, 43000, 43013, ~~43016,~~ 43018, 43027, 43028 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975).

2. Amendment of section and NOTE filed 12-8-2000; operative 1-7-2001 (Register 2000, No. 49).

§ 2316. Determinations of Energy Equivalency of Fuels.

Whenever implementation of this chapter requires values for the energy contents of fuels, the lower heating values in the following table shall be used.

Volumetric Energy Contents

Fuel	BTUs per gallon equivalent
Gasoline	109,600~~116,500~~
~~LPG~~	~~91,500~~
~~Methanol (M1OO)~~	~~56,500~~
~~M85~~	~~65,000~~
~~Ethanol (E1OO)~~	~~75,700~~
~~E85~~	~~81,800~~
~~CNG~~	~~1000 BTU/scf~~
Hydrogen gas	113,000

NOTE: Authority cited: Sections 39600, 39601, 39667, 43013, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975). Reference: Sections 39000, 39001, 39002, 39003, 39500, 39515, 39516, 39667, 43000, 43013, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975).

§ 2317. [RESERVED]~~Satisfaction of Designated Clean Fuel Requirements with a Substitute Fuel.~~

~~(a) Any person may petition the state board to designate by regulation a substitute fuel which may be used instead of a primary designated clean fuel to satisfy any requirements in this chapter pertaining to a designated clean fuel. The state board shall designate such a substitute fuel if it is satisfied that the petitioner has demonstrated all of the following:~~

~~(1) That use of the fuel in low-emission vehicles certified on the primary designated clean fuel will result in emissions of NMOG (on a reactivity-adjusted basis), NOx. and CO no greater than the corresponding emissions from such vehicles fueled with the primary designated clean fuel; as determined pursuant to the procedures set forth in the "California Test Procedure for Evaluating Substitute Fuels and New Clean Fuels," as adopted November 2, 1993, which is incorporated herein by reference.~~

~~(2) That use of the fuel in low-emission vehicles certified on the primary designated clean fuel will result in potential health risks from exposure to benzene, 1,3-butadiene, formaldehyde, and acetadehyde in the aggregate no greater than the corresponding potential health risks for such vehicles fueled with the primary designated clean fuel, as determined pursuant to the procedures set forth in the "California Test Procedure for Evaluating Substitute Fuels and New~~

~~Clean Fuels," as adopted November 2, 1993, which is incorporated herein by reference.~~

~~(3) That if the proposed substitute fuel may be used to fuel any motor vehicle other than low-emission vehicles certified on the primary designated clean fuel:~~

~~(A) Use of the substitute fuel in such other motor vehicles would not increase emissions of NMOG (on a reactivity-adjusted basis), NOx, and CO as determined pursuant to the procedures set forth in the "California Test Procedure for Evaluating the Emission Impacts of Substitute Fuels or New Clean Fuels," as adopted November 2, 1993, which is incorporated herein by reference; and~~

~~(B) Use of the substitute fuel in such other motor vehicles would result in potential health risks from exposure to benzene, 1,3-butadiene, formaldehyde, and acetadehyde in the aggregate no greater than the corresponding potential health risk from the emissions from such vehicles when operating on their customary fuel, as determined pursuant to the procedures set forth in the "California Test Procedure for Evaluating the Emission Impacts of Substitute Fuels or New Clean Fuels," as adopted November 2, 1993, which is incorporated herein by reference; and~~

~~(C) Use of the substitute fuel in such other motor vehicles would not result in increased deterioration of the emission control system on the vehicle and would not void the warranties of any such vehicles.~~

~~(b) Whenever the state board designates a substitute fuel pursuant to this section, the state board shall also establish by regulation required specifications for the substitute fuel.~~

~~(c) Commencing with the effective date of a regulatory action of the state board designating a substitute fuel pursuant to this section, any person may satisfy his or her obligations under this chapter pertaining to a primary designated clean fuel, in whole or in part. by substituting the substitute fuel in place of the primary designated clean fuel.~~

~~NOTE: Authority cited: Sections 39600, 39601, 39667, 43013, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975). Reference: Sections 39000, 39001, 39002, 39003, 39500, 39515, 39516, 39667, 43000, 43013, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975).~~

§ 2318. Sunset for Particular Designated Clean Fuels.

This Chapter 8, shall cease to apply to a particular designated clean fuel once the number of retail clean fuel outlets offering the designated clean fuel represent at least ~~ten~~five percent of all retail gasoline outlets. If an MOA satisfies the requirements of Section 2304(a)(2)(C)3 then this Chapter 8 shall cease to apply to hydrogen fuel once at least 100 hydrogen fueling outlets meeting the performance requirements outlined in Sections 2302(b) and 2309(b) have been established and are operating independent of financial incentives.

NOTE: Authority cited: Sections 39600, 39601, 39667, 43013, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975). Reference: Sections 39000, 39001, 39002, 39003, 39500, 39515, 39516, 39667, 43000, 43013, 43018 and 43101, Health and Safety Code; and *Western Oil and Gas Ass'n. v. Orange County Air Pollution Control District*, 14 Cal. 3d 411, 121 Cal. Rptr. 249 (1975).